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SOIL SURVEY

Chester and Delaware Counties, Pennsylvania

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
PENNSYLVANIA STATE UNIVERSITY
College of Agriculture and Agricultural Experiment Station
and the
PENNSYLVANIA DEPARTMENT OF AGRICULTURE
Soil Conservation Commission

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY of Chester and Delaware Counties will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; serve as a reference for students and teachers; help prospective farmers, land appraisers, bankers, and real estate agents to decide the worth of a particular farm; and aid builders who are planning urban developments. It will also add to our general knowledge about soils.

In making this soil survey, soil scientists walked over the counties. They dug holes and examined surface soils and subsoils; measured slopes with a hand level; noticed differences in the growth of crops, weeds, and grasses; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming, engineering, and related uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then, from these photographs, cartographers prepared the detailed soil map in the back of this report. Fields, woods, roads, streams, and many other landmarks that can be seen on the map are helpful in locating the area in which you are interested.

Locating the soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of these two counties on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the correct sheet of the large map has been located, it will be seen that boundaries of the soils are outlined and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil wherever they appear on the map. The symbol will be inside the area if there is enough room; otherwise, it will be outside the area and a pointer will show where the symbol belongs.

Finding information

Some readers will be more interested in one part of the report than another, for the report has special sections for different groups as well as sections that may be of value to all. The introductory part, which discusses the location of Chester and Delaware Counties, will be of interest mainly to those not familiar with this area. Those not familiar with the two counties may also want to refer to the section "Soil Associations" and the section "General Information About the Counties," which includes facts about agriculture in the area.

Farmers and those who work with farmers will be interested mainly in the section "Descriptions of Soils" and in the section "Use and Management of the Soils." Study of these sections will aid them in identifying soils on a farm, in learning ways the soils can be managed, and in judging what yields can be expected. The "Guide to Mapping Units" at the back of the report will simplify use of the map and the report. This guide gives the map symbol for each soil, the name of the soil, the page on which the soil is described, the capability unit in which the soil has been placed, and the page where the capability unit is described. It also indicates the woodland group and urban group for each soil.

Engineers will want to refer to the section "Engineering Applications." Tables in that section show characteristics of the soils that affect engineering.

Persons interested in science will find information about how the soils were formed and how they were classified in the section "Formation and Classification of the Soils." They will also want to refer to the section "Laboratory Data."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

* * * * *

This soil survey is part of the technical assistance furnished by the Soil Conservation Service to the Chester County Soil Conservation District. Work on the survey was completed in 1959. Unless otherwise indicated, all statements refer to conditions at the time the survey was in progress.

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SOIL SURVEY OF CHESTER AND DELAWARE COUNTIES, PENNSYLVANIA

REPORT BY W. MERRILL KUNKLE

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH PENNSYLVANIA STATE UNIVERSITY COLLEGE OF AGRICULTURE AND AGRICULTURAL EXPERIMENT STATION AND THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION COMMISSION

CHESTER AND DELAWARE COUNTIES are in the southeastern corner of Pennsylvania (fig.1). The two counties adjoin each other. Chester County has a land area of 486,400 acres, and Delaware County, a land area of 118,400 acres. The soils in the two counties are good for agriculture, and a large part of the acreage is suited to cultivated crops. The two counties are also highly urbanized. About 40 percent of Chester County and 74 percent of Delaware County are in urban, industrial, and other nonagricultural uses.

Dairy farming and the raising of poultry and fattening of beef cattle are the main kinds of agriculture in these two counties. The Kennett Square-Avondale section in southeastern Chester County is the most important mushroom-producing area in the Nation. Urban and industrial areas are encroaching on the agricultural areas and are gradually replacing them.

How Soils Are Named, Mapped, and Classified

Soil scientists made this survey to learn what kinds of soils are in Chester and Delaware Counties, where they are located, and how they can be used.

They went into the area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the two counties, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rocks; and many facts about the soils. They dug or bored 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 to the rock material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

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

Many soil series contain soils that are alike except for the texture of their surface layer. According to this difference in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Aldino silt loam and Aldino very stony silt loam are two soil types in the Aldino series. The difference in the texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into soil phases.

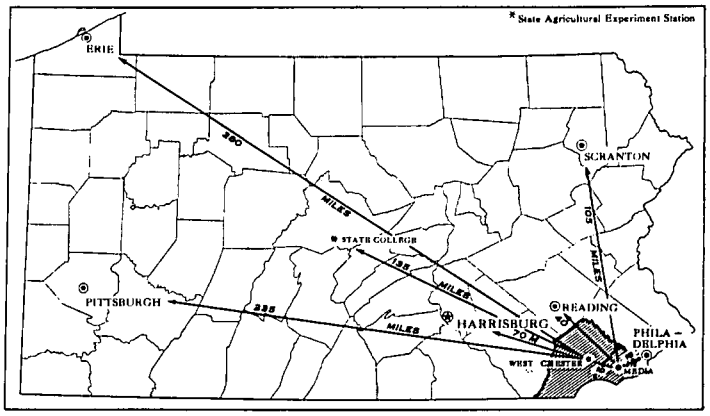

Figure 1.—Location of Chester and Delaware Counties in Pennsylvania.

The name of a soil phase indicates a feature that affects management. For example, Aldino silt loam, 0 to 3 percent slopes, is one of two phases of Aldino silt loam, a soil type that ranges from nearly level to sloping.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. They used photos for their base map because they show woodlands, buildings, field borders, trees, and similar detail that greatly help in drawing boundaries accurately. The soil map in the back of this report 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 management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientist has a problem of delineating areas where the differences between soils are too small to justify separate recognition for the objectives of the soil survey. Therefore he shows the soils as one mapping unit and calls it an undifferentiated mapping unit, for example, Penn and Lansdale sandy loams. Also, in most mapping there are areas to be shown that are so rocky, so shallow, or so frequently worked by wind or water that they cannot be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Made land, gravelly materials, or Tidal marsh, and are called land types rather than soils.

Only part of the soil survey was done when the soil scientist had named and described the soil series and mapping units, and had shown the location of the mapping units on the soil map. The mass of detailed information he had recorded then needed to be presented in different ways for different groups of users, among them farmers, managers of woodlands and rangelands, and engineers.

To do this efficiently, he had to consult with persons in other fields of work and jointly prepare with them groupings that would be of practical value to different users. Such groupings are the capability classes, subclasses, and units, designed primarily for those interested in producing short-lived crops and tame pasture; woodland groups, for those who need to manage wooded tracts; groups of soils for building sites, for those who need help in suburban development; and the classifications used by engineers who build highways or structures to conserve soil and water.

Soil Associations

After studying the soils in a locality and the way they are arranged, it is possible to make a general map that shows the main patterns of soils. Such a map is the colored general soil map in the back of this report. The general soil areas are also called soil associations. Each kind of general soil area, or association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic, although not strictly uniform.

The soils within any one association are likely to differ greatly among themselves in some properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general map does not show the kind of soil at any particular place, but a pattern that has in it several different kinds of soils.

The soil associations are named for the major soil series in them, but soils of other series may also be present. The major soil series of one general soil area may also be present in other areas.

A general map that shows patterns of soils is useful for people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a particular kind of farming or other land use. It does not show accurately the kinds of soils on a single farm or small tract.

The soil associations are discussed in the following pages. More detailed information about the soils is given in the section "Descriptions of Soils."

1. Penn-Croton-Bucks association: Shallow to deep, silty soils on red shale and sandstone

This soil association occupies 39,000 acres immediately south of the Schuylkill River in the northeastern part of Chester County. It is made up mainly of Penn, Croton, and Bucks soils. There are smaller areas of Bowmansville and Rowland soils, which are on flood plains.

The Penn soils are moderately deep. They have a dark-red, silty surface layer and a subsoil of silty clay loam at a depth between 12 and 18 inches. The Croton soils are deep and poorly drained. They are mottled to the surface. The Bucks soils are similar to the Penn soils but are deeper.

The soils in this association are nearly level to steep. In most places they are gently or moderately sloping and have been cleared and used for crops. The acreage of steep, very steep, and stony soils is not extensive. Some of the steep and stony soils have been cleared and pastured, but most of them are wooded.

Dairy farms predominate in this association, but on a few farms the production of general farm crops is combined with the raising of livestock. The sloping soils are likely to erode, and they require protection to help control erosion. In areas where air drainage, slope exposure, and soils are favorable, there are a few commercial orchards consisting of apple and peach trees.

2. Edgemont association: Moderately deep, channery soils on grayish quartzite and phyllite

This soil association is made up of soils of the Edgemont series. It occupies approximately 29,000 acres. The areas are chiefly in the northwestern part of Chester County and in North Valley Hills, adjacent to Chester Valley. A few small areas are scattered in the northern half of Chester County. The soils are mostly on ridges and on the upper parts of slopes.

The soils in this association are nearly level to very steep, but in most places they are gently to moderately sloping. The steep, very steep, and very stony areas are not extensive. About a third of the acreage has been cleared and used for crops and pastures. The rest is wooded.

3. Glenelg-Manor-Chester association: Shallow to deep, silty and channery soils on grayish-brown schist and gneiss

This is the largest soil association in Chester and Delaware Counties. It occupies 393,000 acres and is in nearly all parts of the two counties. The soils range from level to steep, but the largest acreage is gently to moderately sloping.

The principal soils on uplands in this association are the Glenelg, Manor, Chester, Brandywine, Worsham, and Glenville. Less extensive are the Wehadkee, Chewacla, and Congaree soils on flood plains. These soils are underlain mainly by Wissahickon and Peters Creek schist and Baltimore gneiss.

The Glenelg soils are similar to the Chester soils but are shallower over parent material. The Chester soils are deep and well drained. They have a surface layer of dark-brown silt loam and a subsoil of strong-brown, light silty clay loam or silt loam. The Manor soils, developed from similar parent material, are shallow to partly weathered schist and are well drained. Brandywine soils are shallow and droughty. They have a surface layer of very dark gray loam and a subsoil of yellowish-brown, gritty sandy loam. The Brandywine soils developed chiefly from coarse-grained gneiss and pegmatite. The Worsham soils are poorly drained, and the Glenville are moderately well drained. They occur in low-lying areas and around the heads of streams.

Dairy farming and the raising of livestock predominate in this soil association. The crops that are grown are generally used to feed animals on the farms. The sloping soils are likely to erode and require protection to help control erosion. Most of the apple and peach orchards in Chester and Delaware Counties are within this soil association.

4. Hagerstown-Conestoga-Guthrie association: Deep, silty soils on limestone

This soil association occupies 22,000 acres in Chester Valley. The valley is 1 to 2 miles wide. It extends across Chester County from the county line near Atglen northeast through Coatesville, Downingtown, and Valley Forge State Park to the eastern edge of the county. Several other areas of the association are scattered throughout Chester County, but the largest areas are near Avondale and Doe Run.

The major soils in this association are the Hagerstown, Conestoga, Guthrie, and Lawrence, but smaller areas of Bedford, Lindside, and Melvin soils are included. The soils are level to moderately sloping, but most of them are gently sloping. Nearly all of this soil association has been cleared and is used for cultivated crops.

The Hagerstown soils are deep and well drained. They have a surface layer of dark-brown silt loam and a subsoil of strong-brown silty clay loam. The Conestoga soils generally have a lighter texture than the Hagerstown soils, and they are somewhat lighter colored. Their substratum is fine sandy loam. The Guthrie, Lawrence, and Bedford soils are not so well drained as the Hagerstown and Conestoga soils, and they have mottling in the subsoil. The Lindside and Melvin soils are on flood plains.

Except for the Guthrie and Melvin soils, which are poorly drained, all of the soils in this association are fairly well suited to crops. Much of the industrial and urban development in Chester County is within this association.

5. Neshaminy-Glenelg association: Moderately deep and deep, well-drained, silty, channery, and gravelly soils on gabbro and granodiorite

This soil association occupies 73,000 acres. The areas are scattered throughout Chester and Delaware Counties. The soils in this association are gently sloping to steep, but they are mainly moderately sloping. The areas of steep and stony soils are not extensive and are mostly wooded. The major soils in this association are the Neshaminy, Glenelg, Glenville, and Worsham, but there are smaller areas of Chewacla and Wehadkee soils.

The Neshaminy and Glenelg soils are deep to moderately deep and are well drained. They have a surface layer of dark-brown silt loam and a subsoil of reddish-brown silty clay loam. The substratum consists mostly of weathered gabbro and granodiorite. The channery nature of the soils retards erosion.

The Glenville and Worsham soils are not so well drained as the Neshaminy and Glenelg, and they have mottling in the subsoil. The Chewacla and Wehadkee soils are on flood plains.

General farm crops grow well on the soils in this association, but hay and pasture are the main crops.

6. Neshaminy-Chrome-Conowingo association: Moderately deep and deep, silty soils on serpentine

This soil association occupies 10,000 acres in Chester and Delaware Counties. The largest acreage is in the southwestern part of Chester County, known as the barrens. Another fairly large area is in Delaware County; it is about 2 miles west of Media and extends northeast toward Newtown Square. Other small areas are scattered throughout the two counties.

The soils of this association are nearly level to very steep, but they are dominantly moderately sloping. The steep and very steep areas are wooded and consist mostly of Chrome soils.

The Neshaminy soils are deep and are well drained. They have a surface layer of dark yellowish-brown silt loam and a subsoil of yellowish-red silty clay loam. The Chrome soils have a dark grayish-brown, silty surface layer and a dark yellowish-brown, clayey subsoil. The Conowingo soils are deep and have mottling in the lower part of the subsoil. The Calvert and Aldino soils, also in this association, are deep and moderately deep. They are poorly drained and have mottling at or near the surface.

Much idle and abandoned land is in this soil association. General farm crops are grown on a few farms, but the soils are better suited to hay and pasture than to crops that require tillage.

7. Beltsville-Sassafras-Butlertown association: Deep, silty or sandy soils on coastal plain sediments

This soil association occupies 33,000 acres. The areas are in the southeastern section of Delaware County, adjoining the Delaware River.

The soils are nearly level to moderately sloping, but they are mostly gently sloping. The major soils are the Beltsville, Sassafras, and Butlertown, but there are some

areas of Woodstown soils and a few small areas of Othello soils.

The Beltsville soils are deep, moderately well drained, and have a fragipan. Their surface layer is dark grayish-brown silt loam, and their subsoil is yellowish-brown silty clay loam. The Sassafras soils, which are fairly sandy, are well drained, and the Butlertown and Woodstown soils are moderately well drained. The Othello soils are deep and poorly drained. They are mottled near the surface.

These soils are not extensive, and most of them are in areas where farming is done on a part-time basis. Many areas are idle and are likely to be developed as residential areas.

8. Montalto-Watchung-Mount Lucas association: Deep, silty and channery soils on dark-gray diabase

This soil association occupies 5,800 acres in the Triassic area in the northwestern part of Chester County. The soils are gently sloping to very steep, but most areas are moderately sloping and are very stony. These areas are forested.

The major soils of this association are the Montalto, Watchung, and Mount Lucas. There are smaller areas of Brecknock and Lehigh soils.

The Montalto soils are deep and well drained. They have a subsoil of dark-brown silt loam. The Watchung soils are deep; they are poorly drained and have a mottled surface layer. The Mount Lucas soils are moderately well drained and have a mottled subsoil. The Brecknock and Lehigh soils are deep. The Brecknock are well drained, and the Lehigh are moderately well drained. These soils are underlain by baked shale and sandstone.

This soil association is mostly wooded. A few small areas are cultivated, and other areas are pastured.

Use and Management of the Soils

This section has several parts. The first explains the system of capability classification used by the Soil Conservation Service. Then management of groups of soils, the capability units, are described. The next part gives estimated relative yields of the principal crops for each mapping unit. This is followed by a discussion of management of the soils for woodland, for wildlife, and for engineering. Finally, there is a discussion of the soils in relation to rural developments.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on the limitations of the soils, on the risk of damage when they are used, and on the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes, there can be as many as four subclasses. The subclass is indicated 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* means that water in or on the soil will interfere with the growth of plants or with 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 country, indicates that the chief limitation is a climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c* because the soils in it have little or no susceptibility to erosion but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soil enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping of soils for many statements about their management. Capability units are generally identified by Arabic numbers assigned locally, for example, IIe–1 or IIIe–2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations. The grouping does not take into consideration major, and generally expensive, landforming that would change the slope, depth, or other characteristics of the soil. It also does not take into consideration possible, but unlikely, major reclamation projects.

The capability classes, subclasses, and units in which the soils of Chester and Delaware Counties are classified are defined in the listing that follows. The capability units fit into a nationwide system based on the potentialities and limitations of the soils for the most common farm crops and pasture plants. Other groupings are likely to be needed for other purposes.

Class I.—Soils that have a few limitations that restrict their use.

- Unit I–1.—Deep, nearly level, well-drained soils of uplands.
- Unit I–2.—Deep, level or nearly level, well-drained, silty soil of flood plains.

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

Subclass IIe.—Soils subject to moderate erosion if they are not protected.

- Unit IIe–1.—Deep, nearly level to gently sloping, well-drained soils on limestone.
- Unit IIe–2.—Deep or moderately deep, nearly level to gently sloping, well-drained soils on acid materials.
- Unit IIe–3.—Deep, gently sloping, well-drained soil on diabase.
- Unit IIe–4.—Moderately deep, gently sloping, well-drained soils on quartzite.
- Unit IIe–5.—Shallow to moderately deep, gently sloping, well-drained soils of uplands.

Unit IIe-6.—Gently sloping, moderately well drained to somewhat poorly drained soils of uplands.

Subclass IIw.—Soils that have moderate limitations because of excess water.

Unit IIw-1.—Deep, nearly level, moderately well drained soils of uplands.

Unit IIw-2.—Deep, nearly level, moderately well drained soils of flood plains.

Subclass IIs.—Soils that have moderate limitations of moisture capacity or tilth.

Unit IIs-1.—Shallow, nearly level, well-drained soil.

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

Subclass IIIe.—Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe-1.—Deep, moderately sloping, well-drained soils on limestone.

Unit IIIe-2.—Moderately deep or deep, gently sloping to moderately sloping, well-drained, acid soils.

Unit IIIe-3.—Moderately deep, moderately sloping, well-drained soils.

Unit IIIe-4.—Shallow to moderately deep, gently sloping to moderately sloping soils that are well drained.

Unit IIIe-5.—Moderately sloping, moderately well drained to somewhat poorly drained soils.

Subclass IIIw.—Soils that have severe limitations because of excess water.

Unit IIIw-1.—Nearly level, somewhat poorly drained or poorly drained soils that have a slowly permeable subsoil.

Unit IIIw-2.—Nearly level and gently sloping, moderately well drained to somewhat poorly drained soils of uplands.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe.—Soils subject to very severe erosion if they are cultivated and not protected.

Unit IVe-1.—Deep, moderately sloping, well-drained soils on limestone.

Unit IVe-2.—Moderately deep and deep, moderately sloping to moderately steep, well-drained soils.

Unit IVe-3.—Deep, moderately sloping, well-drained soil on diabase.

Unit IVe-4.—Shallow and moderately deep, gently sloping to moderately steep, well-drained soils.

Unit IVe-5.—Moderately deep to somewhat shallow, nearly level or gently sloping, well-drained soils of uplands that are severely eroded.

Subclass IVw.—Soils that have very severe limitations for cultivation because of excess water.

Unit IVw-1.—Nearly level, poorly drained soils that have a tight, slowly permeable subsoil.

Unit IVw-2.—Deep, gently sloping soil that is poorly drained.

Class V.—Soils not likely to erode but that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw.—Soils too wet for cultivation; drainage or protection not feasible.

Unit Vw-1.—Deep, nearly level, poorly drained to very poorly drained soils of uplands.

Class VI.—Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Unit VIe-1.—Moderately deep or deep soils that are moderately steep to steep and well drained.

Unit VIe-2.—Shallow to moderately deep soils that are moderately sloping to steep and well drained.

Subclass VIw.—Soils severely limited by excess water and generally unsuitable for cultivation.

Unit VIw-1.—Deep, nearly level, poorly drained soils of flood plains.

Unit VIw-2.—Gently sloping to moderately sloping, poorly drained soils that have a subsoil of tight clay.

Subclass VIs.—Soils generally unsuitable for cultivation and limited for other uses by their moisture capacity, stones, or other features.

Unit VIs-1.—Deep, nearly level to moderately steep, well-drained soils that are very stony.

Unit VIs-2.—Deep, nearly level to moderately sloping, moderately well drained soils that are very stony.

Class VII.—Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.—Soils very severely limited, chiefly by risk of erosion, if protective cover is not maintained.

Unit VIIe-1.—Shallow to moderately deep, moderately steep and steep, well-drained soils.

Subclass VIIs.—Soils very severely limited by moisture capacity, stones, or other features.

Unit VIIs-1.—Shallow to moderately deep, gently sloping to very steep, very stony soils.

Unit VIIs-2.—Moderately deep to deep, nearly level to gently sloping soils that are somewhat poorly drained or poorly drained and very stony.

Class VIII.—Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants and that restrict their use to recreation, wildlife, water supply, or esthetic purposes.

Subclass VIIIw.—Extremely wet or marshy land.

Unit VIIIw-1.—Tidal marsh.

Management by Capability Units

Soils in one capability unit have about the same limitations and similar risks of damage. The soils in one unit, therefore, need about the same kind of management, though they may have formed from different kinds of parent material and in different ways. The capability units are described in the following pages. The soils in

each unit are listed, and management suitable for all the soils of one unit is suggested.

Capability unit I–1

In this unit are deep, nearly level, well-drained soils of uplands. The soils are moderately permeable and have moderately high to high available moisture capacity. They are moderate to moderately high in productivity and are easy to work. The following soils are in this unit:

Chester silt loam, 0 to 3 percent slopes.
Conestoga silt loam, 0 to 3 percent slopes.
Glenelg channery silt loam, 0 to 3 percent slopes.
Neshaminy gravelly silt loam, 0 to 3 percent slopes.
Sassafras loam, 0 to 3 percent slopes.

The soils of this unit are well suited to corn, small grain, alfalfa, red clover, bromegrass, orchardgrass, timothy, potatoes, tobacco, apples, peaches, and most of the vegetables commonly grown in the county. Keeping tillage to a minimum and turning under crop residues will improve the structure of these soils and help to prevent erosion. If the soils are used for tilled crops, a cover crop needs to be grown in winter and a sod crop of grass or of grasses and legumes should be grown every few years.

Capability unit I–2

Only one soil—Congaree silt loam—is in this unit. This deep, level or nearly level, well-drained, silty soil is on flood plains. It is highly productive and has high available moisture capacity and good tilth. The soil is subject to slight overflow for short periods late in winter and early in spring.

This soil is well suited to corn, small grain, alfalfa, red clover, ladino clover, timothy, and orchardgrass. Tobacco, potatoes, truck crops, and vegetables are grown in small areas. If a sod crop consisting of legumes and grasses is grown every few years, it will supply some organic matter and will help to improve the structure of this soil.

Capability unit IIe–1

In this unit are deep, nearly level to gently sloping, well-drained soils on limestone. The soils are silty and are moderately permeable. They are moderate to high in productivity and in available moisture capacity. These soils are easy to work and respond well to good management, but they are subject to moderate erosion. The following soils are in this unit:

Conestoga silt loam, 0 to 3 percent slopes, moderately eroded.
Conestoga silt loam, 3 to 8 percent slopes, moderately eroded.
Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded.
Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded.

These soils are well suited to corn, small grain, alfalfa, red clover, bromegrass, orchardgrass, tobacco, apples, and peaches. They are also suited to all of the vegetables commonly grown in the area.

Diversion terraces, contour stripcropping, or both, are needed on the gently sloping areas to help control runoff and erosion. Growing a crop of legumes and grasses every few years will help to reduce erosion. The legumes and grasses supply organic matter and improve the structure of the soil. Following a row crop with a cover crop also helps to protect the soils.

Capability unit IIe–2

This unit consists of deep or moderately deep, nearly level to gently sloping, well-drained soils on acid materials of the uplands. The soils are moderately permeable and have moderately high available moisture capacity. Most of them are moderately eroded and are moderate to moderately high in productivity. The following soils are in this unit:

Bucks silt loam, 3 to 8 percent slopes, moderately eroded.
Chester silt loam, 0 to 3 percent slopes, moderately eroded.
Chester silt loam, 3 to 8 percent slopes.
Chester silt loam, 3 to 8 percent slopes, moderately eroded.
Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded.
Glenelg channery silt loam, 3 to 8 percent slopes.
Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded.
Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded.
Sassafras loam, 3 to 8 percent slopes, moderately eroded.

These soils are well suited to corn, small grain, alfalfa, red clover, bromegrass, timothy, orchardgrass, apples, and peaches. They are also suited to potatoes and to all the other vegetables commonly grown in the area.

Field terraces and diversion terraces are needed if tilled crops are grown on the gently sloping areas, or contour stripcropping and diversion terraces should be used. Legumes and grasses need to be grown often enough to help control erosion. They improve the structure of the soil and supply organic matter. Growing a cover crop after each row crop also helps to control erosion.

Capability unit IIe–3

Only one soil—Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded—is in this unit. This deep, well-drained soil overlies diabase. It has moderately slow permeability and is subject to excessive runoff and erosion if it is not protected. The available moisture capacity is moderate, and the soil is moderately to highly productive.

This soil is suited to corn, small grain, alfalfa, red clover, bromegrass, timothy, and orchardgrass. It is also suited to apples and to all of the vegetables commonly grown in the area. The soil warms more slowly in spring than the soils of capability unit IIe–1. It also takes water more slowly and is more erodible.

If tilled crops are grown, this soil needs to be protected by contour stripcropping, field terraces, or diversion terraces. A winter cover crop should be grown after each row crop. A crop of legumes and grasses needs to be included in the cropping system often enough to help protect the soil from erosion. The legumes and grasses supply organic matter and improve the structure of the soil.

Capability unit IIe–4

In this unit are moderately deep, gently sloping, well-drained soils on quartzite. The soils are on uplands. They are moderately productive and have moderate available moisture capacity and moderate to moderately rapid permeability. The following soils are in this unit:

Edgemont channery loam, 3 to 8 percent slopes.
Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.

These soils are suited to corn, small grain, timothy, and orchardgrass. Alfalfa can be grown, but the soils are less well suited to it than to red clover. Tomatoes and potatoes can be grown; in years when moisture is adequate, they make moderate yields. These soils are not suited to other vegetables.

If these soils are used for tilled crops, field terraces, diversion terraces, and contour stripcropping are needed to help control erosion. Growing a mixture of legumes and grasses every 2 or 3 years will also help control erosion. The legumes and grasses return organic matter to the soils and improve the structure. Following each row crop, a cover crop is needed to help protect the soils.

Capability unit IIe–5

This unit is made up of shallow to moderately deep, gently sloping, well-drained soils of uplands. The soils have moderate or moderately rapid permeability and moderately low available moisture capacity. The following soils are in this unit:

Brandywine loam, 3 to 8 percent slopes, moderately eroded.
Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded.
Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded.
Hollinger silt loam, 3 to 8 percent slopes, moderately eroded.
Manor loam, 3 to 8 percent slopes, moderately eroded.
Penn silt loam, 3 to 8 percent slopes, moderately eroded.
Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded.

These soils are fairly well suited to corn, small grain, alfalfa, red clover, timothy, and orchardgrass. Because they are low in available moisture capacity, yields are not high except in years of above-average rainfall. The soils are too droughty for high yields of bluegrass pasture. They are fairly well suited to apples, potatoes, and most of the vegetables commonly grown in the area.

If these soils are used for tilled crops, practices are needed to protect them from erosion. Diversion terraces and contour stripcropping are particularly well suited to that purpose. A crop of legumes and grasses needs to be grown often enough to help control erosion. The legumes and grasses return organic matter to the soils and improve the structure. Growing a winter cover crop after each row crop will also help to protect the soils.

Capability unit IIe–6

In this unit are gently sloping, moderately well drained to somewhat poorly drained soils of uplands. These soils are moderately permeable and have high available moisture capacity. They are moderate to moderately high in productivity. In places the soils have a tight layer in the subsoil that retards drainage. In other places there is a seasonally high water table. These soils are likely to heave in winter, and they are subject to erosion. The following soils are in this unit:

Bedford silt loam, 3 to 8 percent slopes.
Bedford silt loam, 3 to 8 percent slopes, moderately eroded.
Beltsville silt loam, 3 to 8 percent slopes, moderately eroded.
Butlertown silt loam, 3 to 8 percent slopes, moderately eroded.
Glenville silt loam, 3 to 8 percent slopes.
Glenville silt loam, 3 to 8 percent slopes, moderately eroded.
Readington silt loam, 3 to 8 percent slopes.
Readington silt loam, 3 to 8 percent slopes, moderately eroded.

These soils are suited to corn, alsike clover, ladino clover, orchardgrass, timothy, and small grain that is planted in spring. They are not well suited to alfalfa, nor are they suited to small grain planted in fall, because those crops are likely to be killed in winter by heaving. The soils are slow to warm in spring and are not well suited to tree fruits, potatoes, or vegetables that require planting early in spring.

These soils need supplemental drainage for good yields of tilled crops. Tile can be used where adequate outlets are available. Open ditches or bedding can be used where tile drainage is not suitable. Practices are needed to help control erosion on fields that are tilled. Diversion terraces and graded stripcropping can be used to help protect the soils and to dispose of some of the excess water. A cropping system in which legumes and grasses are grown more of the time than tilled crops will also help to control erosion. The legumes and grasses supply organic matter and improve the structure of the soils.

Capability unit IIw–1

In this unit are deep, nearly level, moderately well drained soils of uplands. The soils are moderately permeable and have high available moisture capacity. They are moderately productive but are wet and slow to warm in spring. On long slopes the soils are likely to erode. The following soils are in this unit:

Bedford silt loam, 0 to 3 percent slopes.
Beltsville silt loam, 0 to 3 percent slopes.
Butlertown silt loam, 0 to 3 percent slopes.
Glenville silt loam, 0 to 3 percent slopes.
Readington silt loam, 0 to 3 percent slopes.
Woodstown loam, 0 to 3 percent slopes.

These soils are suited to alsike clover, ladino clover, orchardgrass, timothy, and small grain that is planted in spring. They are not well suited to alfalfa and small grain planted in fall, because those crops are likely to be killed in winter by heaving. The soils are not well suited to other vegetables commonly grown in the area.

These soils need supplemental drainage for good yields of tilled crops. Tile drains can be used if suitable outlets are available. The nearly level areas can be drained by bedding, and diversion terraces can be used to remove excess water that flows from higher areas. In some places graded stripcropping will help protect the soils from runoff and erosion.

Capability unit IIw–2

This unit consists of deep, nearly level, moderately well drained soils of flood plains. The soils are moderately permeable and have high available moisture capacity. They are moderately to highly productive. These soils are flooded occasionally for short periods, generally late in winter or early in spring. The following soils are in this unit:

Chewacla silt loam.
Lindside silt loam.
Rowland silt loam.
Rowland silt loam, dark surface.

Corn, small grain that is seeded in spring, alsike clover, ladino clover, orchardgrass, and timothy can be grown on these soils. The soils are too wet for alfalfa, small grain that is planted in fall, potatoes, or other vegetables commonly grown in the county.

In some places the soils may need supplementary drainage. Surface ditches can be used for that purpose.

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Capability unit IIs–1

Only one soil—Manor loam, 0 to 3 percent slopes, moderately eroded—is in this unit. This nearly level, shallow soil is well drained. Its available moisture capacity is moderately low, and it has moderately rapid permeability. The soil is subject to erosion and is moderately low in productivity.

This soil is suited to corn, small grain, alfalfa, red clover, orchardgrass, and timothy. Yields are not high, however, except in years when rainfall is above normal and is well distributed. The soil is not well suited to tobacco and tree fruits, nor is it suited to potatoes and other vegetable crops commonly grown in the area.

Farming this soil on the contour will help to conserve moisture. Growing a mixture of legumes and grasses every few years will help to supply organic matter and improve the structure of the soil.

Capability unit IIIe–1

This capability unit consists of deep, moderately sloping, well-drained soils on limestone. The soils are on uplands. They are moderately permeable and are subject to severe erosion if they are not protected. These soils are moderate to high in available moisture capacity and in productivity. In general, they are easy to work and respond well to good management. The following soils are in this unit:

Conestoga silt loam, 8 to 15 percent slopes, moderately eroded.
Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded.

If protected from erosion, these soils are well suited to corn, tobacco, and small grain, and to apples and peaches. They are not well suited to potatoes but are fairly well suited to tomatoes and other vegetable crops commonly grown in the area. The soils are very well suited to alfalfa, red clover, bromegrass, orchardgrass, timothy, and bluegrass.

If tilled crops are grown, these soils will need diversion terraces and contour stripcropping to help control erosion. Keeping tillage to a minimum, returning crop residues, if feasible, and growing a cover crop in winter will also help to control erosion and will conserve moisture and improve the structure of the soils.

Capability unit IIIe–2

This unit consists of moderately deep or deep, acid soils of uplands. The soils are gently sloping to moderately sloping and are well drained. They are moderately permeable. The hazard of erosion is serious, and some areas are already severely eroded. These soils have moderate to high available moisture capacity and are moderately to highly productive. The following soils are in this unit:

Chester silt loam, 3 to 8 percent slopes, severely eroded.
Chester silt loam, 8 to 15 percent slopes.
Chester silt loam, 8 to 15 percent slopes, moderately eroded.
Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded.
Glenelg channery silt loam, 8 to 15 percent slopes.
Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded.
Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded.
Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded.

These soils are well suited to corn, small grain, tomatoes, apples, and peaches. They are also well suited to alfalfa, red clover, bromegrass, orchardgrass, and timothy, but they are not well suited to potatoes, because they are too steep.

If these soils are used for tilled crops, they require practices to protect them from erosion. Diversion terraces and contour stripcropping will help to protect the soils and will also conserve moisture. A crop consisting of legumes and grasses needs to be grown often enough to help control erosion. The legumes and grasses add organic matter and improve the structure of the soils.

Capability unit IIIe–3

This unit consists of moderately deep, moderately sloping, well-drained soils on uplands. The soils have moderate permeability. Their available moisture capacity and productivity are also moderate. The hazard of erosion is serious if these soils are cultivated. The following soils are in this unit:

Edgemont channery loam, 8 to 15 percent slopes.
Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.

These soils are well suited to corn, small grain, alfalfa, red clover, orchardgrass, and timothy. They are fairly well suited to apples and peaches.

If these soils are used for tilled crops, diversion terraces and contour stripcropping will be needed to help control erosion. Legumes and grasses should be included in the cropping system to help protect the soils. The legumes and grasses will supply organic matter and improve the structure of the soils. The soils can also be protected by growing a cover crop after each row crop.

Capability unit IIIe–4

In this unit are shallow to moderately deep, gently sloping to moderately sloping soils that are well drained. The soils are on uplands. They are moderately permeable and have moderately low available moisture capacity. Most of the soils are moderately productive, but some of them, particularly the severely eroded ones, are low in productivity. Further erosion will seriously reduce the depth to which plant roots can penetrate. The following soils are in this unit:

Brandywine loam, 8 to 15 percent slopes.
Brandywine loam, 8 to 15 percent slopes, moderately eroded.
Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded.
Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded.
Hollinger silt loam, 8 to 15 percent slopes, moderately eroded.
Manor loam, 3 to 8 percent slopes, severely eroded.
Manor loam, 8 to 15 percent slopes.
Manor loam, 8 to 15 percent slopes, moderately eroded.
Penn silt loam, 8 to 15 percent slopes, moderately eroded.
Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded.

These soils are fairly well suited to corn, small grain, alfalfa, red clover, orchardgrass, and timothy. Yields of these crops are better in seasons of above-normal rainfall than in years when rainfall is only average. The soils are not well suited to potatoes, other vegetables that are commonly grown in the two counties, and to tobacco. Apples and peaches can be grown, but the soils do not store enough moisture for good yields of fruit. If tilled crops are grown on these soils, practices are needed to control

erosion. Diversion terraces and contour stripcropping can be used effectively.

Capability unit IIIe–5

This unit consists of moderately sloping, moderately well drained to somewhat poorly drained soils of uplands. The soils are slowly permeable. They have moderate available moisture capacity and are moderately productive. Because drainage is somewhat restricted, plants growing on them are subject to heaving in winter. Lehigh silt loam, 8 to 15 percent slopes, severely eroded, occupies only a small acreage. Its limitations are those of class IV land, and if this soil were more extensive, it would be grouped in a capability unit under class IV. The following soils are in this unit:

Glenville silt loam, 8 to 15 percent slopes, moderately eroded.
Lehigh silt loam, 8 to 15 percent slopes, severely eroded.

These soils are suited to corn, small grain, red clover, alsike clover, ladino clover, orchardgrass, and timothy. In winter alfalfa is likely to be killed by heaving. Potatoes and other vegetables commonly grown in the two counties are not well suited, nor are apples, peaches, and tobacco.

Diversion terraces and graded stripcropping can be used to protect the soils from erosion if tilled crops are grown. They will also divert excess water so that it will be carried safely from the fields. A cropping system needs to be chosen that includes more grasses and legumes than tilled crops. The grasses and legumes will provide additional protection against erosion, supply organic matter, and improve the structure of the soils.

Capability unit IIIw–1

In this unit are nearly level, somewhat poorly drained or poorly drained soils that have a slowly permeable subsoil. The soils are on uplands and are only slightly susceptible to erosion. Permeability is moderate, and the available moisture capacity is high. These soils have moderately high natural fertility, but they are slow to dry out in spring. The following soils are in this unit:

Aldino silt loam, 0 to 3 percent slopes.
Aldino silt loam, 3 to 8 percent slopes, moderately eroded.
Lawrence silt loam, 0 to 3 percent slopes.
Lawrence silt loam, 3 to 8 percent slopes.
Othello silt loam.

These soils are better suited to pasture or hay than to tilled crops. Grasses and legumes that tolerate water are better to seed than deep-rooted plants that require a well-drained soil. The soils are not well suited to winter small grain and potatoes.

Sodded waterways and graded stripcropping are needed to help control erosion. On long slopes diversion terraces can be used to help remove excess water. Where feasible, open drains or tile drains can be used to remove excess water during periods when runoff is rapid.

Capability unit IIIw–2

In this unit are nearly level and gently sloping, moderately well drained to somewhat poorly drained soils of uplands. The soils are moderately deep to deep. They have tight layers in the subsoil, and the lower part of the subsoil is likely to be waterlogged for fairly long periods in winter and spring. Permeability is slow. These soils are moderately low in productivity. The following soils are in this unit:

Conowingo silt loam, 0 to 3 percent slopes.
Conowingo silt loam, 3 to 8 percent slopes, moderately eroded.
Lehigh silt loam, 3 to 8 percent slopes.
Lehigh silt loam, 3 to 8 percent slopes, moderately eroded.

These soils are suited to corn, small grain that is seeded in spring, timothy, orchardgrass, ladino clover, and alsike clover. They are not well suited to alfalfa and other deep-rooted plants. The soils are slow to warm in spring. If precipitation is above average in spring and summer, yields of corn and small grain will be greatly reduced. Tile drains are not effective for these soils.

Capability unit IVe–1

These are deep, moderately sloping, well-drained soils on limestone in the uplands. The soils are moderately permeable and have high available moisture capacity. Because they are severely eroded, they are low to moderate in fertility, although originally they were very fertile. The soils respond well to good management. The following soils are in this unit:

Conestoga silt loam, 8 to 15 percent slopes, severely eroded.
Hagerstown silt loam, 8 to 15 percent slopes, severely eroded.

These soils are well suited to alfalfa, red clover, bromegrass, orchardgrass, and timothy. Corn and small grain can be grown, but, because of the severe hazard of erosion, it is best to grow corn no more than one-fifth of the time. Diversion terraces and stripcropping are needed to help control erosion. Crops on these soils generally respond well if large amounts of lime and fertilizer are applied.

Capability unit IVe–2

This unit consists of moderately deep and deep, moderately sloping to moderately steep, well-drained soils on uplands. The soils are moderate in permeability and have moderate available moisture capacity. The severely eroded ones are moderately low to low in productivity. The following soils are in this unit:

Chester silt loam, 8 to 15 percent slopes, severely eroded.
Edgemont channery loam, 8 to 15 percent slopes, severely eroded.
Edgemont channery loam, 15 to 25 percent slopes.
Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.
Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded.
Glenelg channery silt loam, 15 to 25 percent slopes.
Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded.
Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded.
Neshaminy gravelly silt loam, 15 to 25 percent slopes.

These soils are suited to alfalfa, red clover, orchardgrass, and timothy. If they are protected adequately by diversion terraces and contour strips, a cropping system can be used in which row crops are grown about one-sixth of the time. Large amounts of fertilizer are required to maintain high-quality stands of forage for long periods.

These soils can be used for apples and peaches, but yields in some places will be reduced by lack of moisture. Growing the trees on the contour will help conserve moisture.

Capability unit IVe-3

Only one soil—Montalto channery silt loam, 8 to 15 percent slopes, severely eroded—is in this unit. This deep, well-drained soil is underlain by diabase. It has moderately slow permeability and moderate to moderately low available moisture capacity. The soil is moderately productive.

This soil is well suited to perennial hay and to mixtures of grasses and legumes made up of alfalfa, red clover, orchardgrass, and timothy. If the soil is used for cultivated crops, diversion terraces and contour strips will be needed to protect it from erosion. The areas should not be plowed or cultivated for reseeding oftener than once every 4 years.

Apples and peaches grow well on this soil. In years when rainfall is below normal during the growing season, however, yields are likely to be lower than in years when there is a greater amount of moisture.

Capability unit IVe-4

In this capability unit are shallow and moderately deep, gently sloping to moderately steep, well-drained soils of uplands. Most of the soils are moderately or severely eroded. Runoff from areas that are tilled is likely to be rapid, and the control of erosion is a serious problem. These soils have moderate or moderately rapid permeability. Most of them have low or moderately low available moisture capacity. Productivity is moderately low. The following soils are in this unit:

Brandywine loam, 8 to 15 percent slopes, severely eroded.
Brandywine loam, 15 to 25 percent slopes.
Brandywine loam, 15 to 25 percent slopes, moderately eroded.
Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded.
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded.
Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded.
Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded.
Hollinger silt loam, 8 to 15 percent slopes, severely eroded.
Manor loam, 8 to 15 percent slopes, severely eroded.
Manor loam, 15 to 25 percent slopes.
Manor loam, 15 to 25 percent slopes, moderately eroded.
Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded.
Penn silt loam, 8 to 15 percent slopes, severely eroded.
Penn silt loam, 15 to 25 percent slopes.
Penn silt loam, 15 to 25 percent slopes, moderately eroded.
Penn and Lansdale sandy loams, 8 to 15 percent slopes, severely eroded.
Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded.

Row crops should be grown on these soils no oftener than one-sixth of the time. The soils are well suited to alfalfa, red clover, bromegrass, orchardgrass, and timothy if adequate amounts of lime and fertilizer are applied. Apples and peaches can be grown where air drainage is suitable. Yields may not be high, however, because the soils do not store enough moisture.

Diversion terraces and contour stripcropping are needed on these soils to help control erosion. In the orchards practices are also needed to protect the soils and to conserve moisture.

Capability unit IVe-5

In this unit are moderately deep to somewhat shallow, nearly level or gently sloping, well-drained soils of uplands. The permeability of these soils is moderate to rapid, and the available moisture-holding capacity is low. The soils are low in fertility, and the content of organic matter is very low. These soils are classified as severely eroded, but, actually, the surface soil was stripped off to serve as casing soil in mushroom houses. The following soils are in this unit:

Glenelg silt loam, 0 to 3 percent slopes, severely eroded.
Glenelg silt loam, 3 to 8 percent slopes, severely eroded.

Erosion is a serious hazard on these soils. The soils need large amounts of barnyard manure, lime, and fertilizer. A permanent cover of suitable grasses and legumes should then be seeded. On the gently sloping areas, diversion terraces are needed to remove excess water when rainfall is heavy. Special care is needed to maintain a good cover of sod at all times in the natural waterways. The sod will prevent gullies from forming. If these soils are tilled, the supply of organic matter needs to be increased.

In some places the soils have been stripped more than once. In these areas special care is needed to restore the soils to a satisfactory level of fertility. To do this, a system can be adopted like the one used by one operator who spreads 2 to 4 inches of spent mushroom soil over areas that have recently been stripped. In fall the area is plowed and seeded to wheat, and the following year it is seeded to alfalfa and timothy. Large amounts of lime and fertilizer are applied, and the alfalfa and timothy are kept on the area for about 8 to 10 years when the soil is again ready for stripping.

Capability unit IVw-1

In this unit are nearly level, poorly drained soils that have a tight, slowly permeable subsoil. These soils are on uplands. They are slowly permeable and are waterlogged most of the time. The soils are medium to low in natural fertility. Erosion is not a problem. The following soils are in this unit:

Croton silt loam, 0 to 3 percent slopes.
Guthrie silt loam.

These soils can be used for hay or pasture, but they are too wet for tilled crops unless they have been artificially drained. They are not suited to deep-rooted grasses and legumes that do not tolerate wetness for long periods.

Open ditches and bedding will help remove the excess water and permit tillage in some places. When the water table is lowered, more plant nutrients become available and roots make better development. Crops generally respond if lime and fertilizer are added after drainage has been established. Tile drains are generally not successful, because of the slow permeability of the subsoil. In many places excess water from more sloping areas above can be removed by using diversion terraces.

Capability unit IVw-2

Only one soil—Croton silt loam, 3 to 8 percent slopes—is in this unit. It is a deep, gently sloping soil that is poorly drained. The soil is on uplands. It is slowly permeable and is waterlogged most of the time. Productivity is moderate to low.

This soil is fairly well suited to pasture or hay. The water table is high most of the time, and the soil is not suited to plants that do not tolerate wetness.

Diversion terraces can be used to help remove excess water. In some places open ditches will provide both

surface and subsurface drainage. The waterways should be kept in sod to prevent them from eroding. Tile drains generally are not practical because of the heavy texture of the subsoil.

Capability unit Vw–1

In this unit are deep, nearly level, poorly drained to very poorly drained soils of uplands. The soils are slowly permeable, and in many places the water table is high. These soils are low in productivity. The following soils are in this unit:

Calvert silt loam, 0 to 3 percent slopes.
Watchung silt loam, 0 to 3 percent slopes.
Worsham silt loam, 0 to 3 percent slopes.

These soils are mostly covered with brush or trees. If cleared, they have only limited use for hay and pasture, but legumes that tolerate wetness will grow.

Surface bedding systems, used in combination with open ditches, will remove excess surface and subsurface water from the areas. Tile drains are generally not practical because the subsoil is too tight to permit water to move readily downward to the tile.

Capability unit VIe–1

In this unit are moderately deep or deep soils that are moderately steep to steep and well drained. These soils are on uplands where the hazard of erosion is moderate to severe. Their available moisture capacity is moderate, and they are moderately productive. The following soils are in this unit:

Edgemont channery loam, 15 to 25 percent slopes, severely eroded.
Edgemont channery loam, 25 to 35 percent slopes.
Edgemont channery loam, 25 to 35 percent slopes, moderately eroded.
Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded.
Glenelg channery silt loam, 25 to 35 percent slopes.
Montalto channery silt loam, 15 to 25 percent slopes, severely eroded.
Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded.

Except for a few areas that are wooded, these soils are used mainly for pasture. A few areas are in orchards.

When the pastured areas are renovated, they need to be reseeded in contour strips. The seedbed should be disked rather than plowed. If feasible to do so, plant new orchards on the contour to help prevent erosion and conserve moisture. Diversion terraces are needed on the moderately sloping areas to retard runoff and to help control erosion. Construct outlets for the safe disposal of water before the diversion terraces are completed.

Capability unit VIe–2

In this unit are shallow to moderately deep soils of uplands that are moderately sloping to steep and well drained. Most of these soils have moderately low available moisture capacity. Nearly all of them are moderately or severely eroded and are low in productivity. The following soils are in this unit:

Brandywine loam, 15 to 25 percent slopes, severely eroded.
Brandywine loam, 25 to 40 percent slopes.
Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded.
Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded.
Hollinger silt loam, 15 to 25 percent slopes, severely eroded.
Manor loam, 15 to 25 percent slopes, severely eroded.
Manor loam and channery loam, 25 to 35 percent slopes.
Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded.
Penn soils, 25 to 35 percent slopes, moderately eroded.

Except for the areas that are wooded, these soils are used mainly for pasture. The carrying capacity of the pastures is not likely to be high, because the soils do not store much moisture. The pastures can be improved by applying lime and fertilizer. Birdsfoot trefoil, orchardgrass, and timothy will grow fairly well where the soils are too steep or too shallow to renovate. To control erosion, diversion terraces can be used if feasible.

Capability unit VIw–1

This unit consists of deep, nearly level, poorly drained soils of flood plains. The soils are subject to very frequent flooding, and they have a high water table most of the time. In most places the soils occur in depressions and receive deposits of fresh material during floods. In places where the water table can be lowered, the permeability of these soils will generally be moderate to moderately high. The following soils are in this unit:

Bowmansville silt loam.
Melvin silt loam.
Wehadkee silt loam.

These soils are used mainly for permanent pasture. Because of the high water table, they are better suited to plants that tolerate wetness than to other kinds of plants. If there is enough slope, drainage can be improved by open ditches or bedding. Drainage will allow roots to penetrate more deeply and will provide better aeration. It is better to disk the areas than to plow them when renovating or reseeding pastures. Lime and fertilizer are needed if the areas are drained.

Capability unit VIw–2

In this unit are gently sloping to moderately sloping, poorly drained soils that have a subsoil of tight clay. The soils are on uplands. They are slowly permeable, and in many places they have a high water table. Their productivity is low. The following soils are in this unit:

Calvert silt loam, 3 to 8 percent slopes.
Calvert silt loam, 3 to 8 percent slopes, moderately eroded.
Watchung silt loam, 3 to 8 percent slopes, moderately eroded.
Worsham silt loam, 3 to 8 percent slopes.
Worsham silt loam, 3 to 8 percent slopes, moderately eroded.
Worsham silt loam, 8 to 15 percent slopes, moderately eroded.

These soils are used mainly for pasture, and grasses and legumes that tolerate wetness grow well. Drainage in the gently sloping areas can be improved by bedding systems or by terraces. In some places open ditches can be used to help remove excess surface and subsurface water. Tile drainage is not economical to use on these soils because of the tight, slowly permeable subsoil.

Capability unit VIs–1

This unit consists of deep, nearly level to moderately steep, well-drained soils that are very stony. The soils are moderately permeable. Their available moisture capacity is moderate to moderately high. Erosion is not a problem. The following soils are in this unit:

Brandywine very stony loam, 0 to 8 percent slopes.
Brandywine very stony loam, 8 to 25 percent slopes.
Brecknock very stony silt loam, 0 to 8 percent slopes.
Brecknock very stony silt loam, 8 to 25 percent slopes.

Chester very stony silt loam, 0 to 8 percent slopes.
Chester very stony silt loam, 8 to 15 percent slopes.
Edgemont very stony loam, 0 to 8 percent slopes.
Edgemont very stony loam, 8 to 25 percent slopes.
Glenelg very stony silt loam, 15 to 25 percent slopes.
Montalto very stony silt loam, 0 to 8 percent slopes.
Montalto very stony silt loam, 8 to 25 percent slopes.
Neshaminy very stony silt loam, 0 to 8 percent slopes.
Neshaminy very stony silt loam, 8 to 25 percent slopes.

These soils are too stony for cultivated crops, but they have limited use for pasture. They are well suited to most kinds of trees. The stones on the surface should be removed to improve the pastures. Grass can then be seeded by hand between the large boulders, and cattle can graze over the area. These soils are too stony for machinery to be used to apply lime and fertilizer.

Capability unit VIs–2

This unit consists of deep, nearly level to moderately sloping, moderately well drained soils that are very stony. The soils are on uplands. They are moderately permeable but generally have a high water table during wet seasons. These soils are moderately productive, but they have many stones on the surface. The soils in this unit are:

Glenville very stony silt loam, 0 to 8 percent slopes.
Lehigh very stony silt loam, 0 to 8 percent slopes.
Lehigh very stony silt loam, 8 to 25 percent slopes.
Mount Lucas very stony silt loam, 0 to 8 percent slopes.

These soils are mainly in trees. They are too stony to be cultivated, but they have limited use for pasture. The soils are better suited to plants that tolerate wetness than to other kinds of plants.

The pastured areas require open ditches to remove excess water in winter and early in spring, or grazing will need to be postponed until the soil is dry.

Capability unit VIIe–1

This unit consists of shallow to moderately deep, moderately steep and steep, well-drained soils of uplands. Most of the soils are droughty and are easily eroded. They have moderate to rapid permeability. The following soils are in this unit:

Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded.
Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded.
Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded.
Hollinger silt loam, 25 to 35 percent slopes, severely eroded.
Manor loam and channery loam, 25 to 35 percent slopes, severely eroded.
Manor soils, 35 to 60 percent slopes.
Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded.
Penn soils, 25 to 35 percent slopes, severely eroded.
Penn soils, 35 to 50 percent slopes.

Because of steep slopes or severe erosion, these soils are not suited to crops and pasture. They have moderate to low capacity for storing moisture and, therefore, are only fairly well suited to trees. Selective cutting and protection from fire and grazing are needed to provide a sustained yield from wooded areas. Planting shrubs to provide food and shelter for wildlife on areas where the stand of trees is thin would help to increase the number of small game.

Capability unit VIIs–1

This unit consists of shallow to moderately deep, gently sloping to very steep, very stony soils of uplands. The soils have moderate available moisture capacity but are not very productive. The following soils are in this unit:

Brandywine very stony loam, 25 to 50 percent slopes.
Brecknock very stony silt loam, 25 to 50 percent slopes.
Edgemont very stony loam, 25 to 60 percent slopes.
Glenelg very stony silt loam, 25 to 35 percent slopes.
Manor very stony loam, 0 to 8 percent slopes.
Manor very stony loam, 8 to 25 percent slopes.
Manor very stony loam, 25 to 60 percent slopes.
Montalto very stony silt loam, 25 to 45 percent slopes.
Neshaminy very stony silt loam, 25 to 45 percent slopes.
Penn very stony silt loam, 0 to 8 percent slopes.
Penn very stony silt loam, 8 to 25 percent slopes.
Penn very stony silt loam, 25 to 50 percent slopes.

Because of stoniness and the steepness of the slopes, these soils are not suited to crops and pasture. They are best used for trees, for wildlife, or for recreation. The stones and strong slopes hinder logging operations.

Capability unit VIIs–2

This unit consists of moderately deep to deep, nearly level to gently sloping soils that are somewhat poorly drained or poorly drained and very stony. The soils are on uplands. They are slowly permeable and are waterlogged during most of the winter and spring months. The following soils are in this unit:

Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded.
Watchung very stony silt loam, 0 to 8 percent slopes.
Worsham very stony silt loam, 0 to 8 percent slopes.

These soils are too stony and wet for crops. They have only limited use for grazing and can be used to a limited extent as woodland. Trees that tolerate wetness are best suited. Open ditches can be used to help remove excess surface and subsurface water, but the areas will need to be cleared of stones. The quality of grazing on the gently sloping areas is better than on the more nearly level areas because the excess water drains off more quickly.

Capability unit VIIIw–1

One miscellaneous land type—Tidal marsh—is in this unit. The areas are mostly near Essington, where Darby Creek joins the Delaware River.

Tidal marsh is not suited to crops and pasture, nor is it suited to trees, but it provides suitable habitats for wildlife. Some areas have been filled in and used for building sites.

Productivity Ratings of the Soils

Productivity ratings for the soils of Chester and Delaware Counties are given in table 1. The productivity rating for a crop grown on a particular soil is a percentage of the standard yield given at the top of the column. The standard yield is the average yield of that particular crop obtained on the best soil in the area under common management.

One of the most productive soils for most crops grown in this area is Chester silt loam, 0 to 3 percent slopes. The other soils in the area have been rated by comparing

TABLE 1.—*Estimated productivity ratings of the soils for crops, hay, and pasture*

[Productivity ratings in columns A are for common management; ratings in columns B are for improved management. Dashes indicate that the crop is not commonly grown or the soil is not suited to it]

Soil	Hay				Corn (100=80 bu. per acre) [1]		Sorghum (100=15 tons per acre)		Wheat (100=35 bu. per acre)		Barley (100=60 bu. per acre)		Oats (100=40 bu. per acre)		Permanent bluegrass pasture (100=50 cow-acre-days) [2]		Pasture of tall grasses and legumes (100=100 cow-acre-days) [2]	
	Alfalfa mixtures (100=3 tons per acre)		Clover mixtures (100=2 tons per acre)															
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Aldino silt loam, 0 to 3 percent slopes			40	65	35	75	35	60	40	55			30	50	65	170	65	145
Aldino silt loam, 3 to 8 percent slopes, moderately eroded			35	55	30	65	30	55	45	55			30	45	60	155	60	135
Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded																		
Bedford silt loam, 0 to 3 percent slopes	70	115	90	110	85	145	85	120	70	85	55	80	80	105	150	275	90	185
Bedford silt loam, 3 to 8 percent slopes	85	140	95	160	90	145	90	120	95	110	60	100	95	120	160	290	100	200
Bedford silt loam, 3 to 8 percent slopes, moderately eroded	80	135	90	110	85	140	85	110	90	105	55	90	90	110	95	225	95	190
Beltsville silt loam, 0 to 3 percent slopes	80	125	85	110	85	145	85	120	85	95	80	105	75	100	85	205	85	180
Beltsville silt loam, 3 to 8 percent slopes, moderately eroded	75	125	80	105	80	140	80	110	80	90	75	100	70	95	80	190	80	165
Bowmansville silt loam															75	150	70	100
Brandywine loam, 3 to 8 percent slopes, moderately eroded	80	140	80	105	70	120	70	105	75	90	75	105	70	95	70	190	75	180
Brandywine loam, 8 to 15 percent slopes	75	135	80	105	65	110	70	105	75	90	65	95	70	85	65	170	75	180
Brandywine loam, 8 to 15 percent slopes, moderately eroded	75	135	75	100	60	105	65	100	70	90	60	85	65	85	60	155	70	155
Brandywine loam, 8 to 15 percent slopes, severely eroded	65	115	65	85	50	80	55	85	65	80	50	80	55	75	50	130	60	135
Brandywine loam, 15 to 25 percent slopes	65	115	65	85	45	80	45	75	65	80	50	80	55	80	50	130	60	135
Brandywine loam, 15 to 25 percent slopes, moderately eroded	60	105	60	80	40	75	40	60	55	70	45	75	55	80	50	130	55	125
Brandywine loam, 15 to 25 percent slopes, severely eroded															45	120	50	115
Brandywine loam, 25 to 40 percent slopes															45	120	50	115
Brandywine very stony loam, 0 to 8 percent slopes															70		65	
Brandywine very stony loam, 8 to 25 percent slopes															60		55	
Brandywine very stony loam, 25 to 50 percent slopes																		
Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded	70	125	75	100	55	90	60	95	75	90	70	100	65	85	65	170	70	155
Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded	65	115	70	95	50	85	60	95	70	85	70	100	65	85	65	170	65	145
Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded	60	105	60	80	45	80	50	80	60	75	60	85	55	70	50	130	60	135
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded	60	100	60	80	45	70	45	75	60	75	60	85	55	70	50	130	60	135
Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded															45	120	50	115
Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded																		
Brecknock very stony silt loam, 0 to 8 percent slopes															70		65	
Brecknock very stony silt loam, 8 to 25 percent slopes															60		55	

See footnotes at end of table.

TABLE 1.—*Estimated productivity ratings of the soils for crops, hay, and pasture*—Continued

Soil	Hay				Corn (100=80 bu. per acre) [1]		Sorghum (100=15 tons per acre)		Wheat (100=35 bu. per acre)		Barley (100=60 bu. per acre)		Oats (100=40 bu. per acre)		Permanent bluegrass pasture (100=50 cow-acre-days) [2]		Pasture of tall grasses and legumes (100=120 cow-acre-days) [2]	
	Alfalfa mixtures (100=3 tons per acre)		Clover mixtures (100=2 tons per acre)															
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Brecknock very stony silt loam, 25 to 50 percent slopes																		
Bucks silt loam, 3 to 8 percent slopes, moderately eroded	90	160	90	120	90	155	90	125	90	110	90	125	90	120	90	215	90	185
Butlertown silt loam, 0 to 3 percent slopes	85	150	90	110	90	145	90	120	85	105	85	120	80	105	90	215	90	185
Butlertown silt loam, 3 to 8 percent slopes, moderately eroded	80	140	85	105	80	130	85	110	80	95	80	115	75	100	85	205	85	180
Calvert silt loam, 0 to 3 percent slopes															60	170	60	145
Calvert silt loam, 3 to 8 percent slopes															70	180	70	155
Calvert silt loam, 3 to 8 percent slopes, moderately eroded															65	170	65	145
Chester silt loam, 0 to 3 percent slopes	100	170	100	125	100	170	100	130	100	115	100	130	100	125	100	190	100	190
Chester silt loam, 0 to 3 percent slopes, moderately eroded	95	160	95	120	95	160	95	125	95	110	95	125	95	120	95	190	95	190
Chester silt loam, 3 to 8 percent slopes	95	160	95	120	95	160	95	125	95	110	95	125	95	120	95	190	95	190
Chester silt loam, 3 to 8 percent slopes, moderately eroded	90	150	95	120	90	145	90	120	90	105	90	120	90	110	90	190	95	190
Chester silt loam, 3 to 8 percent slopes, severely eroded	85	140	90	110	85	140	85	110	85	95	85	115	85	105	75	180	90	185
Chester silt loam, 8 to 15 percent slopes	85	140	90	110	85	140	85	110	85	95	85	115	85	105	75	180	90	185
Chester silt loam, 8 to 15 percent slopes, moderately eroded	80	135	85	105	80	130	80	105	80	90	80	105	80	100	75	180	90	185
Chester silt loam, 8 to 15 percent slopes, severely eroded	75	125	80	100	75	120	75	100	75	85	75	100	75	95	70	170	85	180
Chester very stony silt loam, 0 to 8 percent slopes															70	155	75	145
Chester very stony silt loam, 8 to 15 percent slopes															65	145	70	135
Chewacla silt loam			90	110	98	158	98	130	70	80	50	65	80	110	100	240	95	190
Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded	80	140	80	105	75	130	75	105	80	95	80	115	75	100	75	190	75	165
Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded	75	135	80	105	70	120	70	100	75	90	75	105	65	85	65	170	65	145
Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded	65	115	75	100	65	110	65	95	70	85	70	100	60	80	60	155	60	135
Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded	65	115	75	100	65	110	65	95	70	85	70	100	55	75	60	155	60	135
Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded	60	105	65	85	60	105	60	85	65	80	65	95	50	70	50	130	50	115
Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded																		
Conestoga silt loam, 0 to 3 percent slopes	100	180	95	125	100	160	100	130	100	115		130	100	125	100	240	100	200
Conestoga silt loam, 0 to 3 percent slopes, moderately eroded	100	170	100	125	100	160	100	130	100	115	100	130	100	125	100	240	100	200
Conestoga silt loam, 3 to 8 percent slopes, moderately eroded	95	160	95	120	95	155	95	125	95	110	95	125	95	120	95	225	95	190
Conestoga silt loam, 8 to 15 percent slopes, moderately eroded	90	150	90	110	85	140	85	110	90	105	90	120	90	110	90	215	90	185
Conestoga silt loam, 8 to 15 percent slopes, severely eroded	80	135	80	100	75	120	75	100	80	90	80	105	80	100	80	190	80	165
Congaree silt loam			100	125	100	160	100	130							100	240	100	200
Conowingo silt loam, 0 to 3 percent slopes	45	85	95	120	95	155	95	125	80	90	80	105	80	100	85	205	95	190

Conowingo silt loam, 3 to 8 percent slopes, moderately eroded	60	105	90	110	90	145	90	120	80	90	75	100	75	95	85	205	95	190
Croton silt loam, 0 to 3 percent slopes			50	100	35	65	35	55	40	70					60	145	55	115
Croton silt loam, 3 to 8 percent slopes			55	105	45	75	45	75	45	75					65	170	60	135
Edgemont channery loam, 3 to 8 percent slopes	75	135	75	100	75	130	75	105	75	90	75	105	75	100	80	190	80	145
Edgemont channery loam, 3 to 8 percent slopes, moderately eroded	75	135	75	100	70	120	70	100	70	85	70	100	70	95	75	190	75	145
Edgemont channery loam, 8 to 15 percent slopes	70	125	70	95	65	110	65	95	65	80	65	95	65	85	75	190	75	145
Edgemont channery loam, 8 to 15 percent slopes, moderately eroded	65	115	65	85	60	105	60	85	60	75	60	85	60	80	70	180	70	140
Edgemont channery loam, 8 to 15 percent slopes, severely eroded	60	105	60	80	55	95	55	80	55	70	55	80	55	75	65	170	65	130
Edgemont channery loam, 15 to 25 percent slopes	55	100	55	75	55	95	55	80	55	70	55	80	55	75	65	170	65	130
Edgemont channery loam, 15 to 25 percent slopes, moderately eroded	50	90	50	70	45	80	45	70	45	55	45	65	45	60	55	145	55	110
Edgemont channery loam, 15 to 25 percent slopes, severely eroded																110	40	90
Edgemont channery loam, 25 to 35 percent slopes															45	120	45	95
Edgemont channery loam, 25 to 35 percent slopes, moderately eroded															40	110	40	90
Edgemont very stony loam, 0 to 8 percent slopes																		
Edgemont very stony loam, 8 to 25 percent slopes																		
Edgemont very stony loam, 25 to 60 percent slopes																		
Glenelg channery silt loam, 0 to 3 percent slopes	90	160	90	120	90	130	90	125	90	110	90	125	90	120	90	225	95	155
Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded	85	150	85	110	85	120	85	120	85	105	85	120	85	110	85	215	90	155
Glenelg channery silt loam, 3 to 8 percent slopes	85	150	85	110	85	120	85	120	85	105	85	120	85	110	85	215	90	155
Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded	80	140	80	105	80	115	80	110	80	95	80	115	80	105	80	205	85	150
Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded	75	135	75	100	75	105	75	105	75	90	75	105	75	100	75	190	80	145
Glenelg channery silt loam, 8 to 15 percent slopes	75	135	75	100	75	105	75	105	75	90	75	105	75	100	75	190	75	130
Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded	70	125	70	95	70	100	70	100	70	85	70	100	70	95	70	180	70	120
Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded	65	125	65	85	65	90	65	95	65	80	65	95	65	85	65	170	65	110
Glenelg channery silt loam, 15 to 25 percent slopes	65	125	65	85	65	95	65	95	65	80	65	95	65	85	65	170	65	110
Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded	60	105	60	85	60	90	60	85	60	75	60	85	60	80	60	155	60	100
Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded															55	155	55	100
Glenelg channery silt loam, 25 to 35 percent slopes															50	145	50	95
Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded																		
Glenelg silt loam, 0 to 3 percent slopes, severely eroded	70	125	70	95	70	110	70	100	70	85	70	100	70	95	70	180	70	155
Glenelg silt loam, 3 to 8 percent slopes, severely eroded	60	105	60	80	60	105	60	85	60	75	60	85	60	80	60	155	60	135
Glenelg very stony silt loam, 15 to 25 percent slopes															55	155	55	135
Glenelg very stony silt loam, 25 to 35 percent slopes																		
Glenville silt loam, 0 to 3 percent slopes	85	135	95	120	95	155	95	125	90	105	50	80	80	100	85	205	100	160
Glenville silt loam, 3 to 8 percent slopes	85	140	95	120	90	145	90	120	85	95	50	80	80	100	85	205	95	155

See footnotes at end of table.

TABLE 1.—*Estimated productivity ratings of the soils for crops, hay, and pasture*—Continued

Soil	Hay				Corn (100=80 bu. per acre) [1]		Sorghum (100=15 tons per acre)		Wheat (100=35 bu. per acre)		Barley (100=60 bu. per acre)		Oats (100=40 bu. per acre)		Permanent bluegrass pasture (100=50 cow-acre-days) [2]		Pasture of tall grasses and legumes (100=120 cow-acre-days) [2]	
	Alfalfa mixtures (100=3 tons per acre)		Clover mixtures (100=2 tons per acre)															
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Glenville silt loam, 3 to 8 percent slopes, moderately eroded	80	135	90	110	85	140	85	110	80	90	50	75	75	95	80	190	90	150
Glenville silt loam, 8 to 15 percent slopes, moderately eroded	75	125	85	105	80	130	80	105	75	85	45	70	70	85	75	180	85	145
Glenville very stony silt loam, 0 to 8 percent slopes															75	170	80	120
Guthrie silt loam			75	100											85	190	85	165
Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded	95	160	95	120	95	155	95	125	95	110	75	100	95	120	95	225	95	190
Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded	95	160	95	120	95	155	95	125	95	110	75	100	95	120	90	225	90	190
Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded	90	160	90	120	85	145	85	120	85	105	70	95	85	110	85	215	85	185
Hagerstown silt loam, 8 to 15 percent slopes, severely eroded	80	140	80	105	75	130	75	105	75	90	60	80	75	95	80	205	80	180
Hollinger silt loam, 3 to 8 percent slopes, moderately eroded	90	150	85	105	75	120	80	105	90	105	90	120	85	105	90	215	90	150
Hollinger silt loam, 8 to 15 percent slopes, moderately eroded	85	140	80	100	70	110	75	95	85	95	85	115	80	100	85	205	85	150
Hollinger silt loam, 8 to 15 percent slopes, severely eroded	80	140	70	85	60	95	65	80	75	85	75	100	70	85	80	190	80	140
Hollinger silt loam, 15 to 25 percent slopes, severely eroded															70	170	70	110
Hollinger silt loam, 25 to 35 percent slopes, severely eroded																		
Lawrence silt loam, 0 to 3 percent slopes			85	105	60	90	75	100					60	75	80	190	80	130
Lawrence silt loam, 3 to 8 percent slopes			90	110	65	95	80	105					65	80	85	205	85	145
Lehigh silt loam, 3 to 8 percent slopes			70	95	50	90	55	80	50	90	50	75	60	80	70	170	75	155
Lehigh silt loam, 3 to 8 percent slopes, moderately eroded			65	85	45	80	50	75	45	85	45	65	55	75	65	155	70	145
Lehigh silt loam, 8 to 15 percent slopes, severely eroded			60	80	40	75	45	70	40	80	40	60	50	70	60	145	65	125
Lehigh very stony silt loam, 0 to 8 percent slopes																		
Lehigh very stony silt loam, 8 to 25 percent slopes																		
Lindside silt loam			70	110	85	145	80	120	50	70	45	65	60	110	100	240	100	195
Made land, gravelly materials																		
Made land, silt and clay materials																		
Made land, gabbro and diabase materials																		
Made land, schist and gneiss materials																		
Made land, sanitary land fill																		
Manor loam, 0 to 3 percent slopes, moderately eroded	85	100	85	110	65	110	80	120	85	105	85	120	80	105	80	215	85	145
Manor loam, 3 to 8 percent slopes, moderately eroded	85	100	85	110	60	100	75	110	80	95	80	115	75	100	75	205	80	140
Manor loam, 3 to 8 percent slopes, severely eroded	80	100	80	105	55	90	70	105	75	90	70	105	70	100	60	170	70	120
Manor loam, 8 to 15 percent slopes	80	100	80	105	55	90	70	105	75	90	70	105	70	100	60	170	70	120
Manor loam, 8 to 15 percent slopes, moderately eroded	80	100	80	105	50	85	70	105	75	95	65	100	70	100	60	170	70	120

Manor loam, 8 to 15 percent slopes, severely eroded	75	95	70	95	40	75	60	95	65	80	55	85	60	85	50	145	65	110
Manor loam, 15 to 25 percent slopes	75	95	70	95	30	65	45	75	60	80	55	85	60	85	50	145	65	110
Manor loam, 15 to 25 percent slopes, moderately eroded	70	95	60	85	25	65	40	75	55	75	50	80	55	80	50	130	60	100
Manor loam, 15 to 25 percent slopes, severely eroded															45	120	50	70
Manor loam and channery loam, 25 to 35 percent slopes															45	120	50	70
Manor loam and channery loam, 25 to 35 slopes, severely eroded																		
Manor soils, 35 to 60 percent slopes																		
Manor very stony loam, 0 to 8 percent slopes																		
Manor very stony loam, 8 to 25 percent slopes																		
Manor very stony loam, 25 to 60 percent slopes																		
Melvin silt loam															70	170		130
Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded	95	120	90	110	90	145	90	120	95	110	80	100	90	110	95	225	95	160
Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded	90	120	85	105	80	140	80	105	85	95	90	95	80	100	90	215	90	155
Montalto channery silt loam, 8 to 15 percent slopes, severely eroded	85	110	80	100	70	120	70	95	75	85	60	80	70	85	75	180	80	135
Montalto channery silt loam, 15 to 25 percent slopes, severely eroded															65	155	70	115
Montalto very stony silt loam, 0 to 8 percent slopes															65	155	70	115
Montalto very stony silt loam, 8 to 25 percent slopes															60	145	65	105
Montalto very stony silt loam, 25 to 45 percent slopes																		
Mount Lucas very stony silt loam, 0 to 8 percent slopes															50	120		
Neshaminy gravelly silt loam, 0 to 3 percent slopes	95	160	95	120	95	155	95	125	95	110	95	125	90	110	95	225	95	190
Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded	95	160	95	120	90	145	90	120	90	105	90	120	85	105	90	215	90	185
Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded	90	150	90	110	80	130	80	110	85	105	85	120	80	100	85	205	85	180
Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded	80	140	80	105	65	110	70	100	80	95	80	115	70	95	75	190	75	165
Neshaminy gravelly silt loam, 15 to 25 percent slopes	75	135	70	95	50	90	60	85	75	90	75	105	60	80	70	180	70	155
Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded															60	155	60	135
Neshaminy very stony silt loam, 0 to 8 percent slopes															65	155	65	135
Neshaminy very stony silt loam, 8 to 25 percent slopes															60	145	60	125
Neshaminy very stony silt loam, 25 to 45 percent slopes																		
Othello silt loam			50	75	40	90	40	75					45	60	65	170	60	135
Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded			70	95	50		50	75	65	75	65	85	60	75	70	180	50	85
Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded			65	80	45		45	60	55	60	55	75	50	60	65	155	45	75
Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded															55	130	40	60
Penn silt loam, 3 to 8 percent slopes, moderately eroded	70	125	75	100	65	110	70	100	75	85	65	95	80	120	70	180	80	140
Penn silt loam, 8 to 15 percent slopes, moderately eroded	65	115	70	95	60	105	65	95	70	80	60	85	55	75	65	170	75	125
Penn silt loam, 8 to 15 percent slopes, severely eroded	60	105	65	85	50	80	55	75	60	75	55	80	45	60	55	145	65	105

See footnotes at end of table.

TABLE 1.—*Estimated productivity ratings of the soils for crops, hay, and pasture*—Continued

Soil	Hay				Corn (100=80 bu. per acre) [1]		Sorghum (100=15 tons per acre)		Wheat (100=35 bu. per acre)		Barley (100=60 bu. per acre)		Oats (100=40 bu. per acre)		Permanent bluegrass pasture (100=50 cow-acre-days) [2]		Pasture of tall grasses and legumes (100=120 cow-acre-days) [2]	
	Alfalfa mixtures (100=3 tons per acre)		Clover mixtures (100=2 tons per acre)															
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Penn silt loam, 15 to 25 percent slopes	55	100	60	80	40	75	45	60	55	70	45	65	40	50	50	130	60	100
Penn silt loam, 15 to 25 percent slopes, moderately eroded	50	90	55	75					45	55	40	60	35	50	45	120	55	90
Penn very stony silt loam, 0 to 8 percent slopes																		
Penn very stony silt loam, 8 to 25 percent slopes																		
Penn very stony silt loam, 25 to 50 percent slopes																		
Penn soils, 25 to 35 percent slopes, moderately eroded																		
Penn soils, 25 to 35 percent slopes, severely eroded															45	120		
Penn soils, 35 to 50 percent slopes																		
Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded	70	125	65	85	65	110	65	95	70	85	70	100	65	85	70	180	70	155
Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded	65	115	60	80	60	105	60	85	65	80	65	95	60	80	65	170	65	145
Penn and Lansdale sandy loams 8 to 15 percent slopes, severely eroded	55	95	50	75	50	75	55	75	60	75	55	80	45	60	55	145	65	145
Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded	55	100	50	70	45	75	45	70	55	70	55	70	40	55	55	145	55	125
Readington silt loam, 0 to 3 percent slopes	35	65	75	100	75	130	75	105	50	100	40	60	50	100	80	205	75	130
Readington silt loam, 3 to 8 percent slopes	55	100	80	105	70	110	70	100	60	100	45	65	50	100	85	205	80	145
Readington silt loam, 3 to 8 percent slopes, moderately eroded	45	85	70	95	65	110	65	95	55	90	35	55	45	90	80	205	70	130
Rowland silt loam			85	105	80	130	80	105							85	205	80	140
Rowland silt loam, dark surface			80	105	75	130	75	105							75	190	75	140
Sassafras loam, 0 to 3 percent slopes	85	150	85	110	85	145	85	120	85	105	85	120	85	110	85	215	85	185
Sassafras loam, 3 to 8 percent slopes, moderately eroded	80	140	80	105	75	130	75	105	75	90	75	105	75	100	75	190	75	165
Tidal marsh																		
Watchung silt loam, 0 to 3 percent slopes															60	145	50	105
Watchung silt loam, 3 to 8 percent slopes, moderately eroded															65	155	55	115
Watchung very stony silt loam, 0 to 8 percent slopes																		
Wehadkee silt loam															75	180	70	145
Woodstown loam, 0 to 3 percent slopes	70	125	80	105	80	140	80	110	70	85	70	100	75	100	85	215	85	185
Worsham silt loam, 0 to 3 percent slopes															70	170	60	125
Worsham silt loam, 3 to 8 percent slopes															75	180	65	135
Worsham silt loam, 3 to 8 percent slopes, moderately eroded															70	170	60	125
Worsham silt loam, 8 to 15 percent slopes, moderately eroded															65	155	50	105
Worsham very stony silt loam, 0 to 8 percent slopes																		

[1] If the corn is used for silage, the standard yield is 14 tons per acre.

[2] Cow-acre-days is the number of days 1 acre will graze 1 animal unit without injury to the pasture; an animal unit is 1 cow, steer, or horse, 5 hogs, or 7 sheep.

them with the Chester soil. In table 1 a value of 100 has been assigned to the estimated average annual yield per acre of each crop grown on Chester silt loam, 0 to 3 percent slopes, under common management. The soils of the county are listed alphabetically, and the percentage of the standard yield that is likely to be produced on each soil, under a given level of management, is listed as a productivity rating. Yields for the different soils are expressed as percentage figures; actual yields to be expected, on the average, are computed by multiplying the standard yield figure shown at the top of the column by the percentage figure shown in columns A and B.

The figures in columns A show the percentage of the standard yield that can be expected under the level of management commonly used in Chester and Delaware Counties; those in columns B show the yields that could be expected if the best practices now available were used to increase production. These practices consist of liming the soils and applying fertilizer according to the needs indicated by soil tests; of using proper tillage methods; and of applying all practices needed to control erosion, conserve moisture and organic matter, and to maintain the supply of plant nutrients. The practices also include choosing improved varieties of crops and forage plants and growing them in a suitable cropping system.

The estimates are based largely on interviews with farmers and on observations of representatives of the Soil Conservation Service, the Extension Service, and other agricultural workers who have had experience with the soils and crops of the area. The estimates are also based on the behavior of similar soils in other counties and on average yield data in the area.

The yields shown are not the maximum obtainable. Yields will be greater during years of favorable rainfall and on the farms where improved management practices are used.

Woodland Uses of Soils

The original vegetation of Chester and Delaware Counties was a dense cover of trees. Cutting for commercial purposes and clearing for farms eliminated the virgin stands of timber. Now, the woodlands consist of second- and third-growth stands. The principal forest types that make up the present woodlands (7)[1] and the approximate percentage of each follow:

	Percentage of total woodlands in the counties
Red oak. Northern red oak predominates; associates are black oak, scarlet oak, chestnut oak, and yellow-poplar.	41
Yellow-poplar. Yellow-poplar predominates; associates are black locust, red maple, sweet birch, northern red oak, cucumbertree, sweetgum, and other species that grow where moisture is abundant.	31
Sugar maple-beech-yellow birch. These three species are predominant; associates are varying mixtures of basswood, red maple, hemlock, northern red oak, white ash, white pine, black cherry, sweet birch, American elm, eastern hophornbeam, and cucumbertree.	12
Black ash-American elm-red maple. These three species occur in different proportions, but together they predominate over any other species; red maple and American elm are most abundant in Chester and Delaware Counties; associates are white ash, slippery elm, black gum, yellow birch, sycamore, and hemlock.	8
Pitch pine and Virginia pine. Pitch pine is predominant; chief associates are chestnut oak and scarlet oak. Where Virginia pine is predominant, the principal associates are chestnut oak, black oak, white oak, red maple, and black gum; in some places pitch pine may be present.	5
Chestnut oak. Chestnut oak predominates; common associates are scarlet oak, white oak, black oak, pitch pine, black gum, and red maple; in a few places the associates are white pine, red oak, and Virginia pine.	3

Sawtimber makes up approximately 55 percent of the acreage in commercial forests. Seedlings, saplings, and poletimber account for 40 percent.

In general, the soils are capable of supporting a good growth of red oak, yellow-poplar, and other desirable trees. At the present time many wooded areas are made up predominantly of chestnut oak and pitch pine, but the soils can support red oak and yellow-poplar. Landowners can encourage the more desirable kinds of trees to grow in their woodlands by using good woodland management. If the landowner desires help in planning a program of woodland improvement, he can obtain it from local technicians.

Studies were made in Chester County to determine the rates at which trees would grow on four soils that are extensive in these two counties. The trees were grown in 25 sample plots. The results of the studies are shown in table 2. In table 2 the site index for oak for each of the soils was based on the average height of a normal stand when the trees were 50 years old. The volume of timber that normal stands will produce at different ages can be determined by using this index.

The soils on which trees and associated vegetation grow is the place from which to start managing woodlands. To help in planning management for the soils of these two counties, the soils that have similar characteristics have been placed in woodland groups. The soils have been grouped mainly according to similarity in depth, drainage, texture, and parent material. Each woodland group is described in the pages that follow. Estimated ratings of woodland suitability groups for various factors important to woodland use and management are given in table 3.

The kinds of trees that grow best on the soils of each woodland group are listed in table 3 in order of species priority. The names of the native trees that should be encouraged are also given.

Seedling mortality refers to the expected degree of mortality, or loss of natural seedlings, as influenced by the soils or other environment. It also refers to nursery stock of proper grade that is properly planted. The ratings used to indicate the degree of seedling mortality are *slight*, *moderate*, and *severe*.

[1] Italic numbers in parentheses refer to Literature Cited, page 118.

TABLE 2.—*Plot data for several kinds of oaks grown on*

Number of plot	Soil type	Elevation	Landform	Slope	Aspect
		Feet		*Percent*	
9–19	Edgemont channery loam	560	Rolling upland	12	S. 100°
25–19	Edgemont very stony loam	750	Ridgetop	7	S. 130° E.
28–19	Edgemont channery loam	640	Broad, level upland	11	S. 125° E.
29–19	Edgemont channery loam	650	Broad, level upland	8	S. 150° E.
12–19	Edgemont channery loam	850	Rolling upland	8	S. 165° E.
11–19	Edgemont channery loam	800	Ridgetop	1	N. 330° W.
10–19	Edgemont channery loam	600	Rolling upland	13	N. 30° E.
1–19	Glenelg channery silt loam	340	Rolling upland	11	N. 25° E.
4–19	Glenelg channery silt loam	360	Rolling upland	5	N. 35° E.
5–19	Glenelg silt loam	370	Rolling upland	25	S. 235° W.
7–19	Glenelg channery silt loam	500	Ridgetop	3	Not available
19–19	Glenelg channery silt loam	260	Rolling upland	9	N. 285° W.
22–19	Glenelg silt loam	300	Rolling upland	11	N. 350° W.
3–19	Manor loam	500	Ridgetop	7	S. 148° E.
6–19	Manor loam	500	Ridgetop	6	S. 115° E.
8–19	Manor loam	460	Rolling upland	10	Due N.
30–19	Manor loam and channery loam	450	Rolling upland	30	N. 325° W.
32–19	Manor loam and channery loam	450	Rolling upland	32	S. 240° W.
23–19	Manor soils	220	Steep hillside	36	N. 240° W.
22–19	Montalto very stony silt loam	600	Ridgetop	6	125° SE.
26–19	Montalto very stony silt loam	700	Rolling upland	18	325° NW.
31–19	Montalto very stony silt loam	620	Rolling upland	6	150° SE.
15–19	Montalto very stony silt loam	500	Ridgetop	1	Not available
16–19	Montalto very stony silt loam	490	Rolling upland	7	N. 300° W.
17–19	Montalto very stony silt loam	580	Steep hillside	18	S. 250° W.

A rating of slight in the column showing seedling mortality means that the site has no special problems and that losses would not exceed 25 percent of the planted stock. Normally, satisfactory restocking could be obtained by the first planting and natural regeneration would be adequate. A rating of moderate means that losses of 25 to 50 percent of the seedlings can be expected. Some replanting will be needed to fill in openings after the first planting, and natural regeneration is not always adequate or timely. A rating of severe means that planting losses amount to more than 50 percent of the stock planted; natural regeneration is not adequate, and a second or third planting may be needed. Also, the seedbed will require special preparation, and careful planting techniques will be needed.

Competition from other plants refers to the degree of competition that can be expected from brush, grass, and undesirable trees that invade the planting site.

Limitations to the use of woodland equipment refers to the characteristics of the soils and topographic features that restrict, or prohibit, the use of equipment that is commonly used in harvesting trees or in cultivating or planting seedlings. Steepness of slope, surface stones and boulders, and prolonged wetness of the soil are the principal limitations that restrict the use of equipment on the soils of Chester and Delaware Counties.

The hazard of erosion refers to the likelihood of erosion when the soil is managed according to currently acceptable practices designed to protect the soils. The hazard of erosion is especially severe where access roads and skid roads are poorly located and maintained.

The hazard of windthrow refers to windfirmness as reflected by the characteristics of the soils that control the development of the root system of trees.

Woodland group 1

In this group (see table 3) are deep and moderately deep, well-drained soils that are medium textured. These soils developed in material from schist, gneiss, sandstone, shale, and coastal plain sediments. They are on uplands, terraces, and flood plains that have slopes of as much as 8 percent. The following soils are in this group:

Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded.
Brecknock very stony silt loam, 0 to 8 percent slopes.
Bucks silt loam, 3 to 8 percent slopes, moderately eroded.
Butlertown silt loam, 0 to 3 percent slopes.
Butlertown silt loam, 3 to 8 percent slopes, moderately eroded.
Chester silt loam, 0 to 3 percent slopes.
Chester silt loam, 0 to 3 percent slopes, moderately eroded.
Chester silt loam, 3 to 8 percent slopes.
Chester silt loam, 3 to 8 percent slopes, moderately eroded.
Chester silt loam, 3 to 8 percent slopes, severely eroded.
Chester very stony silt loam, 0 to 8 percent slopes.
Congaree silt loam.
Edgemont channery loam, 3 to 8 percent slopes.
Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.
Edgemont very stony loam, 0 to 8 percent slopes.
Glenelg channery silt loam, 0 to 3 percent slopes.
Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded.
Glenelg channery silt loam, 3 to 8 percent slopes.
Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded.
Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded.
Neshaminy gravelly silt loam, 0 to 3 percent slopes.
Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded.
Neshaminy very stony silt loam, 0 to 8 percent slopes.
Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded.
Sassafras loam, 0 to 3 percent slopes.
Sassafras loam, 3 to 8 percent slopes, moderately eroded.

several soil types in four extensive series in Chester County

Species	Average age	Average height	Crown diameter	Basal area at breast height	Position on slope	Site index for oak
	Years	*Feet*	*Feet*	*Square feet*		
Chestnut oak	114	86	80–100	110	Middle	58
White oak, black oak, chestnut oak, red oak	46	63	80–100	75	Middle	64
Red oak	51	88	80–100	90	Upper	84
Red oak, black oak	45	84	80–100	77	Upper	84
Red oak	60	76	80–100	100	Middle	70
Chestnut oak, white oak, red oak, black oak	80	70	70–90	95	Not significant	54
Black oak, red oak	77	83	80–100	95	Lower	68
Black oak, red oak	71	99	90	80	Middle	80
Black oak, red oak	65	95	80–100	115	Lower	80
Black oak, red oak	75	92	85	90	Middle or center, of slope	74
Black oak, white oak, red oak	70	84	80–100	118	Not available	72
Black oak	60	95	80–100	108	Upper	84
Black oak, red oak	63	101	80–100	103	Upper	86
Chestnut oak, red oak	94	97	60–80	82	Upper	70
Black oak, red oak	66	88	80–100	92	Not significant	76
Black oak, red oak	64	84	60–80	70	Upper	74
Black oak, red oak	85	72	60–80	68	Lower	54
Black oak, red oak	59	95	60–80	71	Middle	82
Red oak, black oak	64	88	70–90	78	Lower	76
Red oak	101	82	65–85	80	Upper	57
Red oak, black oak	46	73	60–80	70	Middle	74
Black oak	72	83	80–100	106	Lower	68
Red oak, white oak, black oak	52	79	70–90	70	Not significant	78
Red oak, black oak	51	74	80–100	85	Upper	74
Black oak, red oak	42	78	60–80	60	Middle	84

Most of these soils are excellent for the production of timber, but the Brecknock, Penn, and Lansdale soils, as well as the severely eroded and very stony soils, are good for that purpose. In general, seedling mortality is slight on these soils, but on the eroded soils it is moderate. On most of the soils, competition from other plants is severe, but, on the severely eroded and very stony soils, it is moderate. Limitations to the use of woodland equipment are slight, except for the very stony soils, which have moderate limitations. The hazard of erosion is slight on most of these soils, but it is moderate on the moderately and severely eroded ones. Except for the severely eroded soils, which are moderately susceptible to windthrow, the hazard of windthrow is slight.

The Congaree soil is on flood plains and is subject to overflow. The floodwaters recede, however, in less than 18 hours.

Woodland group 2

This group (see table 3) consists of deep and moderately deep, well-drained soils that are medium textured. The soils developed in material from limestone and diabase. They are on uplands and have slopes of as much as 8 percent. The following soils are in this group:

Conestoga silt loam, 0 to 3 percent slopes.
Conestoga silt loam, 0 to 3 percent slopes, moderately eroded.
Conestoga silt loam, 3 to 8 percent slopes, moderately eroded.
Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded.
Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded.
Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded.
Montalto very stony silt loam, 0 to 8 percent slopes.

Except for the very stony Montalto soil, which is good for timber, all of these soils are excellent for timber. The mortality of seedlings is slight on all of the soils. On most of the soils, competition from other plants is severe and limitations to the use of equipment are slight. On the very stony Montalto soil, however, competition from other plants and limitations to the use of equipment are moderate. Most of the soils are slightly susceptible to erosion, but the more sloping Hagerstown soil and the Montalto channery silt loam are moderately susceptible. All of the soils are slightly susceptible to windthrow.

Woodland group 3

In this group (see table 3) are deep and moderately deep, well-drained soils that are medium textured. The soils are on uplands and terraces where they developed in material from schist, gneiss, sandstone, and shale. They have slopes of 8 to 25 percent. The following soils are in this group:

Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded.
Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded.
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded.
Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded.
Brecknock very stony silt loam, 8 to 25 percent slopes.
Chester silt loam, 8 to 15 percent slopes.
Chester silt loam, 8 to 15 percent slopes, moderately eroded.
Chester silt loam, 8 to 15 percent slopes, severely eroded.
Chester very stony silt loam, 8 to 15 percent slopes.
Edgemont channery loam, 8 to 15 percent slopes.
Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.
Edgemont channery loam, 8 to 15 percent slopes, severely eroded.
Edgemont channery loam, 15 to 25 percent slopes.
Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.

TABLE 3.—*Species priority and estimated ratings of woodland suitability groups for various factors important to woodland use and management*

[F–1 soils are excellent for timber, the site index for oak is 75 or better, and the expected yield is 13,750 board feet per acre; F–2 soils are good for timber, the site index for oak is 65 to 74, and the expected yield is 9,750 board feet per acre; F–3 soils are fairly good for timber, the site index for oak is 55 to 64, and the expected yield is 6,300 board feet per acre; F–4 soils are poor for timber, the site index for oak is 54 or less, and the expected yield is less than 3,250 board feet per acre]

Woodland group and mapping symbols	Potential productivity	Species priority for—		Seedling mortality	Competition from other plants	Limitations to use of woodland equipment	Hazard of—	
		Native trees	Planted trees				Erosion	Windthrow
Group 1. Deep and moderately deep, well-drained soils on acid materials; 0 to 8 percent slopes (BtB2, BvB, BxB2, ByA, ByB2, CdA, CdA2, CdB, CdB2, CdB3, CgB, Cn, EcB, EcB2, EdB, GeA, GeA2, GeB, GeB2, GeB3, NaA, NaB2, NsB, PtB2, SaA, SaB2).	F–1	Yellow-poplar, red oak, white oak.	White pine, larch, Norway spruce, Austrian pine.	Slight	Severe	Slight	Slight	Slight.
Group 2. Deep and moderately deep, well-drained soils on limestone and diabase; 0 to 8 percent slopes (CmA, CmA2, CmB2, HaA2, HaB2, MoB2, MrB).	F–1	Yellow-poplar, red oak, white oak.	White pine, Austrian pine.	Slight	Severe	Slight	Moderate	Slight.
Group 3. Deep and moderately deep, well-drained soils on acid materials; 8 to 25 percent slopes (BtC2, BtC3, BtD2, BtD3, BvD, CdC, CdC2, CdC3, CgC, EcC, EcC2, EcC3, EcD, EcD2, EcD3, EdD, GeC, GeC2, GeC3, GeD, GeD2, GeD3, GmD, NaC2, NaC3, NaD, NaD3, NsD, PtC2, PtC3, PtD2).	F–1	Yellow-poplar, red oak, white oak.	White pine, larch, Austrian pine, Norway spruce.	Slight	Moderate	Moderate	Moderate	Slight.
Group 4. Deep and moderately deep, well-drained soils on limestone and diabase; 8 to 25 percent slopes (CmC2, CmC3, HaC2, HaC3, MoC2, MoC3, MoD3, MrD).	F–1	Yellow-poplar, red oak, white oak.	White pine, Austrian pine.	Slight	Moderate	Moderate	Severe	Slight.
Group 5. Deep and moderately deep, well-drained soils on acid materials; slopes steeper than 25 percent (BtE3, BvF, EcE, EcE2, EdF, GeE, GeE3, GmE, NsF).	F–2	Yellow-poplar, red oak, white oak.	White pine, larch, spruce, Austrian pine.	Moderate	Moderate	Severe	Severe	Moderate.
Group 6. Deep to moderately deep, well-drained soils on diabase; 25 to 45 percent slopes (MrF).	F–2	Yellow-poplar, red oak, white oak.	White pine, Austrian pine.	Moderate	Moderate	Severe	Moderate	Slight.
Group 7. Deep, moderately well drained soils on acid materials; 0 to 25 percent slopes (BeA, BeB2, Ch, CoA, CoB2, GnA, GnB, GnB2, GnC2, GsB, LeB, LeB2, LeC3, LhB, LhD, RdA, RdB, RdB2, Ro, WnA).	F–2	Yellow-poplar, red oak, white oak.	White pine, larch, Norway spruce, white spruce.	Slight	Severe	Moderate	Slight	Slight.
Group 8. Deep, moderately well drained soils on limestone and diabase; 0 to 25 percent slopes (BdA, BdB, BdB2, Ls, MsB).	F–2	Yellow-poplar, red oak, white oak.	White pine	Slight	Severe	Moderate	Moderate	Slight.
Group 9. Somewhat poorly drained soils on acid materials; 0 to 8 percent slopes (AgA, AgB2, AsB2).	F–3	Yellow-poplar, red oak, white oak.	White pine, spruce, larch.	Moderate	Moderate	Moderate	Moderate	Moderate.
Group 10. Deep, somewhat poorly drained soils on limestone; 0 to 8 percent slopes (LaA, LaB).	F–3	Red oak, ash	White pine	Moderate	Moderate	Moderate	Slight	Moderate.
Group 11. Deep, poorly drained soils on acid materials; 0 to 15 percent slopes (Bo, CaA, CaB, CaB2, CrA, CrB, OtA, Rp, We, WoA, WoB, WoB2, WoC2, WsB).	F–4	Red maple, beech, pin oak.	White pine, white spruce.	Severe	Severe	Severe	Moderate	Severe.

Group 12. Deep, poorly drained soils on limestone and diabase; 0 to 8 percent slopes (Gu, Mn, WaA, WaB2, WcB).	F–4	Red maple, beech, pin oak.	White pine	Severe	Severe	Severe	Slight	Severe.
Group 13. Shallow, well-drained soils on acid materials; 0 to 8 percent slopes (BrB2, BsB, CkB2, GgA3, GgB3, MgA2, MgB2, MgB3, MmB, PeB3, PmB2, PnB).	F–3	Red oak, black oak, pitch pine.	White pine, Virginia pine, Austrian pine.	Moderate	Slight	Slight	Moderate	Moderate.
Group 14. Shallow, well-drained soils on limestone and diabase; 3 to 8 percent slopes (HoB2).	F–2	Red oak, black oak.	White pine, Austrian pine.	Moderate	Moderate	Slight	Moderate	Moderate.
Group 15. Shallow, well-drained soils on acid materials; 8 to 25 percent slopes (BrC, BrC2, BrC3, BrD, BrD2, BrD3, BsD, CkC2, CkC3, CkD2, CkD3, MgC, MgC2, MgC3, MgD, MgD2, MgD3, MmD, PeC3, PeD3, PmC2, PmC3, PmD, PmD2, PnD).	F–3	Red oak, black oak, pitch pine.	White pine, Virginia pine, Austrian pine.	Severe	Slight	Moderate	Moderate	Moderate.
Group 16. Shallow, well-drained soils on limestone; 8 to 25 percent slopes (HoC2, HoC3, HoD3).	F–2	Red oak, black oak.	White pine, Austrian pine.	Moderate	Slight	Moderate	Moderate	Moderate.
Group 17. Shallow, well-drained soils on acid materials; 25 percent slopes or more (BrE, BsF, CkE2, HoE3, MhE, MhE3, MkF, MmF, PnF, PsE2, PsE3, PsF).	F–3	Red oak, black oak, pitch pine.	White pine	Moderate	Slight	Severe	Severe	Moderate.
Group 18. Tidal marsh (Tm)	Not suitable for trees.							

Edgemont channery loam, 15 to 25 percent slopes, severely eroded.
Edgemont very stony loam, 8 to 25 percent slopes.
Glenelg channery silt loam, 8 to 15 percent slopes.
Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded.
Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded.
Glenelg channery silt loam, 15 to 25 percent slopes.
Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded.
Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded.
Glenelg very stony silt loam, 15 to 25 percent slopes.
Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded.
Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded.
Neshaminy gravelly silt loam, 15 to 25 percent slopes.
Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded.
Neshaminy very stony silt loam, 8 to 25 percent slopes.
Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded.
Penn and Lansdale sandy loams, 8 to 15 percent slopes, severely eroded.
Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded.

Most of these soils are excellent for timber. The Brecknock soils are only fairly good for that purpose, however, and the severely eroded and stony soils are good. On most of these soils, seedling mortality is slight, but on the severely eroded soils, it is moderate. As a rule, competition from other plants is moderate, but on the severely eroded Brecknock, Edgemont, and Neshaminy soils and on the moderately or severely eroded Glenelg soils that have slopes of 15 to 25 percent, it is slight. Also, on Chester silt loam, 8 to 15 percent slopes, Edgemont channery loam, 8 to 15 percent slopes, and Glenelg channery silt loam, 8 to 15 percent slopes, competition from other plants is severe.

Except for the very stony soils, which have severe limitations to the use of equipment, limitations to the use of equipment are moderate. The hazard of erosion is moderate on most of the soils, but it is severe on the severely eroded soils and slight on the very stony soils. All of the soils are slightly susceptible to windthrow.

Woodland group 4

This group (see table 3) is made up of deep and moderately deep, well-drained soils that are medium textured. The soils are on uplands and have developed in material from limestone and diabase. They have slopes ranging from 8 to 25 percent. The following soils are in this group:

Conestoga silt loam, 8 to 15 percent slopes, moderately eroded.
Conestoga silt loam, 8 to 15 percent slopes, severely eroded.
Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded.
Hagerstown silt loam, 8 to 15 percent slopes, severely eroded.
Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded.
Montalto channery silt loam, 8 to 15 percent slopes, severely eroded.
Montalto channery silt loam, 15 to 25 percent slopes, severely eroded.
Montalto very stony silt loam, 8 to 25 percent slopes.

Most of these soils are excellent for timber, but the severely eroded and stony soils are good for that purpose. Generally, seedling mortality is slight, but, on the severely eroded soils, it is moderate. Limitations to the use of equipment are moderate, except on the very stony Montalto soil, which has severe limitations. Generally, the hazard of erosion is severe, but the very stony Montalto soil is only slightly susceptible to erosion. The hazard of windthrow is slight on all of these soils.

Woodland group 5

In this group (see table 3) are deep and moderately deep, well-drained soils that are medium textured. The soils developed in material from schist, gneiss, sandstone, and shale. They are on uplands and terraces that have slopes of more than 25 percent. The following soils are in this group:

Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded.
Brecknock very stony silt loam, 25 to 50 percent slopes.
Edgemont channery loam, 25 to 35 percent slopes.
Edgemont channery loam, 25 to 35 percent slopes, moderately eroded.
Edgemont very stony loam, 25 to 60 percent slopes.
Glenelg channery silt loam, 25 to 35 percent slopes.
Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded.
Glenelg very stony silt loam, 25 to 35 percent slopes.
Neshaminy very stony silt loam, 25 to 45 percent slopes.

Most of these soils are good for timber. The very stony soils and the severely eroded Glenelg soil are only fairly good for that purpose, however, and the severely eroded Brecknock soil is poor. Seedling mortality is moderate on most of the soils, but on the severely eroded soils it is severe. Competition from other plants is moderate on all but the severely eroded soils, where competition is slight. It is difficult to use farm equipment on the very stony soils. The hazard of windthrow is moderate for all but the severely eroded soils, which are only slightly susceptible to windthrow.

Woodland group 6

Only one soil—Montalto very stony silt loam, 25 to 45 percent slopes—is in this unit (see table 3). This soil is deep to moderately deep, well drained, and medium textured. It is on uplands and developed in material from diabase.

This soil is good for some kinds of trees, but it is not suited to larch and spruce. Seedling mortality, competition from other plants, and the hazard of erosion are moderate. Limitations to the use of equipment are severe, and there is a slight hazard of windthrow.

Woodland group 7

In this group (see table 3) are deep, moderately well drained soils that are medium textured. The soils developed in material from schist, gneiss, sandstone, shale, and coastal plain sediments. They are on uplands, terraces, and flood plains and have slopes of as much as 25 percent. The following soils are in this group:

Beltsville silt loam, 0 to 3 percent slopes.
Beltsville silt loam, 3 to 8 percent slopes, moderately eroded.
Chewacla silt loam.
Conowingo silt loam, 0 to 3 percent slopes.
Conowingo silt loam, 3 to 8 percent slopes, moderately eroded.
Glenville silt loam, 0 to 3 percent slopes.
Glenville silt loam, 3 to 8 percent slopes.
Glenville silt loam, 3 to 8 percent slopes, moderately eroded.
Glenville silt loam, 8 to 15 percent slopes, moderately eroded.
Glenville very stony silt loam, 0 to 8 percent slopes.
Lehigh silt loam, 3 to 8 percent slopes.
Lehigh silt loam, 3 to 8 percent slopes, moderately eroded.
Lehigh silt loam, 8 to 15 percent slopes, severely eroded.
Lehigh very stony silt loam, 0 to 8 percent slopes.
Lehigh very stony silt loam, 8 to 25 percent slopes.

Readington silt loam, 0 to 3 percent slopes.
Readington silt loam, 3 to 8 percent slopes.
Readington silt loam, 3 to 8 percent slopes, moderately eroded.
Rowland silt loam.
Woodstown loam, 0 to 3 percent slopes.

Most of these soils are good for timber. The Lehigh soils and all of the very stony soils, however, are only fairly good for that purpose. Competition from other plants is severe, except on the Conowingo, Lehigh, and Readington soils, where competition is moderate. On most of the soils, the hazard of erosion is slight, but on the moderately eroded and severely eroded soils it is moderate. The hazard of windthrow is slight for all but the severely eroded soils, which are moderately susceptible to windthrow.

The Chewacla and Rowland soils are on flood plains where they are subject to overflow. The floodwaters recede, however, in less than 18 hours.

Woodland group 8

This group (see table 3) consists of deep, moderately well drained soils that are medium textured. The soils developed in material from limestone and diabase. They are on uplands and flood plains and have slopes of as much as 25 percent. The following soils are in this group:

Bedford silt loam, 0 to 3 percent slopes.
Bedford silt loam, 3 to 8 percent slopes.
Bedford silt loam, 3 to 8 percent slopes, moderately eroded.
Lindside silt loam.
Mount Lucas very stony silt loam, 0 to 8 percent slopes.

Except for the Mount Lucas soil, which is only fairly good for timber, all of these soils are good for timber. Generally, competition from other plants is severe, but it is moderate on the Mount Lucas soil. The hazard of erosion is moderate, except for the Lindside soil and the more level areas of the Bedford soils, where it is slight.

The Lindside soil is on flood plains and is subject to overflow. The floodwaters recede in less than 18 hours.

Woodland group 9

In this group (see table 3) are somewhat poorly drained, medium-textured soils developed in material from schist, gneiss, and serpentine. The soils are on uplands, terraces, and flood plains and have slopes of as much as 8 percent. The following soils are in this group:

Aldino silt loam, 0 to 3 percent slopes.
Aldino silt loam, 3 to 8 percent slopes, moderately eroded.
Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded.

These soils are only fairly good for timber. Seedling mortality, competition from other plants, and limitations to equipment are all moderate. The hazard of erosion is moderate, except for the more nearly level areas of the Aldino soils. There is a moderate hazard of windthrow.

Woodland group 10

The soils in this group (see table 3) are deep, somewhat poorly drained, and medium textured. They are on uplands and developed in material from limestone. The soils have slopes of as much as 8 percent. The following soils are in this group:

Lawrence silt loam, 0 to 3 percent slopes.
Lawrence silt loam, 3 to 8 percent slopes.

The more nearly level Lawrence soil is fairly good for timber, and the more sloping one is poor for that purpose. Seedling mortality, competition from other plants, limitations to the use of woodland equipment, and the hazard of windthrow are all moderate on these soils, but the hazard of erosion is slight.

Woodland group 11

In this group (see table 3) are deep, poorly drained soils that are medium textured. The soils are on uplands, terraces, and flood plains. They developed in material from schist, gneiss, sandstone, and coastal plain sediments. Slopes are as much as 15 percent. The following soils are in this group:

Bowmansville silt loam.
Calvert silt loam, 0 to 3 percent slopes.
Calvert silt loam, 3 to 8 percent slopes.
Calvert silt loam, 3 to 8 percent slopes, moderately eroded.
Croton silt loam, 0 to 3 percent slopes.
Croton silt loam, 3 to 8 percent slopes.
Othello silt loam.
Rowland silt loam, dark surface.
Wehadkee silt loam.
Worsham silt loam, 0 to 3 percent slopes.
Worsham silt loam, 3 to 8 percent slopes.
Worsham silt loam, 3 to 8 percent slopes, moderately eroded.
Worsham silt loam, 8 to 15 percent slopes, moderately eroded.
Worsham very stony silt loam, 0 to 8 percent slopes.

All of these soils are poor for timber. For most of the soils, seedling mortality and competition from other plants is severe, but on the Worsham soils they are moderate. Limitations to the use of equipment are severe on all but the Worsham soils, which have moderate limitations. Except for the soils that have slopes of less than 3 percent, which are only slightly susceptible to erosion, the hazard of erosion is moderate.

The Wehadkee soil is on flood plains and is subject to overflow. The floodwaters recede, however, in less than 18 hours.

Woodland group 12

In this group (see table 3) are deep, poorly drained soils that are medium textured. The soils are on uplands and flood plains. They have developed in material from limestone and diabase and have slopes of as much as 8 percent. The following soils are in this group:

Guthrie silt loam.
Melvin silt loam.
Watchung silt loam, 0 to 3 percent slopes.
Watchung silt loam, 3 to 8 percent slopes, moderately eroded.
Watchung very stony silt loam, 0 to 8 percent slopes.

These soils are poor for timber. On most of the soils, competition from other plants is severe, but on the very stony Watchung soil it is moderate. The hazard of erosion is slight on all but the moderately eroded Watchung soil, but it is moderate on that soil.

The Melvin soil is on flood plains. It is subject to overflow, but the floodwaters recede in less than 18 hours.

Woodland group 13

The soils in this group (see table 3) are shallow, well drained, and medium textured. They are on uplands and developed in material from schist, gneiss, and shale. The soils have slopes of as much as 8 percent. The following soils are in this group:

Brandywine loam, 3 to 8 percent slopes, moderately eroded.
Brandywine very stony loam, 0 to 8 percent slopes.
Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded.

Glenelg silt loam, 0 to 3 percent slopes, severely eroded.
Glenelg silt loam, 3 to 8 percent slopes, severely eroded.
Manor loam, 0 to 3 percent slopes, moderately eroded.
Manor loam, 3 to 8 percent slopes, moderately eroded.
Manor loam, 3 to 8 percent slopes, severely eroded.
Manor very stony loam, 0 to 8 percent slopes.
Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded.
Penn silt loam, 3 to 8 percent slopes, moderately eroded.
Penn very stony silt loam, 0 to 8 percent slopes.

Most of these soils are only fairly good for timber. The moderately eroded Brandywine and Manor soils, however, are good for timber, and the severely eroded Penn soil is poor. Generally, seedling mortality is moderate, but on the severely eroded soils it is severe. Limitations to the use of equipment are slight, except on the Chrome soil and on the very stony soils, which have moderate limitations to the use of equipment. Most of the soils are moderately susceptible to erosion, but the Chrome soil and the very stony soils are slightly susceptible. On the Glenelg and the severely eroded soils, the hazard of erosion is severe.

Woodland group 14

Only one soil—Hollinger silt loam, 3 to 8 percent slopes, moderately eroded—is in this group (see table 3). This shallow, well-drained soil is medium textured. It developed in material from limestone and has slopes of as much as 8 percent.

This soil is good for timber. Seedling mortality, competition from other plants, and the hazards of erosion and windthrow are all moderate, but there is a slight limitation to the use of equipment.

Woodland group 15

In this group (see table 3) are shallow soils that are well drained and medium textured. The soils are on uplands and developed in material from schist, gneiss, and shale. They have slopes of 8 to 25 percent. The following soils are in this unit:

Brandywine loam, 8 to 15 percent slopes.
Brandywine loam, 8 to 15 percent slopes, moderately eroded.
Brandywine loam, 8 to 15 percent slopes, severely eroded.
Brandywine loam, 15 to 25 percent slopes.
Brandywine loam, 15 to 25 percent slopes, moderately eroded.
Brandywine loam, 15 to 25 percent slopes, severely eroded.
Brandywine very stony loam, 8 to 25 percent slopes.
Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded.
Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded.
Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded.
Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded.
Manor loam, 8 to 15 percent slopes.
Manor loam, 8 to 15 percent slopes, moderately eroded.
Manor loam, 8 to 15 percent slopes, severely eroded.
Manor loam, 15 to 25 percent slopes.
Manor loam, 15 to 25 percent slopes, moderately eroded.
Manor loam, 15 to 25 percent slopes, severely eroded.
Manor very stony loam, 8 to 25 percent slopes.
Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded.
Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded.
Penn silt loam, 8 to 15 percent slopes, moderately eroded.
Penn silt loam, 8 to 15 percent slopes, severely eroded.
Penn silt loam, 15 to 25 percent slopes.
Penn silt loam, 15 to 25 percent slopes, moderately eroded.
Penn very stony silt loam, 8 to 25 percent slopes.

Most of these soils are only fairly good for timber, but the uneroded and moderately eroded Brandywine and Manor soils are good for that purpose, and the severely eroded Chrome and Penn soils are poor. Seedling mortality is severe, except on the uneroded and moderately eroded Manor and Penn soils, which have moderate seedling mortality. In general, the hazard of erosion is moderate. It is severe, however, on the moderately eroded Brandywine and Chrome soils and on the soils that are severely eroded.

Woodland group 16

The soils in this group (see table 3) are shallow, well drained, and medium textured. They are on uplands and developed in material from limestone. Slopes range from 8 to 25 percent. The following soils are in this group:

Hollinger silt loam, 8 to 15 percent slopes, moderately eroded.
Hollinger silt loam, 8 to 15 percent slopes, severely eroded.
Hollinger silt loam, 15 to 25 percent slopes, severely eroded.

Of these soils, the moderately eroded Hollinger soil is good for timber, has moderate seedling mortality, and is moderately susceptible to erosion. The rest of the soils are only fairly good for timber. They have severe seedling mortality and a severe hazard of erosion. Competition from other plants is slight on all the soils, and limitations to the use of equipment and the hazard of windthrow are moderate.

Woodland group 17

In this group (see table 3) are shallow, well-drained soils that are medium textured. The soils are on uplands and developed in material from schist, gneiss, and shale. They have slopes of 25 percent or more. The following soils are in this group:

Brandywine loam, 25 to 40 percent slopes.
Brandywine very stony loam, 25 to 50 percent slopes.
Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded.
Hollinger silt loam, 25 to 35 percent slopes, severely eroded.
Manor loam and channery loam, 25 to 35 percent slopes.
Manor loam and channery loam, 25 to 35 percent slopes, severely eroded.
Manor soils, 35 to 60 percent slopes.
Manor very stony loam, 25 to 60 percent slopes.
Penn very stony silt loam, 25 to 50 percent slopes.
Penn soils, 25 to 35 percent slopes, moderately eroded.
Penn soils, 25 to 35 percent slopes, severely eroded.
Penn soils, 35 to 50 percent slopes.

Most of these soils are only fairly good for timber. The uneroded Brandywine and Manor soils, however, are good for timber, and the severely eroded soils are poor. Seedling mortality is moderate, except on the Chrome soil, the uneroded Manor soils, and the severely eroded soils, which have severe seedling mortality. Most of the soils are moderately susceptible to windthrow. On the severely eroded soils, however, the hazard of windthrow is severe.

Woodland group 18

Only one miscellaneous land type—Tidal marsh—is in this group (see table 3). Tidal marsh occupies areas that are at sea level. The areas are subject to tidal overflow and are frequently covered by water. For much of the year the water is brackish; therefore, trees do not grow on the areas.

Wildlife Interpretations

This section tells about the potential of the soils of Chester and Delaware Counties as habitats for wildlife. The principal species of game in these two counties are the ring-necked pheasant, bobwhite, mourning dove, cottontail rabbit, gray squirrel, and white-tailed deer. There are also many kinds of songbirds and insectiverous birds, small animals, and other nongame species throughout the area. These have great value for the pleasure they give to persons who live in the country. They also have significant, but obscure, biological functions that make them important.

The occurrence and abundance of some species of wildlife are related to the kinds of soils. Many of the relationships are indirect and are influenced primarily by land use, the kinds of plants, and topography. Wildlife is generally more abundant, the individual animals tend to be larger, and the rate of production is higher on the fertile soils than on soils of poor quality. Wildlife can be encouraged to live in an area if there is a suitable cover of plants, and the vegetation also helps protect the soils.

Among the possible uses of the soils for wildlife are parks, wildlife refuges, private and leased shooting preserves, and private and public fishing ponds. The landowner can obtain information from the Pennsylvania Game Commission (*6*) about trees, shrubs, vines, and crops that will help to encourage wildlife. Local soil conservationists and wildlife technicians will also help determine the most beneficial practices to use to establish wildlife on a particular farm.

In table 4 the soils in the county have been rated according to their potential as habitats for the principal kinds of game. The ratings given—*high, moderate,* and *low*—take into account the characteristics and productivity of the soils, the topography, land use, and the kind of vegetation and habitat preferred by the species concerned. The table can be used along with the section "Descriptions of Soils" and with the detailed soil map

TABLE 4.—*The soil series and land types rated according to their potential as habitats for the stated species of game*

[Dashes indicate no potential, or the potential is unknown]

Soil series and land types	Pheasant	Bobwhite	Mourning dove	Cottontail rabbit	Gray squirrel	White-tailed deer
Aldino		Low	Low	High	Low	Moderate.
Bedford	High	High	High	High	Moderate	Moderate.
Beltsville	Moderate	High	Moderate	High	High	Moderate.
Bowmansville				Moderate	Moderate	Moderate.
Brandywine	Low	Moderate	Moderate	Moderate	High	Moderate.
Brecknock		Moderate	Moderate	Moderate	Moderate	Moderate.
Bucks	High	Moderate	High	Moderate	High	Moderate.
Butlertown	Moderate	Low	Moderate	Moderate	High	
Calvert		Moderate	Low	Moderate	Moderate	Moderate.
Chester	High	Moderate	Moderate	Moderate	High	Moderate.
Chewacla	High	Low	Low	High	High	High.
Chrome	Moderate	Moderate	Moderate	High	Low	Moderate.
Conestoga	High	Low	High	High	High	High.
Congaree	High	Moderate	Moderate	Moderate	Moderate	Moderate.
Conowingo	High	Moderate	Moderate	Moderate	Moderate	Moderate.
Croton		Low		Moderate	Moderate	Moderate.
Edgemont	Low	Moderate	Low	Moderate	Moderate	Moderate.
Glenelg	Moderate	Moderate	Moderate	Moderate	High	High.
Glenville	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate.
Guthrie				Moderate	Moderate	Moderate.
Hagerstown	High	High	High	High	High	High.
Hollinger	Moderate	Moderate	Moderate	High	High	High.
Lansdale	Low	Moderate	Moderate	Moderate	Moderate	Moderate.
Lawrence	Moderate	Moderate	Low	Moderate	Moderate	Moderate.
Lehigh		Low		Moderate	Moderate	Moderate.
Lindside	Moderate	Moderate	Low	Moderate	Moderate	Moderate.
Made land						
Manor	Low	Low	Moderate	Moderate	Moderate	Moderate.
Melvin				Low	Low	Moderate.
Montalto	Low	High	Moderate	High	High	High.
Mount Lucas	Moderate	Moderate	Moderate	High	Moderate	High.
Neshaminy	Low	Moderate	Moderate	High	High	High.
Othello			Low	High	Moderate	High.
Penn	Low	Low	Moderate	Moderate	Moderate	Moderate.
Readington	Low	Low	Low	Moderate	Moderate	Moderate.
Rowland	Moderate	Low	Moderate	Moderate	High	Moderate.
Sassafras	Moderate	Moderate	Moderate	High	High	Moderate.
Tidal marsh [1]						
Watchung		Low		High	Moderate	High.
Wehadkee		Low		Moderate	Moderate	
Woodstown	Low	Low	Moderate	Moderate	High	
Worsham			Moderate	Moderate	Moderate	High.

[1] Tidal marsh has potential as a habitat for waterfowl; if undisturbed, it also serves as a source of nutrients for estuarine shellfish, crabs, and fish.

at the back of the report to determine the suitability of the soils for various kinds of habitats. The kinds of habitat preferred by the various species of game are discussed in the following paragraphs.

Pheasant prefer large areas of fertile farmland, especially areas where corn or small grain is grown. Apparently, they do best on soils that are high in lime. The widespread practice of liming soils for agriculture may, therefore, influence pheasant to go into areas that normally would be poorly suited to them. Pheasant like grassy areas for nesting, but, generally, their numbers decrease where grassland farming is practiced.

Bobwhite are most abundant in areas where small fields that are planted to corn or small grain adjoin meadows and brushy areas. They are less numerous in areas where open farmland is extensive, in areas where grassland farming is practiced, or in mature forests. The mourning dove, on the other hand, thrives where there are large fields of corn and small grain.

Cottontail rabbit thrive in most habitats but are most abundant in brushy areas that are interspersed with patches of grass. They are least abundant in large areas that are cultivated or that have a dense cover of trees.

Gray squirrel generally prefer wooded areas where there are many oaks, hickories, and other trees that bear nuts. They are most abundant in woodlands that have a heavy undergrowth, but they generally prefer to live near the edges and openings of woods.

White-tailed deer generally like second- and third-growth hardwood forests, brushy areas, and the edges of open fields.

Engineering Applications

This soil survey for Chester and Delaware Counties, Pa., contains information that can be used by engineers to—

(1) Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
(2) Make estimates of the engineering properties of the soils for use in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
(3) Make reconnaissance surveys of soil and ground conditions that will aid in selecting locations for highways and airports and in planning detailed soil surveys for the intended locations.
(4) Locate sand and gravel for use in structures.
(5) Correlate pavement performance with the types of soil and thus develop information that will be useful in designing and maintaining the pavements.
(6) Determine the suitability of the various soil units for cross-country movements of vehicles and construction equipment.
(7) Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making available information about soils that can be used readily by engineers.
(8) Estimate the suitability of sites for the infiltration of waste from septic tanks.
(9) Estimate the nature of material that would interfere with the construction and maintenance of pipelines.

The mapping and the descriptive report are somewhat generalized, and should be used only in planning more detailed field surveys to determine the in-place condition of the soils at the site of the proposed engineering construction.

Some of the terms used by the soil scientist may not be familiar to the engineer, and some words—for example, soil, clay, silt, sand, granular, and aggregate—may have special meanings in soil science. These and other special terms that are used in the soil survey report are defined in the Glossary in the back of the report.

Soil test data

To be able to make the best use of the soil maps and the soil survey reports, the engineer should know the physical properties of the soil materials and the in-place condition of the soils. After testing the soil materials and observing their behavior when used in engineering structures and foundations, the engineer can develop design recommendations for the soil units delineated on the soil map.

Because information is needed about the properties of the soils as related to engineering, three tables are provided in this section. Table 5 gives test data for the soils of eight extensive series in Chester and Delaware Counties; table 6 gives a brief description of the soils with their estimated physical properties and their estimated AASHO and Unified classifications; and table 7 gives estimates of the suitability of the soils for highway construction and for conservation engineering.

To arrive at the test data given in table 5 and thus to help evaluate the soils for engineering purposes, soil samples of the main soil types in eight soil series were tested according to standard procedures of the American Association of State Highway Officials (AASHO). The results of these tests and the classification of each sample according to both the AASHO and the Unified systems are given in table 5. For the rest of the soils in the two counties, the data were compiled partly from reports of nearby counties where soils from the same soil series had been tested, and partly from evaluations made by soil scientists who were familiar with the characteristics of the soils in a particular series.

Although a soil from each of the eight series was sampled in three different localities and, as a result, the test data show some variations in physical characteristics, the data probably do not show the maximum variations in the B and C horizons of the soils within each series. All of the samples were obtained at a depth of 5 feet or less. The test data, therefore, may not be a suitable basis for estimating the characteristics of soil material in deep cuts in areas of rolling or hilly topography.

The data given in table 5 were obtained by mechanical analysis and by testing the soils to determine the liquid limits and plastic limits. Mechanical analyses were made by combining sieve and hydrometer methods. The percentages of clay obtained by the hydrometer method should not be used as a basis for naming the textural classes of soils.

The tests to determine the liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. As the moisture content is further increased, the material changes from the plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture con-

tent at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 5 also gives compaction (moisture-density) data for the tested soils. If a soil material is compacted at a successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed maximum dry density. Data showing moisture density are important in earthwork, for, as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it contains approximately the optimum amount of moisture.

Engineering classification systems

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (*1*). In this system soil materials are classified in seven principal groups. The groups range from A–1, which consists of gravelly soils of high bearing capacity, to A–7, which consists of clay soils having low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol, in table 5.

Some engineers prefer to use the Unified soil classification system (*9*). In this system soil materials are identified as coarse grained, 8 classes; fine grained, 6 classes; and highly organic. The last column of table 5 gives the classification of the tested soils of Chester and Delaware Counties according to the Unified system.

Engineering interpretations

Some information helpful to engineers can be obtained from the detailed soil map and the general soil map. It will sometimes be necessary, however, to refer to other parts of the report. The section that would be most helpful is "Descriptions of Soils."

The descriptions of the soil profiles, as well as the soil maps, should be used in planning detailed surveys at construction sites. These will help the engineer to concentrate on the most suitable soils, indicate sources of sand and gravel, and minimize the number of soil samples needed for testing in the laboratory.

In table 6 the map symbols and the names of the soils are listed alphabetically. The soil test data given in table 5, information taken from the rest of the report, and experience with similar soils in other counties were all used as a basis for preparing this table.

The engineering soil classifications given in table 6 may not apply to all parts of a mapping unit because of variations in the kind of underlying material. Also, the very stony soils have not been rated in this table. In some parts of these two counties, the stones have been removed from the surface but have not been removed from the subsoil and substratum.

In table 7 the soils of each series are rated according to their suitability for winter grading. The rating applies only to the soil material and not to the underlying bedrock. Resistance of the soil material to frost action has also been considered in rating the soils as sources of sand and gravel. As a rule, for a soil to be nonsusceptible to frost action, less than 10 percent of the soil material should pass the No. 200 sieve. If a soil is rated "Good," it may be necessary to examine the area carefully to find material that meets this condition.

In table 7 the ratings given the soils as sources of topsoil for slopes on embankments, ditches, and cut slopes apply to the soils of Chester and Delaware Counties. Generally, the uppermost 8 to 12 inches of soil material was considered for this rating.

The rating of the soil material for road subgrade is based on the texture of the soil material. Soils that have layers of plastic clay that impede internal drainage have low stability when wet; therefore, they are rated "Poor." Marshy soils are rated "Unsuitable."

The suitability of the soil material for road fill depends largely on the texture of the soil and its natural content of water. Plastic soils that have a high natural content of water are difficult to handle, slow to dry, and hard to compact. Consequently, they are rated "Poor." Fine sand and silt and other highly erodible soils require flat slopes, close control of moisture while compacting, and fast vegetation of side slopes to prevent erosion. These soils are rated "Poor to fair."

To determine the suitability of the soils for the vertical alinement of highways, the kinds of materials, as well as the drainage, must be considered carefully. If highway cuts are planned at a location where the water table is high, a survey should be made to determine the need for interceptor drains and underdrains. Seepage on the backslopes of cuts may cause slumping or sliding of the underlying material. If the water table is shallow below the pavement, differential volume change may occur, particularly within the freezing zone, and the decrease in bearing capacity of the saturated or thawed foundation material may cause deterioration of the pavement. Commonly the vertical alinement of roads is planned so that a minimum amount of cut and fill is required.

Roadways constructed on the soils of flood plains need a continuous embankment to place them above the water table. This is generally a minimum of 2 to 4 feet. Suitable materials for use in these embankments may be borrowed from the adjacent bottom lands or from the soils of uplands that are adjacent to the flood plains.

The ratings for waterways are based upon whether or not there is enough slope so that excess water will drain to a suitable outlet. Except for the soils that have a high water table, most soils in these two counties are suitable for building sites. Many of the shallow and wet soils, however, are not sufficiently permeable so that waste from septic tanks will infiltrate at all seasons of the year.

At many construction sites major variations in the soils may occur within the depth of the proposed excavation, and several different kinds of soils may occur within short distances. The soil map, the detailed description of the soils, and the engineering data and recommendations given in this section should be used to plan detailed surveys of soils at construction sites. The soil survey report will enable the soils engineer to concentrate on the most suitable soil units and to take a minimum number of soil samples for testing in the laboratory. Therefore, an adequate soil investigation can be made at minimum cost.

TABLE 5.—*Engineering*

Name of soil and location	Parent material	Pennsylvania report No.	Depth	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Brecknock stony silt loam:						
0.75 mile N. of Coventryville along Route T470. (Modal profile.)	Triassic porcelanite	BE-9037	10–35	B	114	13
		BE-9038	35–40	C	113	15
0.75 mile N. of Coventryville along Route T470. (Subsoil finer textured than that in the modal profile.)	Triassic porcelanite mixed with shale and conglomerate.	BE-9039	14–38	B_1 and B_2	108	17
		BE-9040	38–45	C_1	108	18
1 mile N. of Harmonyville and 200 ft. N. of Rock Run. (Deeper than the modal profile.)	Triassic porcelanite	BE-9041	11–34	B	112	16
		BE-9042	34–50	C	109	16
Chester silt loam:						
Concord Golf Course. (Modal profile.)	Baltimore gneiss	BE-8063	12–21	B_{21}	108	19
		BE-8064	37–49	C_{11}	101	23
1,000 ft. E. of Route 320 along Route 3. (Finer textured than modal profile.)	Mixture of material from the Piedmont and the Coastal Plains (Lafayette formation).	BE-9035	9–41	B	112	14
		BE-9036	41–54	C_1	111	16
2.5 miles S. of Route 3 along Route 320 and 1,865 ft. NE. (Coarser textured than modal profile.)	Wissahickon schist	BE-9033	8–34	B	117	13
		BE-9034	34–42	C_1	110	13
Chrome gravelly silty clay loam:						
½ mile SE. of Lima. (Modal profile.)	Serpentine and chlorite schist.	BE-8065	7–15	B_2	58	55
		BE-8066	25–30	C_2	86	27
W. end of Media bypass U.S. Route 1, near Elwyn Training School, Middletown Township. (More plastic than modal profile.)	Serpentine	BE-8067	7–15	B_2	78	35
		BE-8068	15–25	C_1	69	41
Chrome gravelly silt loam:						
1¼ miles SW. and 100 ft. N. of Newtown Square. (Coarser textured than modal profile.)	Gabbro	BE-8069	9–17	B_2	117	17
		BE-8070	22–30	C_1	123	14
Glenelg channery silt loam:						
0.5 mile E. of Marshalton. (Modal profile.)	Wissahickon schist	BE-19777	8–26	B	115	16
		BE-16563	26–45	C	117	13
0.3 mile S. of Route 15186 along Route 322. (Coarser textured than the modal profile.)	Granodiorite	BE-15070	4–30	B_1 and B_2	118	13
		BE-15071	30–38	C	116	13
0.5 mile E. and 1,400 ft. N. of an intersection between Routes 82 and 52. (Substratum coarser textured than that in the modal profile.)	Mica schist (Wissahickon formation).	BE-15074	8–22	B	115	15
		BE-15075	22–48	C_1	113	16

See footnotes at end of table.

test data [1]

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—						AASHO [4]	Unified [5]
3-in.	¾-in.	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
100	80	76	74	69	52	49	38	24	18	29	6	A-4(3)	ML-CL.
100	89	83	81	76	61	57	44	28	22	29	7	A-4(5)	ML-CL.
100	88	80	77	73	57	53	44	32	24	33	11	A-6(5)	ML-CL.
100	89	80	78	75	62	58	46	31	23	36	12	A-6(6)	ML-CL.
100	81	68	68	60	53	50	39	23	16	32	8	A-4(4)	ML-CL.
100	76	68	64	58	51	48	40	26	18	36	10	A-4(3)	ML-CL.
100	76	70	69	66	52	48	35	21	16	39	14	A-6(4)	ML-CL.
100	100	100	99	92	46	37	25	15	13	45	4	A-5(3)	SM.
100	100	100	99	98	44	37	29	24	22	28	4	A-4(2)	SM-SC.
100	86	85	83	80	67	64	47	29	24	33	10	A-4(6)	ML-CL.
100	100	97	95	74	37	34	30	27	25	30	9	A-4(0)	SM-SC.
100	100	98	98	97	31	25	16	12	11	24	0	A-2-4(0)	SM.
100	100	100	99	96	77	72	55	37	32	103	45	A-7-5(20)	MH.
100	80	72	68	51	26	24	16	7	5	96	43	A-2-7(2)	SM.
100	61	54	51	47	38	36	26	18	14	69	26	A-7-5(5)	GM.
100	76	65	60	55	43	41	31	21	16	116	50	A-7-5(8)	GM.
100	59	57	56	51	33	29	23	14	12	33	9	A-2-4(0)	GM-GC.
100	90	83	78	66	23	18	9	4	3	25	1	A-2-4(0)	SM.
100	100	98	97	90	53	47	33	18	14	31	6	A-4(4)	ML.
100	100	99	97	83	43	36	23	11	8	35	2	A-4(2)	SM.
100	70	64	61	49	32	29	20	14	12	30	8	A-2-4(0)	GM-GC.
100	100	97	92	72	45	40	22	12	9	29	1	A-4(2)	SM.
100	89	74	65	54	36	33	23	15	12	36	8	A-4(0)	SM.
100	100	91	82	70	42	37	21	12	8	35	2	A-4(1)	SM.

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TABLE 5.—*Engineering*

Name of soil and location	Parent material	Pennsylvania report No.	Depth	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Glenville silt loam:						
E. of Brandywine Creek and N. of Taylor Run. (Modal profile.)	Baltimore gneiss, Wissahickon schist.	BE-16557	20–48	B	111	16
		BE-16558	48–52	C	116	14
1.5 miles NW. of Route 202 on property of the West Chester Airport and SW. 350 ft. in the woods. (Shallower than the modal profile.)	Wissahickon schist	BE-15068	6–26	B	104	18
		BE-15069	26–33	C	113	15
1,000 ft. S. and 125 ft. W. of Cupola along Route 15145. (Thicker, harder fragipan than that in the modal profile.)	Anorthosite rocks	BE-15076	7–15	B_1 and B_{21}	106	18
		BE-15077	15–42	B_{22}	108	17
Neshaminy gravelly silt loam:						
1 mile E. of Martins Corner along Road T437. (Modal profile.)	Granodiorite	BE-19778	12–41	B	105	18
		BE-16561	41–54	C	110	17
500 ft. W. of intersection of West Chester bypass and Route 4. (Finer textured than the modal profile.)	Serpentine	BE-16560	8–34	B	101	23
		BE-19776	34–48	C	81	39
Neshaminy silt loam:						
150 ft. N. of Route 3 on Route 352. (B and C horizons coarser textured than those in the modal profile.)	Baltimore gneiss	BE-16565	8–32	B	110	15
		BE-19780	32–42	C_1	116	14
Penn silt loam:						
Along Schuylkill Road in East Coventry Township. (Modal profile.)	Triassic shale	BE-16562	8–24	B	117	15
		BE-16559	24–38	C	116	14
1 mile S. and 10 ft. W. of Schuylkill River along Route 100 near Pottstown bypass. (Subsoil coarser textured than that in the modal profile.)	Shale and sandstone	BE-19779	7–26	B	121	12
		BE-16564	26–38	C_1	122	11
1,500 ft. S. of Schuylkill River on Route 100 near Pottstown bypass. (Shallower than the modal profile.)	Triassic shale	BE-15072	6–14	B_2 and B_3	106	18
		BE-15073	14–28	C	107	18
Sassafras loam:						
Gravel pit in Concord Township. (Modal profile.)	Stratified coastal plain deposits.	BE-8061	16–25	B_{21}	113	16
		BE-8062	55–60+	C_1	114	10
Pyle Road 300 ft. back of house; 50 ft. E. of gravel pit. (Finer textured than modal profile.)	Stratified coastal plain deposits.	BE-9031	10–33	B_{21} and B_{22}	100	23
		BE-9032	33–42	C_1	95	25
400 ft. back of house on Pyle Road; 2,500 ft. E. of Route 202. (Coarser textured than modal profile.)	Stratified coastal plain deposits.	BE-9029	5–33	B	123	11
		BE-9030	33–46	C_1	114	17

[1] Tests performed by Pennsylvania Department of Highways according to standard procedures of the American Association of State Highway Officials (AASHO) (*1*).

[2] Moisture-density tests were performed by using Method A, AASHO Designation T 99-57.

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

test data [1]—Continued

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—						AASHO [4]	Unified [5]
3-in.	¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
100	96	96	94	86	72	69	46	27	20	32	10	A-4(7)	ML-CL.
------	84	76	73	65	50	48	30	19	12	33	9	A-4(3)	SM-SC.
100	100	98	97	95	90	88	60	33	24	34	9	A-4(8)	ML-CL.
------	93	82	76	68	53	50	31	17	13	34	5	A-4(4)	ML.
100	93	91	88	82	76	74	53	29	21	37	9	A-4(8)	ML.
------	93	89	87	82	77	75	53	29	21	33	9	A-4(8)	ML-CL.
100	97	94	93	88	80	79	58	40	33	42	16	A-7-6(11)	ML-CL.
100	84	82	81	76	70	69	49	27	19	32	7	A-4(7)	ML-CL.
100	100	99	95	89	83	81	64	47	39	49	20	A-7-6(14)	ML-CL
100	100	100	100	97	78	74	57	43	38	72	14	A-7-5(14)	MH.
100	100	97	93	75	54	50	35	20	16	34	7	A-4(4)	ML.
100	100	94	84	60	35	31	22	14	11	34	5	A-2-4(0)	SM.
100	93	88	85	82	57	53	40	23	17	24	5	A-4(4)	ML-CL.
100	100	100	99	96	76	74	52	33	23	28	9	A-4(8)	CL.
100	100	100	99	93	51	47	38	28	20	24	7	A-4(3)	ML-CL.
100	100	100	100	98	48	43	34	26	21	23	6	A-4(3)	SM-SC.
100	94	73	67	64	60	59	34	18	11	33	4	A-4(5)	ML.
100	95	73	65	62	60	59	29	14	9	33	4	A-4(5)	ML.
100	100	98	97	91	72	67	51	33	25	35	13	A-6(9)	ML-CL.
100	100	94	81	41	9	8	8	7	6	(6)	(6)	A-1-b(0)	SW-SM.
100	100	98	94	81	60	57	51	45	41	53	20	A-7-5(11)	MH.
100	100	93	89	61	32	28	21	13	10	43	4	A-2-5(0)	SM.
100	100	98	85	54	39	38	28	18	14	32	8	A-4(1)	SM-SC.
100	100	96	92	37	12	11	8	6	5	23	1	A-1-b(0)	SP-SM.

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

[4] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (pt. 1, ed. 7). The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145-49.

[5] Based of the Unified Soil Classification System, Tech. Memo. No 3-357, v. 1, Waterways Expt. Sta. Corps of Engin., March 1953 (*9*).

[6] Nonplastic.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

[Dashes indicate does not apply, or

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
AgA	Aldino silt loam, 0 to 3 percent slopes.	½–1	1½–2½	Moderately well drained to somewhat poorly drained silt loam or very stony silt loam, 1½ to 2½ feet thick; has a claypan at a depth of about 20 inches; underlain by serpentine rock; the very stony soil has boulders, 2 to 3 feet in diameter, on the surface and throughout the profile.	0–8 8–24 24–30
AgB2	Aldino silt loam, 3 to 8 percent slopes, moderately eroded.				
AsB2	Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded.				
BdA	Bedford silt loam, 0 to 3 percent slopes.	2–3	4–6	Moderately well drained silty clay loam, 4 to 6 feet thick; underlain by calciferous schist and marble.	0–11 11–52 52–70
BdB	Bedford silt loam, 3 to 8 percent slopes.	5+	4–6	Moderately well drained silt loam and silty clay loam, 4 to 6 feet thick; underlain by calciferous schist or marble.	0–8 8–40 40–60
BdB2	Bedford silt loam, 3 to 8 percent slopes, moderately eroded.				
BeA	Beltsville silt loam, 0 to 3 percent slopes.	1–2	6+	Moderately well drained silt loam and silty clay loam, 3 to 6 feet thick; underlain by consolidated coastal plain deposits of clay, silt, sand, and gravel that are 4 to 40 feet or more deep; a pan that is very slowly permeable is at a depth between 18 and 20 inches.	0–7 7–48 48+
BeB2	Beltsville silt loam, 3 to 8 percent slopes, moderately eroded.				
Bo	Bowmansville silt loam.	0–1½	3–6	Poorly drained materials of flood plains, 3 to 6 feet thick, washed from Triassic red sandstone and shale in the uplands; subject to periodic flooding; the water table is near the surface.	0–60
BrB2	Brandywine loam, 3 to 8 percent slopes, moderately eroded.	10+	3–4	Well-drained loam and silt loam, 1 to 2 feet thick; underlain by igneous and metamorphic rocks of the Piedmont Plateau; the stony soils have boulders, 1 to 2 feet in diameter, on the surface throughout the profile.	0–6 6–20 20–32
BrC	Brandywine loam, 8 to 15 percent slopes.				
BrC2	Brandywine loam, 8 to 15 percent slopes, moderately eroded.				
BrC3	Brandywine loam, 8 to 15 percent slopes, severely eroded.				
BrD	Brandywine loam, 15 to 25 percent slopes.				
BrD2	Brandywine loam, 15 to 25 percent slopes, moderately eroded.				
BrD3	Brandywine loam, 15 to 25 percent slopes, severely eroded.				
BrE	Brandywine loam, 25 to 40 percent slopes.				
BsB	Brandywine very stony loam, 0 to 8 percent slopes.				
BsD	Brandywine very stony loam, 8 to 25 percent slopes.				
BsF	Brandywine very stony loam, 25 to 50 percent slopes.				

See footnotes at end of table.

Counties, Pa., and their estimated physical properties [1]

information is not available]

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
					2. 0–6. 3	0. 25	5. 2			
CL	A–6	90–95	80–90	55–65	<0. 2	. 13	5. 4	15–30	70–110	Medium.
SM	A–7	80–90	70–85	35–40	<0. 2	. 08	5. 4	12–25	80–115	Low.
					0. 63–2. 0	. 28	6. 3			
CL	A–6	95	90	80	0. 63–2. 0	. 23	6. 4	20	105	Medium.
ML	A–7	85	80	75	0. 63–2. 0	. 25	6. 6	22	102	Low.
					0. 63–2. 0	. 29	6. 5			
ML–CL, MH		99	98	90	0. 63–2. 0	. 21	5. 8	20	105	Low.
ML–CL, ML		99	90	85	0. 63–2. 0	. 27	6. 0	22	102	Low.
					0. 63–2. 0	. 29	5. 0			
CL, ML–CL	A–4 to A–7	100	100	50–70	<0. 2	. 12	5. 4	10–15	116–125	Low to medium.
SC	A–6	100	100	45	0. 63–2. 0	. 08	5. 2	15	113	Low to medium.
CL	A–6	95	90	65	0. 63–2. 0	2. 0	5. 2	20	100	Medium.
					0. 63–2. 0	. 13	5. 0			
SC	A–2	85	75	25	0. 63–2. 0	. 10	4. 5	12	108	Low.
SM	A–2	70	60	20	2. 0–6. 3	. 08	4. 5	14	103	Low.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
BtB2	Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded.	5+	3–4	Well-drained channery silt loam and silty clay loam, 2 to 4 feet thick; underlain by metamorphosed shale, slate, and sandstone; the stony areas have numerous stones, 6 inches to 2 feet in diameter, on the surface and throughout the profile.	0–10 10–35 35–45
BtC2	Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded.				
BtC3	Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded.				
BtD2	Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded.				
BtD3	Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded.				
BtE3	Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded.				
BvB	Brecknock very stony silt loam, 0 to 8 percent slopes.				
BvD	Brecknock very stony silt loam, 8 to 25 percent slopes.				
BvF	Brecknock very stony silt loam, 25 to 50 percent slopes.				
BxB2	Bucks silt loam, 3 to 8 percent slopes, moderately eroded.	5+	3–5	Well-drained silt loam and silty clay loam, 3 to 5 feet thick; underlain by shale and fine-grained sandstone of uplands of the Piedmont Plateau.	0–9 9–46 46–60
ByA	Butlertown silt loam, 0 to 3 percent slopes.	2–2½	6+	Moderately well drained silt loam and silty clay loam, 3 to 6 feet thick; underlain by unconsolidated coastal plain deposits of clay, silt, sand, and gravel that are 4 to 40 feet or more deep.	0–8 8–48 48
ByB2	Butlertown silt loam, 3 to 8 percent slopes, moderately eroded.				
CaA	Calvert silt loam, 0 to 3 percent slopes.	0–1	3+	Poorly drained silt loam and silty clay loam, 3 to 5 feet thick; underlain by serpentine, pyroxenite, and hornblende of uplands of the Piedmont Plateau; in low areas and depressions.	0–8 8–46 46–60
CaB	Calvert silt loam, 3 to 8 percent slopes.				
CaB2	Calvert silt loam, 3 to 8 percent slopes, moderately eroded.				
CdA	Chester silt loam, 0 to 3 percent slopes.	5+	5–6	Well-drained silt loam and silty clay loam, 3 to 5 feet thick; underlain by micaceous loam; developed over schist and gneiss of the Piedmont Plateau; the very stony areas have boulders, ranging from 1 to 2 feet in diameter, on the surface and throughout the profile.	0–8 8–36 36–60
CdA2	Chester silt loam, 0 to 3 percent slopes, moderately eroded.				
CdB	Chester silt loam, 3 to 8 percent slopes.				
CdB2	Chester silt loam, 3 to 8 percent slopes, moderately eroded.				
CdB3	Chester silt loam, 3 to 8 percent slopes, severely eroded.				
CdC	Chester silt loam, 8 to 15 percent slopes.				
CdC2	Chester silt loam, 8 to 15 percent slopes, moderately eroded.				
CdC3	Chester silt loam, 8 to 15 percent slopes, severely eroded.				
CgB	Chester very stony silt loam, 0 to 8 percent slopes.				
CgC	Chester very stony silt loam, 8 to 15 percent slopes.				
Ch	Chewacla silt loam.	0–1	3–6	Moderately well drained material of flood plains, 3 to 6 feet thick; washed from uplands of the Piedmont Plateau; subject to periodic overflow.	0–60

See footnotes at end of table.

Counties, Pa., and their estimated physical properties [1]—Continued

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
-----	-----	-----	-----	-----	2. 0–6. 3	0. 26	5. 2	-----	-----	-----
ML, CL	A-4 to A-6	70–80	70–80	50–60	0. 63–2. 0	. 22	5. 4	13–17	108–114	Low.
ML, CL	A-4 to A-6	70–85	65–80	50–60	0. 63–2. 0	. 18	5. 2	15–18	108–113	Low.
-----	-----	-----	-----	-----	0. 63–2. 0	. 27	5. 6	-----	-----	-----
ML, ML–CL	A-4 to A-7	100	70–90	50–65	0. 63–2. 0	. 16	5. 2	14–18	114–116	Low to medium.
SM, ML	A-4	100	60–85	40–70	0. 2–6. 3	. 14	5. 0	16–19	104–107	Low.
-----	-----	-----	-----	-----	2. 0–6. 3	. 25	5. 2	-----	-----	-----
CL, ML–CL	A-4 to A-7	100	100	50–70	<0. 2	. 13	5. 4	10–15	116–125	Low to medium.
SC	A-6	100	100	45	0. 63–2. 0	. 16	5. 4	15	113	Low to medium.
-----	-----	-----	-----	-----	<0. 2	. 25	5. 0	-----	-----	-----
SM, MH	A-2 to A-7	55–100	55–99	35–80	0. 63–2. 0	. 16	5. 8	18–23	100–107	Low.
SM	A-2 to A-7	65–85	65–80	25–45	0. 63–2. 0	. 10	5. 8	21–23	100–104	Low.
-----	-----	-----	-----	-----	0. 63–2. 0	. 25	6. 5	-----	-----	-----
SM, SC	A-4 to A-6	70–100	70–100	40–50	0. 63–2. 0	. 12	5. 6	13–19	108–116	Low.
SM, ML–CL	A-2-4 to A-5	85–100	85–100	30–70	0. 63–2. 0	. 11	5. 6	13–23	100–110	Low.
CL	A-6	95	85	75	0. 63–2. 0	. 21	5. 4	15	110	Medium.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
CkB2	Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded.	5+	1–2½	Well-drained gravelly silty clay loam and silty clay loam, 1 to 2 feet thick; underlain by serpentine of uplands in the lower Piedmont Plateau; fragments of rock, from 1 to 3 inches in diameter, make up 50 percent or more, by volume, of the lower part of the profile in places.	0–7 7–15 15–30
CkC2	Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded.				
CkC3	Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded.				
CkD2	Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded.				
CkD3	Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded.				
CkE2	Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded.				
CmA	Conestoga silt loam, 0 to 3 percent slopes.	5+	4–6	Well-drained silt loam and silty clay, 4 to 6 feet thick; underlain by calciferous schist of uplands in the Piedmont Plateau.	0–8 8–40 40–60
CmA2	Conestoga silt loam, 0 to 3 percent slopes, moderately eroded.				
CmB2	Conestoga silt loam, 3 to 8 percent slopes, moderately eroded.				
CmC2	Conestoga silt loam, 8 to 15 percent slopes, moderately eroded.				
CmC3	Conestoga silt loam, 8 to 15 percent slopes, severely eroded.				
Cn	Congaree silt loam.	3+	3–6	Well-drained materials of flood plains, 3 to 6 feet thick; washed from uplands in the Piedmont Plateau; subject to occasional overflow.	0–60
CoA	Conowingo silt loam, 0 to 3 percent slopes.	1–2	3–4	Moderately well drained silt loam and silty clay loam, 3 to 4 feet thick; underlain by serpentine and hornblende of the lower Piedmont Plateau.	0–8 8–46 46–60
CoB2	Conowingo silt loam, 3 to 8 percent slopes, moderately eroded.				
CrA	Croton silt loam, 0 to 3 percent slopes.	0–½	3–5	Poorly drained silt loam and silty clay loam, 3 to 5 feet thick; underlain by Triassic shale and sandstone of the Piedmont Plateau.	0–9 9–38 38–60
CrB	Croton silt loam, 3 to 8 percent slopes.				
EcB	Edgemont channery loam, 3 to 8 percent slopes.	5+	2–6	Well-drained channery loam and silt loam, 2 to 6 feet thick; underlain by quartzite of the Piedmont Plateau; the stony soils have large amounts of quartzite on the surface and throughout the profile that range from 3 to 6 feet in diameter; on the steeper slopes there are rock outcrops.	0–9 9–25 25–50
EcB2	Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.				
EcC	Edgemont channery loam, 8 to 15 percent slopes.				
EcC2	Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.				
EcC3	Edgemont channery loam, 8 to 15 percent slopes, severely eroded.				
EcD	Edgemont channery loam, 15 to 25 percent slopes.				
EcD2	Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.				
EcD3	Edgemont channery loam, 15 to 25 percent slopes, severely eroded.				
EcE	Edgemont channery loam, 25 to 35 percent slopes.				
EcE2	Edgemont channery loam, 25 to 35 percent slopes, moderately eroded.				
EdB	Edgemont very stony loam, 0 to 8 percent slopes.				
EdD	Edgemont very stony loam, 8 to 25 percent slopes.				
EdF	Edgemont very stony loam, 25 to 60 percent slopes.				

See footnotes at end of table.

Counties, Pa., and their estimated physical properties [1]—Continued

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
					0. 63–2. 0	0. 21	5. 8			
GM, ML, MH	A–2–4 to A–7–5.	55–100	55–99	35–80	0. 63–2. 0	. 21	5. 8	16–55	57–117	Medium.
SM, GM	A–2–4 to A–7–5.	65–85	65–80	25–45	0. 63–2. 0	. 07	5. 8	14–41	69–122	Low.
					0. 63–2. 0	. 27	6. 0			
ML–CL, MH	A–7	99–100	98–99	85–90	0. 63–2. 0	. 23	6. 5	18–23	100–107	Medium.
ML, ML–CL	A–7	99	90–98	80–85	0. 63–2. 0	. 17	6. 5	21–23	100–104	Medium.
CL	A–6	95	85	75	0. 63–2. 0	. 23	5. 4	15	110	Medium.
					0. 63–2. 0	. 25	5. 0			
GM, SM, MH	A–2 to A–7	55–100	60–99	35–80	0. 63–2. 0	. 16	5. 8	18–23	100–107	Low.
SM	A–2 to A–7	65–85	65–80	25–45	0. 63–2. 0	. 11	5. 8	21–23	100–104	Low.
					0. 63–2. 0	. 23	5. 6			
CH, CL	A–6 to A–7	99	98	65–98	<0. 2	. 14	5. 4	14–21	101–111	High.
CL, SM, SC	A–6	95–100	85–100	30–85	<0. 2	. 12	5. 0	12–17	109–122	Medium.
					2. 0–6. 3	. 18	5. 0			
SM	A–2	80–85	70–75	25–30	0. 63–2. 0	. 17	5. 4	9–11	122–124	Low.
SM	A–1 to A–2	75–80	65–70	20–25	0. 63–2. 0	. 16	5. 8	10	121–122	Low.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
GeA	Glenelg channery silt loam, 0 to 3 percent slopes.	5+	3–5	Well-drained channery silt loam and silty clay loam, 2 to 3 feet thick; underlain by schist, gneiss, gabbro, and granite of uplands in the Piedmont Plateau; the stony soils have cobbles and stones, 6 inches to 2 feet in diameter, on the surface and throughout the profile.	0–8 8–26 26–42
GeA2	Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded.				
GeB	Glenelg channery silt loam, 3 to 8 percent slopes.				
GeB2	Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded.				
GeB3	Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded.				
GeC	Glenelg channery silt loam, 8 to 15 percent slopes.				
GeC2	Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded.				
GeC3	Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded.				
GeD	Glenelg channery silt loam, 15 to 25 percent slopes.				
GeD2	Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded.				
GeD3	Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded.				
GeE	Glenelg channery silt loam, 25 to 35 percent slopes.				
GeE3	Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded.				
GgA3	Glenelg silt loam, 0 to 3 percent slopes, severely eroded.				
GgB3	Glenelg silt loam, 3 to 8 percent slopes, severely eroded.				
GmD	Glenelg very stony silt loam, 15 to 25 percent slopes.				
GmE	Glenelg very stony silt loam, 25 to 35 percent slopes.				
GnA	Glenville silt loam, 0 to 3 percent slopes.	1–1½	3–6	Moderately well drained silt loam and silty clay loam, 3 to 5 feet thick; underlain by schist, gneiss, gabbro, quartzite, and granite of uplands of the Piedmont Plateau; the stony soil has cobbles and stones, 3 inches to 3 feet in diameter, on the surface and throughout the profile.	0–10 10–50 50–72
GnB	Glenville silt loam, 3 to 8 percent slopes.				
GnB2	Glenville silt loam, 3 to 8 percent slopes, moderately eroded.				
GnC2	Glenville silt loam, 8 to 15 percent slopes, moderately eroded.				
GsB	Glenville very stony silt loam, 0 to 8 percent slopes.				
Gu	Guthrie silt loam.	0–½	3–5	Poorly drained silt loam and silty clay loam, 3 to 5 feet thick; underlain by limestone; in low areas and depressions.	0–8 8–34 34–50
HaA2	Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded.	5+	4–6	Silt loam and silty clay loam, 4 to 6 feet thick; underlain by limestone, generally dolomite; bedrock in places is as deep as 10 feet.	0–8 8–53 53–72
HaB2	Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded.				
HaC2	Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded.				
HaC3	Hagerstown silt loam, 8 to 15 percent slopes, severely eroded.				

See footnotes at end of table.

Counties, Pa., and their estimated physical properties [1]—Continued

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
SM, GM, ML	A-2-4 to A-4	65–95	60–95	30–55	0. 63–2. 0	0. 25	6. 0			
SM	A-4	90–95	80–95	40–45	0. 63–2. 0	. 21	5. 4	12–16	115–118	Low.
					0. 63–2. 0	. 11	5. 2	13–16	113–117	Low.
ML, ML–CL	A-4	75–95	75–95	50–90	0. 63–2. 0	. 25	5. 4			
MH	A-4	80–95	75–95	55–80	0. 63–2. 0	. 21	4. 8	16–19	104–107	Low.
						. 11	4. 8	14–16	111–116	Low.
CL	A-4	100	90–100	85–90	0. 2–0. 63	. 28	5. 4			
CL	A-6 to A-7	95–100	85–100	75–90	<0. 2	. 15	6. 0	14–15	110–115	Medium.
					<0. 2	. 13	6. 6	14–20	110–115	Medium.
CL	A-6 to A-7	95–100	85–95	80–95	0. 63–2. 0	. 30	6. 5			
					0. 63–2. 0	. 21	6. 6	16–25	96–113	Medium to high.
CL, ML	A-7	95–100	80–90	75–90	0. 63–2. 0	. 16	6. 4	20–26	92–106	Medium.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
HoB2	Hollinger silt loam, 3 to 8 percent slopes, moderately eroded.	5+	2–6	Well-drained silt loam and loam, 1 to 2 feet thick; underlain by calciferous schist that in places is loose and weathered to a depth of 5 or 6 feet.	0–7 7–21 21–50
HoC2	Hollinger silt loam, 8 to 15 percent slopes, moderately eroded.				
HoC3	Hollinger silt loam, 8 to 15 percent slopes, severely eroded.				
HoD3	Hollinger silt loam, 15 to 25 percent slopes, severely eroded.				
HoE3	Hollinger silt loam, 25 to 35 percent slopes, severely eroded.				
LaA	Lawrence silt loam, 0 to 3 percent slopes.	1–2	4–6	Somewhat poorly drained silt loam and silty clay loam, 4 to 6 feet thick; underlain by calciferous schist and marble.	0–8 8–58 58–70
LaB	Lawrence silt loam, 3 to 8 percent slopes.				
LeB	Lehigh silt loam, 3 to 8 percent slopes.	1–2	2–4	Moderately well drained to somewhat poorly drained silt loam and silty clay loam, 2 to 4 feet thick; underlain by metamorphosed Triassic shale and sandstone; the stony soils have varying amounts of rock fragments, 3 inches to 4 feet in diameter, on the surface and throughout the profile.	0–9 9–30 30–40
LeB2	Lehigh silt loam, 3 to 8 percent slopes, moderately eroded.				
LeC3	Lehigh silt loam, 8 to 15 percent slopes, severely eroded.				
LhB	Lehigh very stony silt loam, 0 to 8 percent slopes.				
LhD	Lehigh very stony silt loam, 8 to 25 percent slopes.				
Ls	Lindside silt loam.	0–1	3–6	Moderately well drained to somewhat poorly drained alluvial materials, 3 to 6 feet thick; washed from limestone uplands; subject to occasional overflow; water table at a depth between 5 and 6 feet.	0–9 9–50 50–72
Ma	Made land, gravelly materials.	3+	4+	Well drained to moderately well drained, mixed coastal plain materials, 3 to 8 feet thick; underlain by unconsolidated coastal plain deposits of clay, silt, sand, and gravel ranging from 4 to 40 feet or more in thickness.	(6)
Mc	Made land, silt and clay materials.				
Md	Made land, gabbro and diabase materials.				
Me	Made land, schist and gneiss materials.				
Mf	Made land, sanitary land fill.				
MgA2	Manor loam, 0 to 3 percent slopes, moderately eroded.	5+	2–7	Well-drained loam, very fine sandy loam, and saprolite, 2 to 7 feet thick; underlain by schist, gneiss, and granite of uplands of the Piedmont Plateau; the channery and stony soils have varying amounts of fragmented rock, from 1 inch to 2 feet in diameter, on the surface and throughout the profile.	0–7 7–21 21–50
MgB2	Manor loam, 3 to 8 percent slopes, moderately eroded.				
MgB3	Manor loam, 3 to 8 percent slopes, severely eroded.				
MgC	Manor loam, 8 to 15 percent slopes.				
MgC2	Manor loam, 8 to 15 percent slopes, moderately eroded.				
MgC3	Manor loam, 8 to 15 percent slopes, severely eroded.				
MgD	Manor loam, 15 to 25 percent slopes.				
MgD2	Manor loam, 15 to 25 percent slopes, moderately eroded.				
MgD3	Manor loam, 15 to 25 percent slopes, severely eroded.				
MhE	Manor loam and channery loam, 25 to 35 percent slopes.				
MhE3	Manor loam and channery loam, 25 to 35 percent slopes, severely eroded.				
MkF	Manor soils, 35 to 60 percent slopes.				
MmB	Manor very stony loam, 0 to 8 percent slopes.				
MmD	Manor very stony loam, 8 to 25 percent slopes.				
MmF	Manor very stony loam, 25 to 60 percent slopes.				

See footnotes at end of table.

Counties, Pa., and their estimated physical properties [1]—Continued

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
GM, SM, GP-GM.	A-1 to A-6	35–80	30–80	10–40	2. 0–6. 3 0. 63–2. 0	0. 21 . 14	6. 0 6. 2	15–18	108–112	Low.
GM, SM	A-2 to A-5	65–90	60–85	20–35	0. 63–2. 0	. 07	6. 4	16–18	105–110	Low.
ML-CL	A-6	100	98	90	0. 63–2. 0 0. 2–0. 63	. 25 . 12	7. 0 6. 0	17	105	Medium.
CL	A-6	100	95	85	0. 2–0. 63	. 18	5. 0	20	105	Medium.
CL, ML, GM	A-2 to A-6	30–95	30–95	25–85	0. 63–2. 0 <0. 2	. 22 . 19	6. 0 5. 4	17–19	100–110	Low.
GM-GC, ML, CL.	A-2 to A-6	40–65	35–65	30–55	<0. 2	. 12	5. 2	17–21	102–108	Low.
ML	A-4	100	90–100	70–80	0. 63–2. 0 0. 63–2. 0	. 28 . 23	6. 0 5. 8	17–19	105–110	Low.
CL	A-6	90–100	90–100	60–80	0. 63–2. 0	(5)	5. 2	17–19	105–110	Medium.
GM, SM, GP-GM.	A-1 to A-6	35–80	30–80	10–40	2. 0–6. 3 0. 63–2. 0	. 21 . 17	5. 0 5. 4	15–18	108–112	Low.
GM, SM	A-2 to A-5	65–90	60–85	20–40	0. 63–2. 0	. 11	5. 6	16–18	105–110	Low.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
Mn	Melvin silt loam.	0–½	4–7	Poorly drained silt loam and silty clay loam, 3 to 7 feet thick, that contains quartz pebbles and fragments of schist; derived from alluvial materials; subject to overflow; water table is at a depth between 2 and 5 feet.	0–24 24–60
MoB2	Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded.	5+	3–5	Channery silt loam and silty clay loam, 3 to 5 feet thick; underlain by diabase; the stony soils have diabase boulders, as much as 8 feet in diameter, on the surface and throughout the profile.	0–8 8–40 40–56
MoC2	Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded.				
MoC3	Montalto channery silt loam, 8 to 15 percent slopes, severely eroded.				
MoD3	Montalto channery silt loam, 15 to 25 percent slopes, severely eroded.				
MrB	Montalto very stony silt loam, 0 to 8 percent slopes.				
MrD	Montalto very stony silt loam, 8 to 25 percent slopes.				
MrF	Montalto very stony silt loam, 25 to 45 percent slopes.				
MsB	Mount Lucas very stony silt loam, 0 to 8 percent slopes.	1–2	3–5	Moderately well drained to somewhat poorly drained silt loam and silty clay loam, 3 to 6 feet thick; underlain by diabase; large boulders up to 8 feet in diameter, are on the surface and throughout the profile.	0–7 7–40 40–50
NaA	Neshaminy gravelly silt loam, 0 to 3 percent slopes.	5+	4–6	Well-drained gravelly silt loam and silty clay loam, 3 to 4 feet thick; underlain by gabbro and granodiorite of uplands in the lower Piedmont Plateau; the stony soils have cobbles and stones, from 3 inches to 3 feet in diameter, on the surface and throughout the profile.	0–8 8–37 37–54
NaB2	Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded.				
NaC2	Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded.				
NaC3	Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded.				
NaD	Neshaminy gravelly silt loam, 15 to 25 percent slopes.				
NaD3	Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded.				
NsB	Neshaminy very stony silt loam, 0 to 8 percent slopes.				
NsD	Neshaminy very stony silt loam, 8 to 25 percent slopes.				
NsF	Neshaminy very stony silt loam, 25 to 45 percent slopes.				
OtA	Othello silt loam.	0–1	4+	Poorly drained silt loam and fine sand, 3 to 6 feet thick; underlain by unconsolidated sandy and gravelly coastal plain deposits that are as much as 25 feet in depth.	0–12 12–30 30–60
PeB3	Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded.	5+	1	Well-drained shaly silt loam, 1 foot thick; underlain by Triassic shale and fine-grained sandstone of uplands in the Piedmont Plateau; there are numerous chips of shale throughout the profile.	0–12
PeC3	Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded.				
PeD3	Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded.				

See footnotes at end of table.

Counties, Pa., and their estimated physical properties [1]—Continued

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
CL	A-6	100	95	70–80	0. 63–2. 0	0. 25	6. 6	14	110	Medium.
ML–CL	A-4	90–95	85–95	60–70	<0. 2	(5)	6. 8	12	114	Low.
					0. 63–2. 0	. 27	6. 2			
MH	A-7	97	95–100	90–95	0. 63–2. 0	. 23	5. 2	26–27	94	Medium.
MH	A-7	98	95–100	90–95	0. 63–2. 0	. 13	5. 8	29–31	85–89	Medium
					0. 63–2. 0	. 28	5. 4			
MH	A-7	75	70	65	0. 2–0. 63	. 18	6. 0	25	95	Medium.
MH	A-7	70	65	60	0. 2–0. 63	. 15	6. 8	30	90	Medium.
					2. 0–6. 3	. 27	6. 0			
ML, ML–CL	A-4 to A-7-6	95–99	90–95	55–80	0. 63–2. 0	. 20	6. 6	15–24	101–110	Medium.
SM, MH, ML	A-2-4 to A-7-5	80–95	80–100	35–80	0. 63–2. 0	. 12	6. 8	13–39	80–116	Medium.
					0. 63–2. 0	. 17	5. 0			
CL	A-4	100	100	70	0. 63–2. 0	. 11	5. 0	13	115	Low.
SC	A-2	100	100	35	2. 0–6. 3	. 07	5. 0	12	112	Low.
SM	A-2	75	50	30	0. 63–2. 0	. 17	5. 5	12–18	110	Low.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
PmB2	Penn silt loam, 3 to 8 percent slopes, moderately eroded.	5+	2–4	Well-drained silt loam to silty clay loam, 2 to 3 feet thick; underlain by Triassic shale and fine-textured sandstone of uplands in the Piedmont Plateau; the stony soils have fragments of sandstone that range from 1 inch to 2 feet in diameter on the surface and throughout the profile.	0–8 8–24 24–38
PmC2	Penn silt loam, 8 to 15 percent slopes, moderately eroded.				
PmC3	Penn silt loam, 8 to 15 percent slopes, severely eroded.				
PmD	Penn silt loam, 15 to 25 percent slopes.				
PmD2	Penn silt loam, 15 to 25 percent slopes, moderately eroded.				
PnB	Penn very stony silt loam, 0 to 8 percent slopes.				
PnD	Penn very stony silt loam, 8 to 25 percent slopes.				
PnF	Penn very stony silt loam, 25 to 50 percent slopes.				
PsE2	Penn soils, 25 to 35 percent slopes, moderately eroded.				
PsE3	Penn soils, 25 to 35 percent slopes, severely eroded.				
PsF	Penn soils, 35 to 50 percent slopes.				
PtB2	Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded.				
PtC2	Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded.				
PtC3	Penn and Lansdale sandy loams, 8 to 15 percent slopes, severely eroded.				
PtD2	Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded.				
RdA	Readington silt loam, 0 to 3 percent slopes.	1+	2–5	Moderately well drained silt loam to silty clay loam, 2 to 5 feet thick; underlain by Triassic shale and fine-grained sandstone of uplands in the Piedmont Plateau.	0–8 8–38 38–60
RdB	Readington silt loam, 3 to 8 percent slopes.				
RdB2	Readington silt loam, 3 to 8 percent slopes, moderately eroded.				
Ro	Rowland silt loam.	0–2	4–5	Moderately well drained stream deposits, 4 to 5 feet thick; washed from Triassic red shale and sandstone of uplands.	0–60
Rp	Rowland silt loam, dark surface.	0–3	3–15	Moderately well drained, mixed alluvial deposits, 3 to 10 feet thick; there are large amounts of coal screenings in the uppermost 2 feet; subject to periodic overflow.	0–60
SaA	Sassafras loam, 0 to 3 percent slopes.	5+	6+	Well-drained loam, silty clay loam, and coarse sandy loam, 3 to 6 feet thick; underlain by unconsolidated coastal plain deposits of silt, clay, sand, and gravel that are 4 to 40 or more feet thick.	0–9 9–55 55–63
SaB2	Sassafras loam, 3 to 8 percent slopes, moderately eroded.				
Tm	Tidal marsh.	0	----------	Mixture of silty clay and clay subject to tidal overflow and frequently under water; underlain by unconsolidated coastal plain deposits.	----------
WaA	Watchung silt loam, 0 to 3 percent slopes.	0–1	3–4½	Poorly drained silt loam and silty clay loam to clay loam, 3 to 4 feet thick; underlain by diabase; the stony soil has diabase boulders up to 8 feet in diameter on the surface.	0–9 9–38 38–50
WaB2	Watchung silt loam, 3 to 8 percent slopes, moderately eroded.				
WcB	Watchung very stony silt loam, 0 to 8 percent slopes.				
We	Wehadkee silt loam.	0–1	5–8	Poorly drained silt loam, silty clay loam, stratified sands, and mixed flood plain materials, 5 to 8 feet thick; washed from schist and gneiss of uplands; subject to frequent overflow.	0–70

See footnotes at end of table.

Counties, Pa., and their estimated physical properties [1]—Continued

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
ML, CL–ML	A–4	75–100	65–99	50–60	2. 0–6. 3 0. 63–2. 0	0. 27 . 18	6. 0 5. 6	12–18	106–122	Low.
ML, CL	A–4	75–100	65–100	50–75	0. 63–2. 0	. 08	5. 2	10–18	107–122	Low.
					0. 63–2. 0	. 26	5. 6			
ML–CL, CL	A–4 to A–7	95–100	90–100	75–95	0. 2–0. 63	. 18	5. 0	16–20	103–110	Low to medium.
CL, SM, ML–CL.	A–2 to A–7	85–95	80–95	30–70	<0. 2	. 07	5. 0	11–21	100–121	Low to medium.
ML	A–7	95	80	60	0. 63–2. 0	. 23	5. 4	12	105	Medium.
CL	A–6	95	90	60	0. 63–2. 0	. 23	5. 2	18	115	Low.
					2. 0–6. 3	. 17	5. 0			
MH, SM, ML	A–4 to A–7–5	98	85–95	40–75	0. 63–2. 0	. 17	5. 8	10–23	99–123	Low.
SM	A–1–b to A–2–5	90–95	80–90	10–30	>6. 3	. 13	5. 9	10–25	95–115	Low.
					0. 63–2. 0	. 23	5. 2			
MH	A–7	85	75	60	<0. 2	. 18	6. 4	20	102	Medium.
MH	A–7	75	65	55	<0. 2	. 15	6. 6	22	100	Medium.
ML	A–7	100	90	80	0. 63–2. 0	. 21	4. 5	20	100	Low.

TABLE 6.—*Brief description of the soils of Chester and Delaware*

Symbol on map	Soil name	Depth to seasonally high water table	Depth to bedrock	Brief description of soil	Depth from surface
		Feet	*Feet*		*Inches*
WnA	Woodstown loam, 0 to 3 percent slopes.	2–3	10+	Moderately well drained silty clay loam, 3 to 4 feet thick; underlain by unconsolidated coastal plain sand and gravel that in places is 15 to 20 feet deep.	0–10 10–45 45–60
WoA	Worsham silt loam, 0 to 3 percent slopes.	0–1	3–5	Poorly drained silt loam and clay loam, 3 to 5 feet thick; underlain by schist and gneiss of the Piedmont Plateau; the stony soil has cobbles and stones that range from 3 inches to 3 feet in diameter on the surface and throughout the profile.	0–9 9–56 56–72
WoB	Worsham silt loam, 3 to 8 percent slopes.				
WoB2	Worsham silt loam, 3 to 8 percent slopes, moderately eroded.				
WoC2	Worsham silt loam, 8 to 15 percent slopes, moderately eroded.				
WsB	Worsham very stony silt loam, 0 to 8 percent slopes.				

[1] Properties given for Brecknock, Chester, Chrome, Glenelg, Glenville, Neshaminy, Penn, and Sassafras series are based on analyses made by Pennsylvania Department of Highways; others are estimates interpolated from this data and test data from other counties.

[2] The available moisture capacity in inches per inch of soil depth is an approximation of the capillary water in the soil when wet to field capacity. When the soil is "air dry," this amount of water will wet the soil material described to a depth of 1 inch without deeper percolation.

TABLE 7.—*Suitability and characteristics of the soils of*

[The characteristics listed are those that cause difficulty in the stated kind of construction.

Soil series and map symbols	Suitability for winter grading	Resistance to frost action	Suitability of material for—		Suitability as source of—		Characteristics that affect—	
			Road subgrade	Road fill	Topsoil	Sand and gravel	Vertical alinement for highways	
							Materials [1]	Drainage
Aldino (AgA, AgB2, AsB2)	Poor	Poor	Poor to fair.	Poor	Fair	Unsuitable	Instability	Seasonal high water table.
Bedford (BdA, BdB, BdB2)	Fair	Fair	Fair	Good	Good	Poor		
Beltsville (BeA, BeB2)	Fair	Fair	Poor to fair.	Fair	Good	Variable	Claypan	Claypan
Bowmansville (Bo)	Poor	Poor	Poor to fair.	Poor	Fair	Unsuitable	Instability	Seasonal high water table.
Brandywine (BrB2, BrC, BrC2, BrC3, BrD, BrD2, BrD3, BrE, BsB, BsD, BsF).	Good	Fair	Good	Good	Fair	Unsuitable		
Brecknock (BtB2, BtC2, BtC3, BtD2, BtD3, BtE3, BvB, BvD, BvF).	Fair	Fair	Poor to fair.	Fair	Fair	Unsuitable		
Bucks (BxB2)	Fair	Fair	Poor to fair.	Fair	Good	Unsuitable		
Butlertown (ByA, ByB2)	Fair	Poor	Poor to fair.	Poor	Good	Variable	Claypan	
Calvert (CaA, CaB, CaB2)	Poor	Poor	Poor	Poor	Fair	Unsuitable	Instability	Seasonal high water table.
Chester (CdA, CdA2, CdB, CdB2, CdB3, CdC, CdC2, CdC3, CgB, CgC).	Good	Poor	Fair	Fair	Good	Unsuitable		

See footnote at end of table.

Counties, Pa., and their estimated physical properties [1]—Continued

Classification		Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Optimum moisture for compaction [3]	Maximum dry density [3]	Shrink-swell potential [4]
Unified	AASHO	No. 4	No. 10	No. 200						
					Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*	
ML	A-7	95	85	65	2. 0–6. 3	0. 15	6. 2			
CL–ML	A-4	90	80	55	0. 63–2. 0	. 21	5. 5	15–20	108	Low.
					>6. 3	. 07	5. 2	14–21	105	Low.
MH	A-7	90–100	85–95	80–90	0. 2–0. 63	. 22	5. 8			
ML	A-7-5	90–100	65–75	60–70	<0. 2	. 18	5. 2	15–20	105	Low.
					<0. 2	. 08	5. 0	12–18	112	Low.

[3] Estimates are based on AASHO Designation T 99–57, Method A, in which only the material passing the No. 4 sieve is considered. For those soils containing material larger than that passing a No. 4 sieve, the optimum moisture will be lower and the maximum dry density higher than these estimated values.

[4] In general, soil classified as CH and A–7 have high shrink-swell potential. Clean sand and gravel (single grain) and soil material that has small amounts of nonplastic to slightly plastic fines, as well as most other nonplastic to slightly plastic soil materials, have low shrink-swell potential.

[5] Free water.

[6] Variable.

Chester and Delaware Counties for engineering construction

Dashes indicate the soil generally has no special characteristics that interfere with the stated use]

Characteristics that affect—Continued		Characteristics that affect suitability for—								
Infiltration of waste from septic tanks	Construction and maintenance of pipelines	Dikes and levees	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Building sites
			Reservoir area	Embankment					
Slowly permeable.	Shallow soil.	----------	Shallow soil.	Lacks binder.	Heavy subsoil.	Shallow soil.	Shallow soil.	Shallow soil.	Wetness.
Claypan	Fluctuating water table.	Instability	Claypan	Claypan	Restrictive claypan.	Claypan	Claypan	Claypan	Claypan.
High water table.	High water table.	Instability	Instability	Instability	Flooding	Poor drainage; slow permeability.	Flooding	Flooding	Flooding.
----------	Shallow soil.	----------	Rapid permeability.	Rapid permeability.	----------	Shallow soil.	Shallow soil.	Shallow soil.	----------
Hardpan	Shallow soil.	----------	Permeable substratum.	Permeability.	----------	Stones	Shallow soil.	Hardpan	----------
Substratum drainage.	----------	----------	Permeable substratum.	Instability	Claypan	Claypan	Claypan	Claypan	Substratum drainage.
Seasonal high water table.	High water table.	Instability	Instability	Instability	Slowly permeable.	Wetness	High water table.	Claypan	Substratum drainage.
----------	----------	Instability	Permeable substratum.	Permeability.	Not needed.	----------	----------	----------	----------

TABLE 7.—*Suitability and characteristics of the soils of Chester*

Soil series and map symbols	Suitability for winter grading	Resistance to frost action	Suitability of material for—		Suitability as source of—		Characteristics that affect—	
			Road subgrade	Road fill	Topsoil	Sand and gravel	Vertical alinement for highways	
							Materials [1]	Drainage
Chewacla (Ch)	Fair	Fair	Poor to fair.	Fair	Good	Unsuitable		Seasonal high water table.
Chrome (CkB2, CkC2, CkC3, CkD2, CkD3, CkE2).	Fair	Poor	Poor	Poor	Fair	Unsuitable	Instability	
Conestoga (CmA, CmA2, CmB2, CmC2, CmC3).	Fair	Fair	Fair	Fair	Good	Unsuitable		
Congaree (Cn)	Fair	Fair	Fair	Fair	Good	Unsuitable		Flooding
Conowingo (CoA, CoB2)	Fair	Fair	Fair	Fair	Fair	Unsuitable	Claypan	Seasonal high water table.
Croton (CrA, CrB)	Poor	Fair	Poor to fair.	Poor	Fair	Unsuitable	Plastic soil material.	Seasonal high water table.
Edgemont (EcB, EcB2, EcC, EcC2, EcC3, EcD, EcD2, EcD3, EcE, EcE2, EdB, EdD, EdF).	Good	Fair	Fair to good.	Poor	Fair	Fair for sand.	Stones; slopes.	
Glenelg (GeA, GeA2, GeB, GeB2, GeC, GeC2, GeD, GeD2, GeE, GmD, GmE).	Good	Fair	Fair to good.	Fair to good.	Good	Unsuitable		
Glenelg, severely eroded (GeB3, GeC3, GeD3, GeE3, GgA3, GgB3).	Fair	Fair	Fair	Fair to good.	Very poor.	Unsuitable		
Glenville (GnA, GnB, GnB2, GnC2, GsB).	Fair	Poor	Poor to fair.	Poor	Good	Unsuitable		Seasonal high water table.
Guthrie (Gu)	Poor	Fair	Fair	Poor	Fair	Unsuitable	Weak pan	Seasonal high water table.
Hagerstown (HaA2, HaB2, HaC2, HaC3).	Fair	Fair	Good	Fair	Good	Unsuitable		
Hollinger (HoB2, HoC2, HoC3, HoD3, HoE3).	Good	Fair	Good	Fair to good.	Good	Unsuitable	Shallow soil.	
Lawrence (LaA, LaB)	Fair	Poor	Fair	Fair	Fair	Unsuitable	Weak pan	Seasonal high water table.
Lehigh (LeB, LeB2, LeC3, LhB, LhD).	Fair	Fair	Fair	Fair	Fair	Unsuitable	Claypan	Seasonal high water table.
Lindside (Ls)	Fair to poor.	Poor	Fair	Poor to fair.	Good	Unsuitable		High water table.
Made land (Ma, Mc, Md, Me)	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable
Made land (Mf)	Poor	Variable	Poor	Poor	Poor	Unsuitable	Unsuitable	
Manor(MgA2, MgB2, MgB3, MgC, MgC2, MgC3, MgD, MgD2, MgD3, MhE, MhE3, MkF, MmB, MmD, MmF).	Good	Fair	Good	Good	Fair	Unsuitable	Instability	
Melvin (Mn)	Poor	Poor	Poor	Fair	Fair	Unsuitable		Seasonal high water table and flooding.

See footnote at end of table.

and Delaware Counties for engineering construction—Continued

Characteristics that affect—Continued		Characteristics that affect suitability for—							
			Farm ponds						
Infiltration of waste from septic tanks	Construction and maintenance of pipelines	Dikes and levees	Reservoir area	Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Building sites
Flooding	Flooding		Flooding	Flooding	Seasonal high water table.	Flooding	Flooding	Difficult to obtain outlets.	Flooding.
Shallow soil.	Shallow soil.	Shallow to bedrock.	Shallow soil.	Instability		Shallow soil.	Shallow, stony soils.	Shallow soil.	Shallow soil.
		Permeability.	Rapid permeability.	Rapid permeability.					
Flooding	Flooding	Variable	Flooding	Flooding		Flooding	Flooding	Flooding	Flooding.
					Slow permeability.	Slow permeability.			Seasonal high water table.
High water table.	High water table.	Instability	Instability	Instability	High water table; seeps.	Wetness	High water water table.	High water table.	Wetness.
Shallow soil.	Shallow soil.	Rapid permeability.	Permeable substratum.	Permeability.		Shallow soil.	Shallow soil.		
		Rapid permeability.	Permeable substratum.	Permeability.					
Shallow soil.		Rapid permeability.	Permeable substratum.	Permeability.		Low water-holding capacity.	Shallow soil.	Highly erodible.	
Claypan	Fluctuating water table.	Instability	Variable substratum.		High water table; seeps.	Restricted drainage.			Seasonal high water table.
Seasonal high water table.	Fluctuating water table.	Instability		Instability	Weak claypan.	Slow permeability.	High water table.	High water table.	Wetness.
Shallow soil.	Bedrock; stones.	Rapid permeability.	Shallow soil.	Shallow soil.		Shallow soil.	Shallow soil.	Shallow soil.	Bedrock.
Seasonal high water table.	Fluctuating water table.	Instability		Instability	Weak claypan.	Slow permeability.	High water table.	Weak claypan.	Wetness.
Permeability of subsoil.	Wetness	Instability	Shallow soil.	Shallow soil.	Impermeable substratum.	Slow permeability.	Hardpan	Weak claypan.	Hardpan; stones.
Flooding	High water table.	Permeability.	Unsuitable; flooding.	Flooding	Flooding; not enough slope.	Slow permeability.	High water table.	Flooding	Flooding.
Variable Instability	Variable Unsuitable	Variable Unsuitable	Variable Unsuitable	Variable Unsuitable	Variable Variable	Variable Unsuitable	Variable Unsuitable	Variable Unsuitable	Variable. Instability.
		Instability	Permeable substratum.	Instability				Shallow soil.	
Flooding	Flooding	Variable	Flooding	Flooding	Flooding	High water table.	High water table.	Flooding	Flooding.

TABLE 7.—*Suitability and characteristics of the soils of Chester*

Soil series and map symbols	Suitability for winter grading	Resistance to frost action	Suitability of material for—		Suitability as source of—		Characteristics that affect—	
			Road subgrade	Road fill	Topsoil	Sand and gravel	Vertical alinement for highways	
							Materials [1]	Drainage
Montalto (MoB2, MoC2, MoC3, MoD3, MrB, MrD, MrF).	Poor to fair.	Fair	Fair	Fair	Fair	Unsuitable	Stones	
Mount Lucas (MsB)	Fair to poor.	Poor	Fair	Fair	Fair	Unsuitable		Seasonal high water table.
Neshaminy (NaA, NaB2, NaC2, NaC3, NaD, NaD3, NsB, NsD, NsF).	Good	Fair	Good	Fair to good.	Fair	Unsuitable		
Othello (OtA)	Poor	Poor to fair.	Fair	Fair to good.	Fair	Variable		Occasional high water table.
Penn shaly silt loam (PeB3, PeC3, PeD3).	Good	Fair	Good	Fair	Poor	Poor		
Penn silt loam (PmB2, PmC2, PmC3, PmD, PmD2, PnB, PnD, PnF).	Fair	Fair	Fair to good.	Good	Fair	Poor		
Penn soils (PsE2, PsE3, PsF)	Good	Fair	Good	Good	Fair	Poor		
Penn and Lansdale (PtB2, PtC2, PtC3, PtD2).	Good	Fair	Good	Good	Fair	Fair		
Readington (RdA, RdB, RdB2)	Poor to fair.	Poor to fair.	Poor to fair.	Fair	Fair	Poor	Instability	Seasonal high water table.
Rowland (Ro)	Poor	Poor	Fair	Fair to good.	Fair	Fair	Instability	Flooding
Rowland, dark surface (Rp)	Poor	Fair	Poor to fair.	Fair	Poor	Fair	Instability	Flooding
Sassafras (SaA, SaB2)	Good	Fair to good.	Good	Good	Good	Fair to good.		
Tidal marsh (Tm)	Poor	Poor	Unsuitable.	Unsuitable.	Poor	Unsuitable	Marsh	High water table.
Watchung (WaA, WaB2, WcB)	Poor	Poor	Poor	Poor	Poor	Unsuitable	Instability	High water table.
Wehadkee (We)	Poor	Poor	Poor to fair.	Poor to fair.	Fair	Poor	Instability	High water table; flooding.
Woodstown (WnA)	Poor to fair.	Poor	Fair	Fair	Fair	Fair	Instability	Seasonal high water table.
Worsham (WoA, WoB, WoB2, WoC2, WsB).	Poor	Poor	Poor	Poor	Fair	Poor	Instability	High water table; seeps.

[1] Except for Beltsville, Butlertown, Made land, Othello, Rowland, Sassafras, Tidal marsh, and Woodstown, the soils are shallow to bedrock.

and Delaware Counties for engineering construction—Continued

Characteristics that affect—Continued		Characteristics that affect suitability for—							
			Farm ponds						
Infiltration of waste from septic tanks	Construction and maintenance of pipelines	Dikes and levees	Reservoir area	Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Building sites
Permeability of subsoil.									
Restricted drainage.	Wetness	Instability	Instability		Weak claypan.	Slow permeability.	Slow permeability.	Weak claypan.	Wetness.
Restricted drainage.	Wetness	Instability	Permeable substratum.		Weak claypan.	High water table.	High water table.	High water table.	Wetness.
Shallow to bedrock.	Shallow soil.	Unsuitable	Shallow soil.	Rapid permeability.		Shallow to hard shale.	Shallow soil.	Shallow to shale.	
Impermeable substratum.		Instability							
Impermeable substratum.	Slopes	Instability; slopes.	Slopes; shallow soil.	Instability		Shallow soil; slope.		Shallow soil; slope.	
Slow permeability.			Permeable substratum.			Shallow soil.			
Slow permeability.	Seasonal high water table.		Permeable substratum.		Hardpan	Hardpan		Hardpan	Wet substratum.
High water table; flooding.	Poor drainage.	Instability	Flooding	Flooding	Difficult to obtain outlet.	Slow permeability.	Flooding	Flooding	High water table; flooding.
	Flooding	Instability	Flooding; instability.	Instability			Flooding	Flooding	Flooding.
		Instability	Permeable substratum.	Permeable substratum.					
High water table.	High water table.	Unsuitable	High water table.		Impossible; no outlet.	High water table.	High water table.	High water table.	High water table.
Slow permeability.	High water table.	Lacks binder.	Lacks binder.	Lacks binder.	Slow permeability.	High water table.			Wetness.
High water table.	Flooding; high water table.		Flooding	Variable	Flooding; difficult to obtain outlet.	Flooding; high water table.	Flooding	Flooding; difficult to obtain outlet.	Flooding
Slow permeability.	Seasonal high water table.		Permeable substratum.		Slow permeability.	Permeability of subsoil.			Wet substratum
Slow permeability.	Seasonal high water table.	Instability	Permeable substratum.	Instability	Seeps; slopes.	Wetness		Difficult to obtain outlet.	Wetness.

Soils and Rural Developments [2]

This section is designed to aid planning officials, realtors, and others interested in residential use of rural areas near growing cities. Typically, these are areas beyond the expanding suburbs, where homes are scattered among patches of farmland.

The soils of Chester and Delaware Counties have been placed in 13 groups on the basis of their characteristics that affect use for suburban or residential construction. The main characteristics considered are depth of the soil, degree of slope, internal drainage, freedom from flooding, kind of parent material, and stoniness. The soils in any one group are much alike in those characteristics affecting their suitability for home and community developments. Each group is described in terms of its characteristics and its suitability for suburban developments.

The grouping of soils for building sites, with information given in the two sections "Engineering Applications" and "Descriptions of Soils," along with maps in the back of this report, will aid those seeking suitable sites. The groupings, however, are not a substitute for the detailed investigation needed at the site proposed for an expensive development. Also, the groupings take into account only the characteristics of the soils. Not considered are distance to established centers, transportation lines, and other economic factors. Groupings of soils for building sites should not be confused with groupings of soils for agriculture or forestry; that is, capability units and woodland suitability groups.

Group 1 for building sites

These are deep, well-drained, permeable soils with slopes of 0 to 8 percent. The following soils are in this group:

Chester silt loam, 0 to 3 percent slopes.
Chester silt loam, 0 to 3 percent slopes, moderately eroded.
Chester silt loam, 3 to 8 percent slopes.
Chester silt loam, 3 to 8 percent slopes, moderately eroded.
Chester silt loam, 3 to 8 percent slopes, severely eroded.
Conestoga silt loam, 0 to 3 percent slopes.
Conestoga silt loam, 0 to 3 percent slopes, moderately eroded.
Conestoga silt loam, 3 to 8 percent slopes, moderately eroded.
Edgemont channery loam, 3 to 8 percent slopes.
Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.
Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded.
Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded.
Made land, gravelly materials.
Made land, schist and gneiss materials.
Sassafras loam, 0 to 3 percent slopes.
Sassafras loam, 3 to 8 percent slopes, moderately eroded.

This group consists of soils that have few natural limitations, are the most easily cultivated, and are among the best for agriculture in the two counties. Except for Made land, the soils are better used for agriculture than for homes or other buildings. If they are selected as building sites, their mild slope and ease of grading make them desirable locations for stores, factories, schools, and hospitals.

In some places the Hagerstown soils are not suitable for foundations, because of solution caverns in the underlying rocks. The other soils are generally suitable, but each potential building site should be examined carefully.

These soils are suitable as fields for septic tanks because they have good permeability, are not affected by a seasonal high water table, and absorb septic tank effluent fairly rapidly.

Group 2 for building sites

These are deep, well-drained, permeable soils with slopes of 8 to 25 percent. The following soils are in this group:

Chester silt loam, 8 to 15 percent slopes.
Chester silt loam, 8 to 15 percent slopes, moderately eroded.
Chester silt loam, 8 to 15 percent slopes, severely eroded.
Conestoga silt loam, 8 to 15 percent slopes, moderately eroded.
Conestoga silt loam, 8 to 15 percent slopes, severely eroded.
Edgemont channery loam, 8 to 15 percent slopes.
Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.
Edgemont channery loam, 8 to 15 percent slopes, severely eroded.
Edgemont channery loam, 15 to 25 percent slopes.
Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.
Edgemont channery loam, 15 to 25 percent slopes, severely eroded.
Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded.
Hagerstown silt loam, 8 to 15 percent slopes, severely eroded.

These soils have slopes satisfactory for residences but are somewhat steep for large stores, factories, schools, or hospitals. Most areas provide suitable foundations, but there is some slow soil creep on the steeper slopes.

The soils in this group have good surface drainage and are free of a seasonal high water table. If they are used for residential developments, runoff and gully erosion may be problems.

The soils will absorb a normal load of effluent from septic tanks. If large amounts of waste infiltrate the Conestoga and Hagerstown soils, the ground water will be contaminated because the bedrock under these soils contains large channels.

Group 3 for building sites

These are deep, well-drained, slowly to moderately permeable soils with slopes of 0 to 8 percent. The following soils are in this group:

Bucks silt loam, 3 to 8 percent slopes, moderately eroded.
Butlertown silt loam, 0 to 3 percent slopes.
Butlertown silt loam, 3 to 8 percent slopes, moderately eroded.
Made land, silt and clay materials.
Made land, gabbro and diabase materials.
Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded.
Montalto very stony silt loam, 0 to 8 percent slopes.
Neshaminy gravelly silt loam, 0 to 3 percent slopes.
Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded.
Neshaminy very stony silt loam, 0 to 8 percent slopes.

The soils of this group are deep and well drained. Except for Made land and the very stony Montalto and Neshaminy soils, all of them are well suited to truck farming or similar specialized agriculture. Their use for that purpose, rather than for construction, should be considered.

All of these soils have slopes favorable for stores, factories, and schools. They all provide suitable foundations. If the very stony Montalto and Neshaminy soils are used for construction, however, the many boulders will add to the cost of excavating and grading.

These soils do not have a seasonal high water table,

[2] By F. G. Loughry, State soil scientist, Soil Conservation Service, in consultation with officials of the Pennsylvania Department of Health.

but there is a perched water table for a short time after rains. Drainage and aeration are good.

These soils absorb waste materials less rapidly than the soils of groups 1 and 2. Larger disposal fields will therefore be required if septic tanks are to operate satisfactorily.

Group 4 for building sites

These are deep, well-drained, slowly permeable soils with slopes of 8 to 25 percent. The following soils are in this group:

Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded.
Montalto channery silt loam, 8 to 15 percent slopes, severely eroded.
Montalto channery silt loam, 15 to 25 percent slopes, severely eroded.
Montalto very stony silt loam, 8 to 25 percent slopes.
Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded.
Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded.
Neshaminy gravelly silt loam, 15 to 25 percent slopes.
Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded.
Neshaminy very stony silt loam, 8 to 25 percent slopes.

The soils in this group have slopes that are satisfactory for residences. They are somewhat steep, however, for the buildings and large grounds needed for commercial and industrial enterprises. In the main the soils provide suitable foundations, but some slow soil creep occurs on the steeper slopes.

The very stony Montalto and Neshaminy soils contain boulders that increase the cost and difficulty of excavating and grading. During and after construction, runoff likely will be a serious problem on soils of this group. If these soils are not protected, severe erosion may take place and nearby lower areas may be flooded and covered by deposits of silt.

These soils do not have a seasonal high water table. They have good internal drainage and are well aerated, but they absorb waste from septic tanks more slowly than the soils of groups 1 and 2. If these soils are used as fields for septic tanks, the fields must be larger than for the soils of groups 1 and 2.

Group 5 for building sites

These are predominantly moderately deep, well-drained soils with slopes of 0 to 8 percent. The following soils are in this group:

Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded.
Brecknock very stony silt loam, 0 to 8 percent slopes.
Chester very stony silt loam, 0 to 8 percent slopes.
Edgemont very stony loam, 0 to 8 percent slopes.
Glenelg channery silt loam, 0 to 3 percent slopes.
Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded.
Glenelg channery silt loam, 3 to 8 percent slopes.
Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded.
Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded.
Glenelg silt loam, 0 to 3 percent slopes, severely eroded.
Glenelg silt loam, 3 to 8 percent slopes, severely eroded.
Made land, sanitary land fill.
Manor loam, 0 to 3 percent slopes, moderately eroded.
Manor loam, 3 to 8 percent slopes, moderately eroded.
Manor loam, 3 to 8 percent slopes, severely eroded.
Manor very stony loam, 0 to 8 percent slopes.

Except for the very stony soils and Made land, the soils of this group are fairly good for agriculture. Their slopes are favorable for stores, factories, schools, and similar large structures requiring ready access. If the very stony soils are used for construction, the many boulders will increase the cost of excavating and grading.

Most of the areas are suitable for foundations, but bedrock is only 2 to 4 feet from the surface in most places. The upper part of the bedrock is partially weathered and soft, and in many places bedrock of varying hardness is reached in excavating. In many places the Glenelg and Manor soils are underlain by saprolite, or rotten rock, to a depth of 20 feet. This rotten rock is not stable under heavy weight. Made land, sanitary land fill, is subject to settling and is, therefore, a poor foundation.

Because these soils are well drained and permeable, they readily absorb wastes and are suitable fields for septic tanks.

Group 6 for building sites

These are predominantly moderately deep, well-drained, permeable soils with slopes of 8 to 25 percent. The following soils are in this group:

Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded.
Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded.
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded.
Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded.
Brecknock very stony silt loam, 8 to 25 percent slopes.
Chester very stony silt loam, 8 to 15 percent slopes.
Edgemont very stony loam, 8 to 25 percent slopes.
Glenelg channery silt loam, 8 to 15 percent slopes.
Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded.
Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded.
Glenelg channery silt loam, 15 to 25 percent slopes.
Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded.
Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded.
Glenelg very stony silt loam, 15 to 25 percent slopes.
Manor loam, 8 to 15 percent slopes.
Manor loam, 8 to 15 percent slopes, moderately eroded.
Manor loam, 8 to 15 percent slopes, severely eroded.
Manor loam, 15 to 25 percent slopes.
Manor loam, 15 to 25 percent slopes, moderately eroded.
Manor loam, 15 to 25 percent slopes, severely eroded.
Manor very stony loam, 8 to 25 percent slopes.

These soils have slopes that can be used as sites for residences, but they are too steep for large stores, factories, schools, or other buildings requiring ready access. The soils are fairly suitable as foundations for small structures.

Boulders scattered on the surface and through the underlying material of the very stony soils make excavating and grading somewhat difficult and expensive. The partly weathered rocks, or saprolite, underlying the Glenelg and Manor soils are soft and somewhat elastic in many places. There is slow soil creep on the steep slopes. While construction is taking place, runoff is a problem. It may cause severe gullying.

These soils do not have a seasonal high water table. They have good internal drainage and are well aerated. The soils absorb effluent satisfactorily and are suitable as fields for septic tanks.

Group 7 for building sites

These are shallow, well-drained soils with slopes of 0 to 8 percent. The following soils are in this group:

Brandywine loam, 3 to 8 percent slopes, moderately eroded.
Brandywine very stony loam, 0 to 8 percent slopes.
Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded.
Hollinger silt loam, 3 to 8 percent slopes, moderately eroded.
Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded.
Penn silt loam, 3 to 8 percent slopes, moderately eroded.
Penn very stony silt loam, 0 to 8 percent slopes.
Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded.

These soils are shallow over bedrock. In most places the bedrock is hard enough so that the soils are suitable for foundations, but that underlying the Chrome soil is soft or variable. Areas of these soils are generally too small for shopping centers, factories, schools, or similar construction. The very stony phases of Brandywine and Penn soils contain enough boulders to increase the cost of grading.

Excavating in soils of this group usually requires that the bedrock be quarried to some extent. As a rule, after earth moving is completed, the material that remains is too shallow or contains too many fragments of raw, broken rock to be suitable for growing grass, shrubs, or trees. Also, the soil material is droughty, and special problems can be expected in revegetating the areas and establishing good lawns.

Although these soils are well drained and well aerated, they are permeable to a depth of only 1 or 2 feet. Every site should be tested carefully to be sure that water that has been added does not build up to saturate the entire soil and then come to the surface. Difficulty can be expected if the soils are used as fields for septic tanks. Where effluent does sink into cracks in the bedrock it may contaminate the ground water because the soil material makes a poor filter.

Group 8 for building sites

These are shallow, well-drained soils with slopes of 8 to 25 percent. The following soils are in this group:

Brandywine loam, 8 to 15 percent slopes.
Brandywine loam, 8 to 15 percent slopes, moderately eroded.
Brandywine loam, 8 to 15 percent slopes, severely eroded.
Brandywine loam, 15 to 25 percent slopes.
Brandywine loam, 15 to 25 percent slopes, moderately eroded.
Brandywine loam, 15 to 25 percent slopes, severely eroded.
Brandywine very stony loam, 8 to 25 percent slopes.
Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded.
Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded.
Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded.
Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded.
Hollinger silt loam, 8 to 15 percent slopes, moderately eroded.
Hollinger silt loam, 8 to 15 percent slopes, severely eroded.
Hollinger silt loam, 15 to 25 percent slopes, severely eroded.
Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded.
Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded.
Penn silt loam, 8 to 15 percent slopes, moderately eroded.
Penn silt loam, 8 to 15 percent slopes, severely eroded.
Penn silt loam, 15 to 25 percent slopes.
Penn silt loam, 15 to 25 percent slopes, moderately eroded.
Penn very stony silt loam, 8 to 25 percent slopes.
Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded.
Penn and Lansdale sandy loams, 8 to 15 percent slopes, severely eroded.
Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded.

The soils in this group have slopes that are satisfactory as sites for residences. They are too steep, however, for shopping centers, factories, or similar large commercial, industrial, or institutional construction. In most of the soils, bedrock is at a depth of 1 to 2 feet. In most places the bedrock is hard enough to be satisfactory for foundations, but the Chrome soils overlie soft, schistose bedrock.

Generally, excavation in these soils requires some quarrying of the bedrock. If the very stony soils are used for construction, the large number of boulders will increase the cost of grading. On the steeper slopes there is some slow soil creep.

In many places runoff and the resulting erosion are problems during construction. If earthmoving is necessary, the soils are so shallow that the soil material left is poor for growing grass, shrubs, or trees. Droughtiness makes it hard to establish good lawns and vigorous shrubs.

Although these soils are well drained and do not have a seasonal high water table, the bedrock near the surface keeps them from absorbing water well. If water is added, as in the areas used as fields for septic tanks, it may seep out of the hillsides farther down the slope.

Group 9 for building sites

These are well-drained soils with slopes that are steeper than 25 percent. The following soils are in this group:

Brandywine loam, 25 to 40 percent slopes.
Brandywine very stony loam, 25 to 50 percent slopes.
Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded.
Brecknock very stony silt loam, 25 to 50 percent slopes.
Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded.
Edgemont channery loam, 25 to 35 percent slopes.
Edgemont channery loam, 25 to 35 percent slopes, moderately eroded.
Edgemont very stony loam, 25 to 60 percent slopes.
Glenelg channery silt loam, 25 to 35 percent slopes.
Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded.
Glenelg very stony silt loam, 25 to 35 percent slopes.
Hollinger silt loam, 25 to 35 percent slopes, severely eroded.
Manor loam and channery loam, 25 to 35 percent slopes.
Manor loam and channery loam, 25 to 35 percent slopes, severely eroded.
Manor soils, 35 to 60 percent slopes.
Manor very stony loam, 25 to 60 percent slopes.
Montalto very stony silt loam, 25 to 45 percent slopes.
Neshaminy very stony silt loam, 25 to 45 percent slopes.
Penn very stony silt loam, 25 to 50 percent slopes.
Penn soils, 25 to 35 percent slopes, moderately eroded.
Penn soils, 25 to 35 percent slopes, severely eroded.
Penn soils, 35 to 50 percent slopes.

The soils in this group are well drained but are too steep to be used as sites for ordinary dwellings. In most suburban areas they can best be used as open spaces or for parks or forests. Some areas may be suitable for use as extensive pastures or game preserves.

In many places these soils occur in areas where the view is unobstructed. Therefore, use of large tracts for luxury housing may be feasible. Each building site

would require special study and design if used for that purpose.

Group 10 for building sites

These are deep, moderately well drained soils with slopes of 0 to 8 percent. The following soils are in this group:

Bedford silt loam, 0 to 3 percent slopes.
Bedford silt loam, 3 to 8 percent slopes.
Bedford silt loam, 3 to 8 percent slopes, moderately eroded.
Beltsville silt loam, 0 to 3 percent slopes.
Beltsville silt loam, 3 to 8 percent slopes, moderately eroded.
Conowingo silt loam, 0 to 3 percent slopes.
Conowingo silt loam, 3 to 8 percent slopes, moderately eroded.
Glenville silt loam, 0 to 3 percent slopes.
Glenville silt loam, 3 to 8 percent slopes.
Glenville silt loam, 3 to 8 percent slopes, moderately eroded.
Glenville very stony silt loam, 0 to 8 percent slopes.
Lehigh silt loam, 3 to 8 percent slopes.
Lehigh silt loam, 3 to 8 percent slopes, moderately eroded.
Lehigh very stony silt loam, 0 to 8 percent slopes.
Mount Lucas very stony silt loam, 0 to 8 percent slopes.
Readington silt loam, 0 to 3 percent slopes.
Readington silt loam, 3 to 8 percent slopes.
Readington silt loam, 3 to 8 percent slopes, moderately eroded.
Woodstown loam, 0 to 3 percent slopes.

These soils are moderately well drained, but in most years they have a seasonal high water table for a period of several weeks. The high water table causes sealing and drainage problems in basements. The soils have gentle slopes that are favorable for stores, factories, schools, and similar commercial, industrial, or institutional construction. The many boulders in the very stony phases of Glenville, Lehigh, and Mount Lucas soils increase the cost of excavating and grading.

If these soils are used as fields for septic tanks, the water table will be too high for several weeks each year and the effluent will not be absorbed properly. In some of the more permeable soils, such as the Bedford, Glenville, and Woodstown, absorption can be improved if an independent tile drainage system that has an adequate outlet is installed before the field is established. For seasonal use in summer, as for a summer camp, these soils may be used satisfactorily as fields for septic tanks, but the fields need to be large.

Group 11 for building sites

These are deep, moderately well drained soils with slopes of 8 to 25 percent. The following soils are in this group:

Glenville silt loam, 8 to 15 percent slopes, moderately eroded.
Lehigh silt loam, 8 to 15 percent slopes, severely eroded.
Lehigh very stony silt loam, 8 to 25 percent slopes.

These soils have moderately good internal drainage but have a seasonal high water table and seepage on the hillsides. They are suitable as foundations for houses, but there are problems in sealing and draining the basements. The boulders in the Lehigh very stony silt loam increase the difficulty of excavating and grading.

Seepage through the subsoil when there is a seasonal high water table makes these soils poor as fields for septic tanks. If much waste is added to the septic-tank system, it may seep out on the surface farther down the slope.

Group 12 for building sites

These are poorly and somewhat poorly drained soils of uplands that have slopes of 0 to 15 percent. The following soils are in this group:

Aldino silt loam, 0 to 3 percent slopes.
Aldino silt loam, 3 to 8 percent slopes, moderately eroded.
Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded.
Calvert silt loam, 0 to 3 percent slopes.
Calvert silt loam, 3 to 8 percent slopes.
Calvert silt loam, 3 to 8 percent slopes, moderately eroded.
Croton silt loam, 0 to 3 percent slopes.
Croton silt loam, 3 to 8 percent slopes.
Guthrie silt loam.
Lawrence silt loam, 0 to 3 percent slopes.
Lawrence silt loam, 3 to 8 percent slopes.
Othello silt loam.
Watchung silt loam, 0 to 3 percent slopes.
Watchung silt loam, 3 to 8 percent slopes, moderately eroded.
Watchung very stony silt loam, 0 to 8 percent slopes.
Worsham silt loam, 0 to 3 percent slopes.
Worsham silt loam, 3 to 8 percent slopes.
Worsham silt loam, 3 to 8 percent slopes, moderately eroded.
Worsham silt loam, 8 to 15 percent slopes, moderately eroded
Worsham very stony silt loam, 0 to 8 percent slopes.

All of these soils have a high water table for several months of the year. The Watchung and Worsham soils have a high water table for an even longer period, or for most of the year, and at times water stands on the surface of these soils. The sloping, moderately eroded phases of Worsham soils occur as small seepage areas on hillsides.

The soils of group 12 for building sites are generally unsatisfactory as foundations for heavy structures. If they are used for commercial or residential construction, fill will be needed to raise floors above the level reached by the water table. The fill needs adequate drainage so that the water will not rise to the new level.

These soils are unsuitable as fields for septic tanks. If they are used for that purpose, the distribution lines are below the level of the normal water table for long periods.

Group 13 for building sites

These are soils of flood plains that are subject to overflow. The following soils are in this group:

Bowmansville silt loam.
Chewacla silt loam.
Congaree silt loam.
Lindside silt loam.
Melvin silt loam.
Rowland silt loam.
Rowland silt loam, dark surface.
Tidal marsh.
Wehadkee silt loam.

These soils are flooded by the normal high waters of streams. Tidal marsh is covered by water twice each day. The other soils are flooded from two or three times a year to once in several years.

Some areas of these soils may have value as parks and recreational areas, and some may be used for agriculture. The soils are not suitable as sites for homes or other buildings.

Descriptions of Soils

In this section the soil series of Chester and Delaware Counties are described in alphabetical order. Following the general description of each series is a profile description of a soil that is typical of that series. Each of the other mapping units of the series is compared to the typical soil for which a profile is described, and additional facts about each are given. Further information on the use and management of each soil is given in the section "Use

and Management of the Soils." Terms used to describe the soils are given in the Glossary.

A list of the soils mapped is given at the back of the report, along with the capability unit, the woodland group, and the urban group of each. The approximate acreage and proportionate extent of the soils are given in table 8. Their location and distribution are shown on the soil map at the back of this report.

TABLE 8.—*Approximate acreage and proportionate extent of the soils mapped*

Soil	Chester County		Delaware County	
	Acres	*Percent*	*Acres*	*Percent*
Aldino silt loam, 0 to 3 percent slopes	91	(1)	0	0
Aldino silt loam, 3 to 8 percent slopes, moderately eroded	133	(1)	28	(1)
Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded	102	(1)	0	0
Bedford silt loam, 0 to 3 percent slopes	803	0. 2	0	0
Bedford silt loam, 3 to 8 percent slopes	318	. 1	0	0
Bedford silt loam, 3 to 8 percent slopes, moderately eroded	694	. 1	0	0
Beltsville silt loam, 0 to 3 percent slopes	0	0	676	.6
Beltsville silt loam, 3 to 8 percent slopes, moderately eroded	174	(1)	710	. 6
Bowmansville silt loam	792	0. 2	0	0
Brandywine loam, 3 to 8 percent slopes, moderately eroded	830	. 2	140	. 1
Brandywine loam, 8 to 15 percent slopes	111	(1)	106	. 1
Brandywine loam, 8 to 15 percent slopes, moderately eroded	596	. 1	9	(1)
Brandywine loam, 8 to 15 percent slopes, severely eroded	597	. 1	763	. 6
Brandywine loam, 15 to 25 percent slopes	170	(1)	257	. 2
Brandywine loam, 15 to 25 percent slopes, moderately eroded	226	(1)	46	(1)
Brandywine loam, 15 to 25 percent slopes, severely eroded	658	. 1	742	. 6
Brandywine loam, 25 to 40 percent slopes	553	. 1	638	. 5
Brandywine very stony loam, 0 to 8 percent slopes	227	(1)	2	(1)
Brandywine very stony loam, 8 to 25 percent slopes	1, 558	. 3	265	. 2
Brandywine very stony loam, 25 to 50 percent slopes	663	. 1	264	. 2
Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded	412	. 1	0	0
Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded	125	(1)	0	0
Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded	22	(1)	0	0
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded	8	(1)	0	0
Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded	12	(1)	0	0
Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded	26	(1)	0	0
Brecknock very stony silt loam, 0 to 8 percent slopes	59	(1)	0	0
Brecknock very stony silt loam, 8 to 25 percent slopes	56	(1)	0	0
Brecknock very stony silt loam, 25 to 50 percent slopes	2	(1)	5	(1)
Bucks silt loam, 3 to 8 percent slopes, moderately eroded	3, 015	. 6	0	0
Butlertown silt loam, 0 to 3 percent slopes	0	0	265	. 2
Butlertown silt loam, 3 to 8 percent slopes, moderately eroded	0	0	752	. 6
Calvert silt loam, 0 to 3 percent slopes	278	. 1	14	(1)
Calvert silt loam, 3 to 8 percent slopes	62	(1)	11	(1)
Calvert silt loam, 3 to 8 percent slopes, moderately eroded	156	(1)	0	0
Chester silt loam, 0 to 3 percent slopes	427	. 1	20	(1)
Chester silt loam, 0 to 3 percent slopes, moderately eroded	2, 269	. 5	159	. 1
Chester silt loam, 3 to 8 percent slopes	537	. 1	68	. 1
Chester silt loam, 3 to 8 percent slopes, moderately eroded	9, 873	2. 0	1, 514	1. 3
Chester silt loam, 3 to 8 percent slopes, severely eroded	181	(1)	0	0
Chester silt loam, 8 to 15 percent slopes	12	(1)	1	(1)
Chester silt loam, 8 to 15 percent slopes, moderately eroded	138	(1)	118	. 1
Chester silt loam, 8 to 15 percent slopes, severely eroded	114	(1)	0	0
Chester very stony silt loam, 0 to 8 percent slopes	331	. 1	0	0
Chester very stony silt loam, 8 to 15 percent slopes	401	. 1	0	0
Chewacla silt loam	8, 651	1. 8	2, 030	1. 7
Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded	1, 406	. 3	225	. 2
Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded	688	. 1	174	. 1
Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded	444	. 1	296	. 2
Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded	165	(1)	69	. 1
Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded	208	(1)	133	. 1
Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded	445	. 1	0	0
Conestoga silt loam, 0 to 3 percent slopes	915	. 2	0	0
Conestoga silt loam, 0 to 3 percent slopes, moderately eroded	706	. 1	0	0
Conestoga silt loam, 3 to 8 percent slopes, moderately eroded	7, 818	1. 6	0	0
Conestoga silt loam, 8 to 15 percent slopes, moderately eroded	582	. 1	0	0
Conestoga silt loam, 8 to 15 percent slopes, severely eroded	829	. 2	0	0
Congaree silt loam	962	. 2	245	. 2
Conowingo silt loam, 0 to 3 percent slopes	461	. 1	0	0
Conowingo silt loam, 3 to 8 percent slopes, moderately eroded	1, 189	. 2	223	. 2
Croton silt loam, 0 to 3 percent slopes	1, 116	. 2	0	0
Croton silt loam, 3 to 8 percent slopes	773	. 2	0	0
Edgemont channery loam, 3 to 8 percent slopes	3, 100	. 6	0	0
Edgemont channery loam, 3 to 8 percent slopes, moderately eroded	6, 821	1. 4	0	0
Edgemont channery loam, 8 to 15 percent slopes	4, 588	. 9	0	0
Edgemont channery loam, 8 to 15 percent slopes, moderately eroded	2, 505	. 5	0	0

See footnote at end of table.

TABLE 8.—*Approximate acreage and proportionate extent of the soils mapped*—Continued

Soil	Chester County		Delaware County	
	Acres	*Percent*	*Acres*	*Percent*
Edgemont channery loam, 8 to 15 percent slopes, severely eroded	1,829	0.4	0	0
Edgemont channery loam, 15 to 25 percent slopes	581	.1	0	0
Edgemont channery loam, 15 to 25 percent slopes, moderately eroded	803	.2	0	0
Edgemont channery loam, 15 to 25 percent slopes, severely eroded	1,010	.2	0	0
Edgemont channery loam, 25 to 35 percent slopes	399	.1	0	0
Edgemont channery loam, 25 to 35 percent slopes, moderately eroded	906	.2	0	0
Edgemont very stony loam, 0 to 8 percent slopes	494	.1	0	0
Edgemont very stony loam, 8 to 25 percent slopes	1,363	.3	0	0
Edgemont very stony loam, 25 to 60 percent slopes	1,228	.3	0	0
Glenelg channery silt loam, 0 to 3 percent slopes	1,429	.3	203	.2
Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded	2,508	.5	23	(1)
Glenelg channery silt loam, 3 to 8 percent slopes	6,147	1.3	930	.8
Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded	116,982	24.1	12,780	10.8
Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded	3,613	.7	810	.6
Glenelg channery silt loam, 8 to 15 percent slopes	4,214	.9	2,377	2.0
Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded	20,417	4.2	8,257	7.0
Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded	27,379	5.6	4,186	3.5
Glenelg channery silt loam, 15 to 25 percent slopes	1,297	.3	1,494	1.3
Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded	1,957	.4	815	.7
Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded	6,306	1.3	1,298	1.1
Glenelg channery silt loam, 25 to 35 percent slopes	414	.1	759	.6
Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded	479	.1	199	.2
Glenelg silt loam, 0 to 3 percent slopes, severely eroded	27	(1)	0	0
Glenelg silt loam, 3 to 8 percent slopes, severely eroded	434	.1	0	0
Glenelg very stony silt loam, 15 to 25 percent slopes	334	.1	0	0
Glenelg very stony silt loam, 25 to 35 percent slopes	281	.1	0	0
Glenville silt loam, 0 to 3 percent slopes	3,496	.7	286	.2
Glenville silt loam, 3 to 8 percent slopes	7,320	1.5	2,080	1.8
Glenville silt loam, 3 to 8 percent slopes, moderately eroded	18,622	3.8	4,840	4.1
Glenville silt loam, 8 to 15 percent slopes, moderately eroded	476	.1	108	.1
Glenville very stony silt loam, 0 to 8 percent slopes	55	(1)	1,077	.9
Guthrie silt loam	1,631	.3	0	0
Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded	955	.2	0	0
Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded	7,158	1.5	0	0
Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded	551	.1	0	0
Hagerstown silt loam, 8 to 15 percent slopes, severely eroded	774	.2	0	0
Hollinger silt loam, 3 to 8 percent slopes, moderately eroded	156	(1)	0	0
Hollinger silt loam, 8 to 15 percent slopes, moderately eroded	77	(1)	0	0
Hollinger silt loam, 8 to 15 percent slopes, severely eroded	92	(1)	0	0
Hollinger silt loam, 15 to 25 percent slopes, severely eroded	278	.1	0	0
Hollinger silt loam, 25 to 35 percent slopes, severely eroded	96	(1)	0	0
Lawrence silt loam, 0 to 3 percent slopes	1,198	.2	0	0
Lawrence silt loam, 3 to 8 percent slopes	866	.2	0	0
Lehigh silt loam, 3 to 8 percent slopes	13	(1)	0	0
Lehigh silt loam, 3 to 8 percent slopes, moderately eroded	50	(1)	0	0
Lehigh silt loam, 8 to 15 percent slopes, severely eroded	22	(1)	0	0
Lehigh very stony silt loam, 0 to 8 percent slopes	7	(1)	0	0
Lehigh very stony silt loam, 8 to 25 percent slopes	1	(1)	0	0
Lindside silt loam	870	.2	0	0
Made land, gravelly materials	0	0	9,939	8.4
Made land, silt and clay materials	0	0	12,247	10.3
Made land, gabbro and diabase materials	10	(1)	2,753	2.3
Made land, schist and gneiss materials	1,689	.3	15,650	13.2
Made land, sanitary land fill	0	0	216	.2
Manor loam, 0 to 3 percent slopes, moderately eroded	160	(1)	0	0
Manor loam, 3 to 8 percent slopes, moderately eroded	13,473	2.8	1,347	1.1
Manor loam, 3 to 8 percent slopes, severely eroded	1,213	.2	5	(1)
Manor loam, 8 to 15 percent slopes	3,217	.7	451	.4
Manor loam, 8 to 15 percent slopes, moderately eroded	5,154	1.1	2,006	1.7
Manor loam, 8 to 15 percent slopes, severely eroded	20,115	4.1	718	.6
Manor loam, 15 to 25 percent slopes	2,470	.5	685	.6
Manor loam, 15 to 25 percent slopes, moderately eroded	1,968	.4	973	.8
Manor loam, 15 to 25 percent slopes, severely eroded	13,177	2.7	453	.4
Manor loam and channery loam, 25 to 35 percent slopes	2,046	.4	990	.8
Manor loam and channery loam, 25 to 35 percent slopes, severely eroded	7,063	1.5	403	.3
Manor soils, 35 to 60 percent slopes	2,425	.5	595	.5
Manor very stony loam, 0 to 8 percent slopes	153	(1)	0	0
Manor very stony loam, 8 to 25 percent slopes	571	.1	92	.1
Manor very stony loam, 25 to 60 percent slopes	1,288	.3	1	(1)
Melvin silt loam	679	.1	376	.3
Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded	1,622	.3	2	(1)
Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded	495	.1	0	0

See footnote at end of table.

TABLE 8.—*Approximate acreage and proportionate extent of the soils mapped*—Continued

Soil	Chester County		Delaware County	
	Acres	*Percent*	*Acres*	*Percent*
Montalto channery silt loam, 8 to 15 percent slopes, severely eroded	202	(1)	0	0
Montalto channery silt loam, 15 to 25 percent slopes, severely eroded	135	(1)	0	0
Montalto very stony silt loam, 0 to 8 percent slopes	868	0. 2	0	0
Montalto very stony silt loam, 8 to 25 percent slopes	711	. 1	0	0
Montalto very stony silt loam, 25 to 45 percent slopes	88	(1)	0	0
Mount Lucas very stony silt loam, 0 to 8 percent slopes	9	(1)	0	0
Neshaminy gravelly silt loam, 0 to 3 percent slopes	1, 289	. 3	214	. 2
Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded	7, 977	1. 6	2, 894	2. 4
Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded	617	. 1	1, 117	. 9
Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded	788	. 2	148	. 1
Neshaminy gravelly silt loam, 15 to 25 percent slopes	124	(1)	149	. 1
Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded	272	. 1	152	. 1
Neshaminy very stony silt loam, 0 to 8 percent slopes	402	. 1	112	. 1
Neshaminy very stony silt loam, 8 to 25 percent slopes	716	. 1	1, 119	. 9
Neshaminy very stony silt loam, 25 to 45 percent slopes	308	. 1	850	. 7
Othello silt loam	0	0	477	. 4
Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded	307	. 1	0	0
Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded	379	. 1	0	0
Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded	912	. 2	0	0
Penn silt loam, 3 to 8 percent slopes, moderately eroded	14, 892	3. 1	0	0
Penn silt loam, 8 to 15 percent slopes, moderately eroded	3, 743	. 8	0	0
Penn silt loam, 8 to 15 percent slopes, severely eroded	4, 181	. 9	0	0
Penn silt loam, 15 to 25 percent slopes	64	(1)	0	0
Penn silt loam, 15 to 25 percent slopes, moderately eroded	283	. 1	0	0
Penn very stony silt loam, 0 to 8 percent slopes	609	. 1	0	0
Penn very stony silt loam, 8 to 25 percent slopes	1, 279	. 3	0	0
Penn very stony silt loam, 25 to 50 percent slopes	123	(1)	0	0
Penn soils, 25 to 35 percent slopes, moderately eroded	10	(1)	0	0
Penn soils, 25 to 35 percent slopes, severely eroded	497	. 1	0	0
Penn soils, 35 to 50 percent slopes	137	(1)	0	0
Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded	797	. 2	0	0
Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded	577	. 1	0	0
Penn and Lansdale sandy loams, 8 to 15 percent slopes, severely eroded	356	. 1	0	0
Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded	69	(1)	0	0
Readington silt loam, 0 to 3 percent slopes	1, 221	. 3	0	0
Readington silt loam, 3 to 8 percent slopes	488	. 1	0	0
Readington silt loam, 3 to 8 percent slopes, moderately eroded	1, 629	. 3	0	0
Rowland silt loam	827	. 2	0	0
Rowland silt loam, dark surface	822	. 2	0	0
Sassafras loam, 0 to 3 percent slopes	0	0	37	(1)
Sassafras loam, 3 to 8 percent slopes, moderately eroded	0	0	131	. 1
Tidal marsh	0	0	1, 280	1. 1
Watchung silt loam, 0 to 3 percent slopes	441	. 1	10	(1)
Watchung silt loam, 3 to 8 percent slopes, moderately eroded	342	. 1	0	0
Watchung very stony silt loam, 0 to 8 percent slopes	221	(1)	2	(1)
Wehadkee silt loam	13, 924	2. 9	3, 231	2. 7
Woodstown loam, 0 to 3 percent slopes	0	0	209	. 2
Worsham silt loam, 0 to 3 percent slopes	12, 682	2. 6	1, 416	1. 2
Worsham silt loam, 3 to 8 percent slopes	3, 777	. 8	18	(1)
Worsham silt loam, 3 to 8 percent slopes, moderately eroded	3, 700	. 8	9	(1)
Worsham silt loam, 8 to 15 percent slopes, moderately eroded	48	(1)	0	0
Worsham very stony silt loam, 0 to 8 percent slopes	1, 575	. 3	301	. 3
Gravel pits	4	(1)	6	(1)
Quarries	203	(1)	165	. 1
Water	2, 008	. 4	952	. 8
Total	486, 400	100. 0	118, 400	100. 0

[1] Less than 0.1 percent.

Aldino Series

The Aldino series consists of shallow, moderately well drained to somewhat poorly drained soils developed in material from serpentine. The soils have a very dark gray surface layer. Their subsoil is mottled yellowish brown and light grayish brown. It is underlain by a layer of partly weathered fragments of serpentine; between the rocks there is clayey material.

These soils are mainly nearly level or gently sloping. They are mostly in the southwestern part of Chester County, known locally as the barrens, but other small areas are between West Chester and Paoli. The native forests consisted mainly of scrub oak, red oak, stunted cedar, and dwarfed white pine.

Aldino soils are adjacent to soils of the Conowingo, Calvert, and Chrome series, all of which formed from similar parent material. The Aldino soils are somewhat

shallower than the Conowingo soils. The soils of both series are moderately well drained to somewhat poorly drained. The Aldino soils are better drained than the Calvert soils, and their surface layer is not so dark. They are less well drained than the Chrome soils and are also somewhat deeper in places. In addition, their subsoil is mottled.

Typical profile of Aldino silt loam, 0 to 3 percent slopes:

- A_{00} Recently fallen leaves and twigs.
- A_0 1 inch to 0 of organic mull.
- A_1 0 to 2 inches, very dark gray (N 3/0)[3] silt loam; weak, fine, granular structure; friable when moist; pH 5.2; clear, wavy lower boundary; 0 to 2 inches thick.
- A_2 2 to 6 inches, grayish-brown (2.5Y 5/2) silt loam; weak, medium, crumb structure; friable when moist, slightly sticky when wet; pH 5.2; clear, wavy lower boundary; 3 to 5 inches thick.
- A_3 6 to 9 inches, olive-gray (5Y 5/2) silt loam with a few, fine, faint mottles of light yellowish brown (2.5Y 6/4); weak, medium, platy structure; friable when moist, sticky and slightly plastic when wet; pH 5.2; gradual, wavy lower boundary; 3 to 5 inches thick.
- B_2 9 to 22 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, distinct mottles of light brownish gray (2.5Y 6/2); moderate, thick, platy structure; thin coatings of clay on the surface of peds; firm when moist, sticky and plastic when wet; pH 5.4; gradual, wavy lower boundary; 10 to 14 inches thick.
- C 22 to 30 inches, partly weathered serpentine; between the rocks there are thin layers of clay loam, the colors of which are the same as those in the B_2 horizon.
- D 30 inches +, solid serpentine.

Aldino silt loam, 0 to 3 percent slopes (AgA).—The profile of this soil is the same as the profile described as typical for the series.

Unless this soil is drained, it is poorly suited to crops. Most of the excess surface and subsurface water can be removed through open ditches. This will lower the water table and will also improve the aeration of the soil. The soil is better suited to hay or pasture than to crops that require tillage. Grasses and legumes that tolerate wetness grow fairly well. Lime and fertilizer are required, however, to maintain the vigor of the plants. If a cropping system is used, choose plants that tolerate wetness.

Some areas have not been cleared, and these are best kept in trees. Suitable trees are white pine, Scotch pine, larch, hemlock, and red maple.

This soil is in capability unit IIIw–1; woodland group 9; and group 12 for building sites.

Aldino silt loam, 3 to 8 percent slopes, moderately eroded (AgB2).—Except that this soil is thinner and is better drained, it is similar to the soil described as typical for the series. Depth to mottling is between 9 and 12 inches.

This soil is used mostly for pasture or as woodland. If it is well managed, it can be used to grow small grain and corn. The soil is unsuitable for alfalfa and other crops that cannot tolerate excess moisture.

Applying lime and fertilizer according to the needs indicated by soil tests, will increase the quality and the yields of pasture crops. Using open ditches to provide drainage will remove much of the excess water during wet periods. The ditches also help lower the water table and thus improve the aeration of the soil. Suitable trees to grow on this soil are red maple, white pine, pitch pine, and hemlock.

This soil is in capability unit IIIw–1; woodland group 9; and group 12 for building sites.

Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded (AsB2).—Except that it is stony, the profile of this soil is similar to that described as typical for the series.

The many large stones on this soil make it unsuitable for cultivation. This soil has only a limited use for pasture. Its principal use is for trees. Scotch pine, white pine, Virginia pine, and hemlock are suitable trees to grow on this soil. Silky cornel and autumn olive are suitable for wildlife plantings.

This soil is in capability unit VIIs–2; woodland group 9; and group 12 for building sites.

Bedford Series

The Bedford series consists of deep, moderately well drained soils. The soils are underlain by marble and other lime-bearing rocks. They are in depressions and on gentle slopes in the uplands. Their surface layer is grayish-brown silt loam, and their subsoil is yellowish-brown, light silty clay loam. Faint mottling is generally at a depth between 28 and 32 inches.

These soils are in Chester County. They are in Chester Valley and in a few areas scattered near Kennett Square, Avondale, Doe Run, and Willowdale. The native vegetation was a forest made up of white oak, red oak, black oak, chestnut, poplar, walnut, hickory, ash, and wild cherry.

The Bedford soils are near soils of the Hagerstown, Hollinger, Conestoga, Lawrence, and Guthrie series, all of which are underlain by lime-bearing rocks. The Bedford soils are deeper than the Hollinger soils, which are well drained and shallow. They are not so well drained as the Hagerstown and Conestoga soils, but they are better drained than the Lawrence soils. The Bedford soils are better drained than the Guthrie soils, and the Guthrie soils are mottled near the surface and have a dark-gray surface layer.

Typical profile of Bedford silt loam, 3 to 8 percent slopes, moderately eroded:

- A_p 0 to 8 inches, grayish-brown (2.5Y 5/2) silt loam; fine, medium, crumb structure; friable when moist; slightly acid (pH 6.5); clear, smooth lower boundary; 7 to 9 inches thick.
- B_2 8 to 12 inches, brownish-yellow (10YR 6/8) silt loam; fine, medium, subangular blocky structure; thin clay films on peds; friable when moist, slightly sticky when wet; medium acid (pH 6.0); clear, wavy lower boundary; 3 to 5 inches thick.
- B_{22} 12 to 30 inches, yellowish-brown (10YR 5/8) silty clay loam; moderate, medium, subangular blocky structure; thin coatings of clay on peds; friable when moist, slightly sticky when wet; strongly acid (pH 5.5); gradual, irregular lower boundary; 15 to 20 inches thick.
- B_{23g} 30 to 46 inches, yellowish-brown (10YR 5/6) silty clay loam; many, fine, distinct mottles of light brownish gray (2.5Y 6/2); moderate, fine, subangular blocky structure; 10 to 20 percent, by volume, consists of fragments of schist and quartz; friable when moist, sticky and slightly plastic when wet; medium acid (pH 5.8).

Depth to mottling ranges from 20 to 36 inches in these soils. In places there is a firm, compact layer at a depth below 24 inches. The parent material contains varying

[3] Symbols express Munsell color notations; unless otherwise stated, color is that of moist soil. Other terms are defined in the Soil Survey Manual (*11*) or in the Glossary.

amounts of lime. Depth to bedrock ranges from 36 inches to many feet.

The Bedford soils have moderately slow permeability, and their available moisture capacity is moderate to moderately high. The soils are moderately fertile. They are easy to work.

Bedford silt loam, 0 to 3 percent slopes (BdA).—This soil has a thicker surface layer and subsoil than those in the profile described as typical for the series. Also, the slopes are less steep.

The soil is well suited to truck crops and general farm crops. It is also well suited to the forage crops commonly grown, except for the deep-rooted ones. Using a cropping system in which a mixture of grasses and legumes is grown every few years improves the soil structure and returns organic matter to the soil. Cultivating on the contour helps to control erosion. White oak, red oak, black oak, tulip-poplar, hickory, and ash are the main trees growing on this soil.

The soil is in capability unit IIw–1; woodland group 8; and group 10 for building sites.

Bedford silt loam, 3 to 8 percent slopes (BdB).—The profile of this soil is similar to the one described as typical for the series, except that this soil is in wooded areas. Consequently, the surface is covered by a thin layer of recently fallen leaves and twigs. Just below is a dark grayish-brown mull of decayed leaves and roots. Underneath the mull is an A_1 horizon, 3 to 5 inches thick, of dark-gray silt loam that has weak, thin, platy, and somewhat granular structure.

The A_2 horizon, underlying the A_1, is yellowish-brown silt loam, 4 to 6 inches thick. It has weak, medium, subangular blocky structure. The layers below the A_2 horizon are similar to those in the typical profile.

In areas of this soil that have been cleared, most farm crops and truck crops grow well if lime and fertilizer are added. The soil is not suited to deep-rooted plants that require a well-drained soil. Using contour stripcropping and diversion terraces on areas that are tilled helps to control erosion. Growing grasses and legumes every few years will return organic matter to the soil. Red oak, white oak, black oak, tulip-poplar, red maple, hickory, and walnut grow well on this soil.

This soil is in capability unit IIe–6; woodland group 8; and group 10 for building sites.

Bedford silt loam, 3 to 8 percent slopes, moderately eroded (BdB2).—The profile of this soil is the same as the profile described as typical for the series.

This soil is well suited to truck crops and to the general farm crops commonly grown in the area. Diversion terraces and contour stripcropping are needed to control erosion in areas that are tilled. Growing a mixture of grasses and legumes every 3 or 4 years in the cropping system will return organic matter to the soil. Red oak, white oak, black oak, hickory, tulip-poplar, walnut, and ash are well suited to this soil.

This soil is in capability unit IIe–6; woodland group 8; and group 10 for building sites.

Beltsville Series

The Beltsville series consists of moderately well drained soils formed in silt over coastal plain unconsolidated sand, clay, and gravel. The surface layer of the soils is dark grayish-brown silt loam. The subsoil is yellowish-brown silt loam that grades to a silty, mottled fragipan at a depth between 15 and 20 inches.

These soils occupy a strip of land about 3 miles wide that borders the Delaware River. They are mainly in the southeastern part of Delaware County, but a few, small, scattered areas are in the Great Valley of Chester County. The native vegetation was a forest of white oak, red oak, chestnut, tulip-poplar, and other hardwoods.

The Beltsville soils are near soils of the Butlertown and Othello series. They are not so well drained as the Butlertown soils and have a thicker, harder fragipan. They are better drained than the Othello soils, which have mottling in or near the surface.

Typical profile of Beltsville silt loam, 0 to 3 percent slopes:

A_p 0 to 7 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, fine, crumb structure; friable when moist; pH 5.0; clear, wavy lower boundary; 6 to 10 inches thick.

B_1 7 to 12 inches, yellowish-brown (10YR 5/6) silt loam; weak, fine, crumb and somewhat weak, thin, platy structure; thin coatings of clay on peds; friable when moist; pH 5.2; clear, wavy lower boundary; 3 to 6 inches thick.

B_{21g} 12 to 22 inches, yellowish-brown (10YR 5/8) silt loam; a few, fine, faint mottles of light brownish gray (2.5Y 6/2); moderate, medium, platy and moderate, medium, blocky structure; thin, discontinuous coatings of clay on the surfaces of peds; firm when moist; pH 5.2; clear, wavy lower boundary; 10 to 15 inches thick.

B_{22m} 22 to 48 inches, yellowish-brown (10YR 5/6) silty clay loam; many, medium, distinct mottles of light brownish gray (2.5Y 6/2) and yellowish red (5YR 5/8); moderate, medium, platy and moderate, medium, blocky structure; very firm when moist, slightly sticky when wet; pH 5.4; 24 to 36 inches thick.

The texture of the surface layer is fairly uniform, and these soils are relatively free of gravel in the uppermost 48 inches. The soils have moderate to slow permeability and are acid throughout the profile. They have a moderate capacity for holding moisture. These soils are better suited to shallow-rooted crops than to deep-rooted ones.

Beltsville silt loam, 0 to 3 percent slopes (BeA).—The profile of this soil is the same as the one described as typical for the series.

In Chester County, east of Paoli, there are several small areas in which the subsoil is redder than that in the typical profile described, depth to mottling is greater, and the fragipan is weaker. The areas were too small to map separately and have been included with this soil in mapping.

Corn, small grain, and hay can be grown on Beltsville silt loam, 0 to 3 percent slopes, but alfalfa is not well suited. The compact, silty layer, at a depth below 15 to 20 inches, prevents adequate drainage, good aeration, and the proper development of roots. Therefore, grasses and legumes that are tolerant of these soil conditions grow best. Fairly large amounts of lime and fertilizer are required, but yields of crops are only fair to good. Red oak, white oak, red maple, and black cherry are the main trees growing on this soil.

This soil is in capability unit IIw–1; woodland group 7; and group 10 for building sites.

Beltsville silt loam, 3 to 8 percent slopes, moderately eroded (BeB2).—Except that nearly 50 percent of the original surface layer has been lost through erosion, the

profile of this soil is similar to that described as typical for the series.

Small grain, corn, and hay crops are suited to this soil. Alfalfa and other deep-rooted crops are not suited. The compact subsoil restricts drainage, good aeration, and the development of roots; therefore, shallow-rooted grasses and legumes are better suited than deep-rooted ones. Crops on this soil respond well if lime and fertilizer are applied according to the needs indicated by soil tests.

Contour stripcropping, diversion terraces, and a cropping system that includes a sod of legumes and grasses at least 50 percent of the time are needed to control erosion and improve the structure of the soil. Red oak, white oak, hickory, Scotch pine, and white pine are well suited to this soil.

This soil is in capability unit IIe–6; woodland group 7; and group 10 for building sites.

Bowmansville Series

The Bowmansville series consists of deep, poorly drained soils on flood plains. The soils formed in deposits of sand, silt, and clay washed from Triassic sandstone and shale. Their surface layer is mottled reddish brown and grayish brown, and their subsoil is mottled brownish yellow and brownish gray. In some places there are stratified layers of sand and silt in the lower part of the B horizon. The Bowmansville soils occur only in the northern part of Chester County. The native vegetation was a forest made up mainly of maple, cottonwood, hickory, red oak, and ash.

The parent material from which the Bowmansville soils formed is similar to that of the Rowland, Penn, Bucks, and Readington soils. The Bowmansville soils, however, have poorer drainage than the Rowland soils, which are also on flood plains. They are in lower positions than the Penn, Bucks, and Readington soils, which occupy areas above the flood plain. The Penn and Bucks soils are well drained, and the Readington soils are moderately well drained. Only one soil of the series—Bowmansville silt loam—is mapped in these two counties.

Typical profile of Bowmansville silt loam:

- A_p 0 to 9 inches, dark reddish-brown (5YR 3/4), red (2.5YR 4/6), and grayish-brown (10YR 5/2) silt loam; a few, medium, faint mottles; weak, thin, platy structure that breaks to weak, fine, crumb structure; friable; strongly acid (pH 5.2), clear, lower boundary; 8 to 11 inches thick.
- C_1 9 to 16 inches, reddish-brown (5YR 4/4) and grayish-brown (2.5Y 5/2) loam; common, medium, distinct mottles; a few small quartz pebbles; weak, fine, crumb structure; friable; strongly acid (pH 5.2); clear, wavy lower boundary; 6 to 8 inches thick.
- D_1 16 to 24 inches, brownish-yellow (10YR 6/6) and light brownish-gray (10YR 6/2) loam; common, medium, distinct mottles; a few quartz pebbles; weak, medium, crumb structure; firm; strongly acid (pH 5.4); gradual, wavy lower boundary; 7 to 10 inches thick.
- D_2 24 to 38 inches, brownish-yellow (10YR 6/6) and light reddish-brown (5YR 6/3) sandy loam; weak, fine, granular structure that breaks to loose, single grains; loose to very friable; strongly acid (pH 5.2); gradual, irregular lower boundary; 12 to 15 inches thick.
- D_3 38 inches +, reddish-brown fragments of arkose sandstone, and rounded quartz pebbles.

The substratum of these soils varies considerably in texture and in the amount of mottling. The texture of the substratum ranges from loam to silty clay loam, and in some places the substratum contains layers of silt and sand. The intensity of mottling in the surface layer and the range in color vary. Depth to the water table ranges from 20 to 36 inches.

Areas of these soils are flooded very frequently, and the water table is near the surface for long periods. In dry seasons, however, the water table may drop to a depth of 3 or 4 feet. Because excess water stands on the soils most of the time, aeration is poor and productivity is medium to low.

Bowmansville silt loam (Bo).—The profile of this soil is the one described as typical for the series.

This nearly level soil is not suited to the cultivated crops commonly grown in these two counties, but it is moderately well suited to pasture. The pastures are of poor quality. This is the result of the poor drainage, which causes aeration to be poor, and because the capacity of the soil for supplying plant nutrients is low. Sedges and reeds persist unless the soil is artificially drained. The pastures could be greatly improved if the areas were drained and adequately limed and fertilized.

This soil is in capability unit VIw–1; woodland group 11; and group 13 for building sites.

Brandywine Series

The Brandywine series consists of well-drained soils that have a thin B horizon. The soils are underlain by partly weathered, coarse-grained gneiss and pegmatite. They have a dark grayish-brown surface layer and a yellowish-brown subsoil. The soils are droughty. They are mainly in areas that are hilly or steep, but in a few places they are on the tops of ridges. The native vegetation was a forest made up of black oak, red oak, chestnut oak, and hickory.

The Brandywine soils are near the Glenelg, Glenville, Worsham, and Chester soils. They are not so fine textured as the Chester and Glenelg soils and are less deep and more droughty. The Brandywine soils have less clay in the subsoil than the Glenville soils, and, unlike those soils, they are free of mottling. They are better drained than the Worsham soils, which have mottling near the surface.

Typical profile of Brandywine loam, 15 to 25 percent slopes:

- A_0 1 inch to 0, dark grayish-brown mull that is partially decomposed.
- A_1 0 to 2 inches, very dark gray (10YR 3/1) loam; weak, very fine, granular structure; very friable when moist; very strongly acid (pH 4.8); clear, wavy lower boundary; 2 to 3 inches thick.
- A_2 2 to 6 inches, grayish-brown (2.5Y 5/2) loam; weak, fine, granular structure; very friable; very strongly acid (pH 5.0); clear, wavy lower boundary; 3 to 5 inches thick.
- B_2 6 to 20 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine, subangular blocky structure; friable; strongly acid (pH 5.3); gradual, wavy lower boundary; 12 to 16 inches thick.
- C_1 20 to 32 inches, yellowish-brown (10YR 5/8) loamy sand stained with dark brown (10YR 4/3); weak, fine, granular structure; single grain; firm in place, but friable if crushed; very strongly acid (pH 4.5); 10 to 15 percent, by volume, consists of fragments of rock; gradual, irregular lower boundary; 10 to 14 inches thick.

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C_2 32 to 60 inches, pale-brown (10YR 6/3) to brownish-yellow (10YR 6/8) loamy sand; weak, fine, granular structure that breaks to single grain; firm in place, but crushes easily in the hand; very strongly acid (pH 4.5); 24 to 30 inches thick.

D_r 60 inches +, solid rock that is but little weathered.

In some places the B_2 horizon is thinner than that in the profile described, or is almost lacking. The texture of the subsoil ranges from loam to sandy loam. The percentage of rock fragments in the profile ranges from 10 to 30 percent by volume.

The permeability of these soils is moderately rapid to rapid. The available moisture capacity is moderate to low, and fertility is medium to low. In the steeper areas most of the original surface layer has been lost through erosion and gullies have formed in a few places. Leaching has been active in these soils, mainly because the soil material is fairly porous.

Brandywine loam, 3 to 8 percent slopes, moderately eroded (BrB2).—This soil has a thinner surface layer and subsoil than those in the profile described as typical for the series. As a result, the profile of this soil is shallower than the profile described. The soil has moderately low available moisture capacity. It is low to moderately low in fertility.

Diversion terraces and contour stripcropping are needed on tilled areas to help control erosion and retain moisture. A sod crop of grasses and legumes should be grown at least once every 3 or 4 years to help increase the content of organic matter and improve the structure of the soil. White oak, red oak, black oak, tulip-poplar, hickory, and ash grow well on this soil.

The soil is in capability unit IIe–5; woodland group 13; and group 7 for building sites.

Brandywine loam, 8 to 15 percent slopes (BrC).—Nearly all of this soil is wooded. It is covered by 1 inch of very dark grayish-brown (2.5Y 3/2) loam that has weak, fine, granular structure. The loam is very friable and is very strongly acid. Just below is the A_1 horizon of light olive-brown (2.5Y 5/4) loam that has weak, fine, granular structure and is 3 inches thick. The A_2 horizon of grayish-brown (10YR 5/2) fine sandy loam has weak, fine, granular structure, is friable, and is 8 inches thick. The B_2 horizon, a brownish-yellow (10YR 6/8) heavy loam, has weak, medium, subangular blocky structure, is friable, and is 12 to 20 inches thick. At a depth below 20 inches, the profile is like the one described as typical for the series.

This soil is fairly well suited to small grain, corn, and hay crops. Yields are limited, however, by the low available moisture capacity. Contour stripcropping, diversion terraces, and sodded waterways are needed to control runoff and to retain the water needed for plants to grow. Lime and fertilizer are required in cultivated areas. They should be applied according to the needs indicated by soil tests. Hay crops ought to be grown at least 2 years out of 4.

White oak, red oak, black oak, chestnut oak, hickory, and beech grow fairly well on this soil.

This soil is in capability unit IIIe–4; woodland group 15; and group 8 for building sites.

Brandywine loam, 8 to 15 percent slopes, moderately eroded (BrC2).—The profile of this soil is similar to the one described as typical for the series, but it is thinner than the one described and it contains fragments of schist. Also, erosion has removed part of the original surface layer, and plowing has mixed part of the subsoil with the remaining surface soil.

This soil is used primarily for pasture and hay crops, but the principal cultivated crops are corn and small grain. The low supply of moisture and low fertility limit yields. Grasses and legumes that grow well, even though the water supply is low, are better suited than other crops. Growing grasses and legumes 2 years in 4 helps build up the content of organic matter and also helps to control erosion. Contour stripcropping and diversion terraces are needed to control erosion on tilled fields. White oak, red oak, hickory, beech, and black oak are well suited to this soil.

This soil is in capability unit IIIe–4; woodland group 15; and group 8 for building sites.

Brandywine loam, 8 to 15 percent slopes, severely eroded (BrC3).—Nearly all of the original surface layer of this soil has been removed by erosion. The present surface layer consists mainly of subsoil. The soil is shallow. Gullies are common.

The available moisture capacity of this soil is low, and the fertility is low. Permeability is moderately rapid.

This soil is better suited to permanent pasture and hay than to other crops. The soil is fairly loose and open, and aeration is good. Considerable leaching occurs during the winter and spring seasons; consequently, large amounts of lime and fertilizer are required. Red oak, white oak, chestnut oak, beech, and hickory are the trees that grow fairly well on this soil.

This soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Brandywine loam, 15 to 25 percent slopes (BrD).—The profile of this soil is the one described as typical for the series.

This soil is all wooded, but it can be used for pasture or hay if it is cleared. Red oak, white oak, black oak, ash, hickory, and beech grow well on this soil.

This soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Brandywine loam, 15 to 25 percent slopes, moderately eroded (BrD2).—This soil is nearly all wooded. The profile is similar to the one described as typical for the series, except that this soil lacks an A_0 horizon and the surface layer is thinner.

This soil is well suited to trees, but it can be used for pasture or hay. Red oak, white oak, black oak, hickory, and beech are well suited.

This soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Brandywine loam, 15 to 25 percent slopes, severely eroded (BrD3).—This soil has lost all or nearly all of its original surface layer through erosion, and, in a few places, part of the subsoil is gone. In other places part of the subsoil has been mixed with the surface layer by plowing. Depth to the parent material is generally between 10 and 14 inches. Fragments of rock are more numerous in the profile than in the profile described as typical for the series. In a few places there are shallow gullies.

This soil is low in fertility, and its available moisture capacity is low. Permeability is moderately rapid to rapid, and the soil is well aerated. This soil is droughty. It is not well suited to tilled crops, but it is suited to pasture or trees.

This soil is in capability unit VIe–2; woodland group 15; and group 8 for building sites.

Brandywine loam, 25 to 40 percent slopes (BrE).—The profile of this soil is shallower than that described as typical for the series. Included with it in mapping are a few areas that are severely eroded. In the eroded areas the A_0 and A_1 horizons are lacking and the present surface layer is grayish-brown (10YR 5/2), very friable loam that has weak, fine, granular structure and is only 3 to 4 inches thick. Mixed with this horizon is soil material from the uppermost part of the subsoil, which is also thin. Just below is a horizon of yellowish-brown (10YR 5/6), friable loam that has weak, fine, subangular blocky structure and is about 8 inches thick. This is underlain by sandy loam material and partially weathered fragments of rock.

Brandywine loam, 25 to 40 percent slopes, is used primarily as woodland and is well suited to that use. Harvest cutting, protection from grazing, and other good management practices are needed in the areas of woodland. Red oak, white oak, black oak, beech, hickory, and dogwood are well suited to this soil.

This soil is in capability unit VIe–2; woodland group 17; and group 9 for building sites.

Brandywine very stony loam, 0 to 8 percent slopes (BsB).—The profile of this soil is somewhat thicker than that described as typical for the series.

The size and number of rocks in this soil make it unsuitable for cultivation. Some areas can be used for pasture, but the pastures are difficult to maintain. The soil is best used as woodland. Black oak, red oak, white oak, tulip-poplar, beech, and hickory are well suited.

This soil is in capability unit VIs–1; woodland group 13; and group 7 for building sites.

Brandywine very stony loam, 8 to 25 percent slopes (BsD).—Except that the profile of this soil is somewhat shallower over bedrock, it is similar to the one described as typical for the series.

The soil is not well suited to cultivated crops, nor is it suited to pasture because of the stones. It is probably best used for trees. White oak, red oak, black oak, hickory, and beech are well suited. Harvest cutting, protection from fire and grazing, and other woodland improvement practices are needed to maintain the productivity of the soil and to prevent erosion.

This soil is in capability unit VIs–1; woodland group 15; and group 8 for building sites.

Brandywine very stony loam, 25 to 50 percent slopes (BsF).—The profile of this soil is thinner than that described as typical for the series.

The large and numerous stones make cultivation impossible. All of this soil is used as woodland, and it is well suited to that use. White oak, red oak, black oak, and beech are well suited.

This soil is in capability unit VIIs–1; woodland group 17; and group 9 for building sites.

Brecknock Series

The soils in the Brecknock series are moderately deep and are well drained. They are underlain by Triassic shale and sandstone, highly metamorphosed by contact with diabase intrusive dikes. Hard porcelanite or slate, resulting from this metamorphism, is on the surface and throughout the subsoil. The fragments of slate range in color from dark blue to purple.

The surface layer of these soils is very dark gray or black, and the subsoil is very dark gray or dark grayish brown. These soils occur only in the northern part of Chester County, where diabase, known locally as traprock, has intruded into the red shale and sandstone of the Triassic system. The native vegetation consisted mainly of red oak, black oak, chestnut oak, and hickory, but it included white oak, tulip-poplar, and dogwood.

The Brecknock soils are near the Penn, Montalto, Lehigh, and Croton soils. They have a darker colored surface layer and subsoil than the Penn soils, which are reddish. Their subsoil contains less clay than that of the Montalto soils, which have stronger brown colors. The parent material of the Brecknock soils is similar to that of the Lehigh soils. The Brecknock soils are better drained than the Lehigh and Croton and are free of mottling. In contrast, the Lehigh soils have a mottled subsoil and the Croton soils are mottled throughout.

Typical profile of Brecknock very stony silt loam, 8 to 25 percent slopes:

- A_{00} 2 inches to 1 inch, litter of hardwood leaves.
- A_0 1 inch to 0, leaf mold that is matted with roots and fungus mycelium.
- A_1 0 to 3 inches, very dark gray (10YR 3/1) very stony silt loam; weak, fine, granular structure; very friable; very strongly acid (pH 4.6); gradual, wavy lower boundary; 2 to 3½ inches thick.
- A_2 3 to 10 inches, very dark gray (N 3/0) stony silt loam; weak, thin, platy structure; friable; about 25 percent, by volume, is coarse fragments; strongly acid (pH 5.2); clear, wavy lower boundary; 5 to 11 inches thick.
- B_{21} 10 to 16 inches, very dark gray (N 3/0) stony silt loam; weak, fine to medium, subangular blocky structure; distinct coats of clay on peds; friable to firm; strongly acid (pH 5.4); gradual, wavy lower boundary; 4 to 8 inches thick.
- B_{22} 16 to 19 inches, dark grayish-brown (2.5Y 4/2) stony silty clay loam; weak to moderate, medium, subangular blocky structure; distinct coats of clay on peds; friable to firm; strongly acid (pH 5.2); about 20 percent, by volume, is coarse fragments; abrupt, wavy lower boundary; 2 to 4 inches thick.
- B_{23} 19 to 27 inches, dark-brown (10YR 3/3) stony silty clay loam; weak, medium, blocky structure; distinct coats of clay on peds; firm; strongly acid (pH 5.4); about 20 percent, by volume, is coarse fragments; clear, wavy lower boundary; 6 to 12 inches thick.
- B_3 27 to 35 inches, dark-brown (10YR 3/3) stony silt loam; weak, medium, blocky structure that breaks to weak, medium, platy structure; partial coatings of clay, and a few coats of manganese on peds; about 20 percent, by volume, is coarse fragments; abrupt, broken lower boundary; firm; strongly acid (pH 5.2); 6 to 10 inches thick.
- C_1 35 to 40 inches, dark-brown (10YR 4/3) stony silt loam that is streaked with dark-gray (N 3/0) silt loam; weak to moderate, medium, platy structure; firm; strongly acid (pH 5.2); contains many partially weathered fragments of slate.
- C_2 40 inches +, very dark bluish-gray (10B 2/1), weathered slate.

In areas near the separation between the Brecknock and Penn series, the lower B horizons have a reddish hue. Depth to the parent material ranges from 15 to 35 inches, and depth to hard rock ranges from 30 to 40 inches. In a few places the texture of the surface layer is loam, but the subsoil is mainly silt loam or silty clay loam.

The available moisture capacity of these soils is moderate, and their permeability is moderate. The soils are low in fertility and are strongly acid throughout the solum.

The stones on the surface and throughout the solum consist of cobbles and boulders of quartzite and slate, as much as 8 inches in diameter. About 25 percent of the

surface layer and 20 percent of the subsoil, by volume, are made up of coarse fragments.

Between 75 and 90 percent of the acreage of Brecknock soils is in forest.

Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded (BtB2).—In most places this soil has lost between 40 and 60 percent of the original surface layer through erosion, and part of the subsoil has been mixed with the remaining surface layer. The present surface layer lacks the large stones typical of the profile described for the series.

Small grain, corn, and hay are the principal crops grown on this soil. Contour cultivation, stripcropping, and diversion terraces are needed to help control erosion in tilled fields. Growing a sod crop of grasses and legumes 2 years in 4 helps to maintain the content of organic matter and improve the structure of the soil. Red oak, white oak, black oak, and beech grow fairly well on this soil.

This soil is in capability unit IIe–5; woodland group 1; and group 5 for building sites.

Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded (BtC2).—This soil has been cultivated, and much of its original surface layer has been lost through erosion. Plowing has mixed material from the subsoil with the remaining surface soil. The resulting surface layer is thinner and less productive than the original one.

This soil has moderate available moisture capacity and is moderately low to low in fertility. There are shallow gullies in a few places. The number of channery fragments in the surface layer hinders cultivation somewhat.

This soil is fairly well suited to small grain, corn, and hay crops. Contour cultivation, contour stripcropping, and diversion terraces are needed to control erosion. Growing a sod of grasses and legumes at least 2 years out of 4 is necessary to add organic matter to the soil and to improve its structure.

This soil is in capability unit IIIe–4; woodland group 3; and group 6 for building sites.

Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded (BtC3).—Nearly all of the original surface layer of this soil is gone, and the entire profile is shallow because of erosion. The present plow layer is made up of material that was formerly in the subsoil. In a few places gullies have formed.

The available moisture capacity of this soil is low, and the soil is low in fertility. Permeability is slow.

This soil is better suited to permanent vegetation than to tilled crops. A permanent sod of grasses and legumes helps to control erosion. Applying lime and fertilizer according to the needs indicated by soil tests will help to maintain the hay crop or pasture. Black oak, chestnut, red oak, beech, and hickory grow on this soil, but yields are low.

This soil is in capability unit IVe–4; woodland group 3; and group 6 for building sites.

Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded (BtD2).—The profile of this soil is shallower and contains fewer stones than that described as typical for the series. There is an occasional gully, caused by erosion, in a few places. Fragments of slate are numerous on the surface and in the subsoil.

This soil is well suited to hay crops or pasture, and it can be plowed occasionally to reseed. A sod of grasses and legumes is needed to control erosion and to maintain the structure of the soil. Apply lime and fertilizer according to the needs indicated by soil tests. This soil is well suited to trees. Several areas that were once cultivated are now used as woodland.

This soil is in capability unit IVe–4; woodland group 3; and group 6 for building sites.

Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded (BtD3).—The profile of this soil is shallower than that described as typical for the series. Nearly all of the original surface layer has been lost through erosion, and the present surface layer consists mainly of material from the subsoil. Included with this soil are a few areas that are slightly to severely eroded. The lower half of the subsoil in these areas is faintly mottled.

Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded, is well suited to permanent pasture, but large amounts of fertilizer and lime are needed to maintain a sod of grasses and legumes. This soil is also well suited to red oak, white oak, black oak, hickory, and beech trees.

This soil is in capability unit VIe–2; woodland group 3; and group 6 for building sites.

Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded (BtE3).—The profile of this soil is very shallow over bedrock. Nearly all of the original surface layer has been lost through erosion, and the present surface layer is made up of material from the upper part of the subsoil. This soil is better suited to trees than to other uses.

The soil is in capability unit VIIe–1; woodland group 5; and group 9 for building sites.

Brecknock very stony silt loam, 0 to 8 percent slopes (BvB).—Except that it has milder slopes, this soil is similar to the one described as typical for the series. Because of stoniness, this soil is unsuitable for cultivation, but it has a limited use for pasture. Red oak, white oak, tulip-poplar, ash, and hickory are well suited.

This soil is in capability unit VIs–1; woodland group 1; and group 5 for building sites.

Brecknock very stony silt loam, 8 to 25 percent slopes (BvD).—The profile of this soil is the one described as typical for the series. This soil is not suited to cultivation, but it has limited use for pasture. Red oak, black oak, white oak, and hickory grow fairly well on this soil.

This soil is in capability unit VIs–1; woodland group 3; and group 6 for building sites.

Brecknock very stony silt loam, 25 to 50 percent slopes (BvF).—The profile of this soil is shallower than the one described as typical for the series. Depth to bedrock is generally about 30 inches.

Because of numerous large stones, this soil is better suited to trees than to tilled crops or pasture, and it should be kept in trees. Red oak, black oak, white oak, and red maple grow fairly well, especially on the north- and east-facing slopes.

This soil is in capability unit VIIs–1; woodland group 5; and group 9 for building sites.

Bucks Series

The Bucks series consists of deep, well-drained soils. The soils are underlain by Triassic red shale and sandstone. The surface layer is dark reddish-brown silt loam. The subsoil is a reddish-brown silty clay loam that in some places has a purplish cast. Beneath the subsoil is a layer

of dark-red, partially weathered fragments of shale. Depth to bedrock ranges from 3 to 5 feet.

These soils are on broad, gently sloping uplands that adjoin steeper areas of Penn soils. They are in the northern part of Chester County and border the Schuylkill River. The soils occupy an area 3 to 5 miles wide. They are east of Phoenixville and extend westward to the Berks County line. The native vegetation was mostly red oak, white oak, black oak, hickory, tulip-poplar, and black walnut.

The Bucks soils are near the Penn, Readington, and Croton soils. They are deeper and their subsoil is better developed than that of the moderately deep Penn soils; they are better drained than the Readington soils, which are moderately well drained, and the Croton soils, which are poorly drained. The Bucks soils, unlike the Readington and Croton soils, are free of mottling. The Readington soils have mottling in the lower part of the subsoil, and the Croton soils have mottling at or near the surface. Only one soil of the series—Bucks silt loam, 3 to 8 percent slopes, moderately eroded—is mapped in these two counties.

Typical profile of Bucks silt loam, 3 to 8 percent slopes, moderately eroded:

- A_p 0 to 9 inches, dark reddish-brown (5YR 3/4) silt loam; weak, fine, granular structure; friable when moist; strongly acid (pH 5.4); clear, smooth lower boundary; about 9 inches thick
- B_1 9 to 13 inches, reddish-brown (5YR 5/4) silt loam; weak, fine, granular structure; friable when moist; medium acid (pH 5.6); clear, wavy lower boundary; 3 to 5 inches thick.
- B_{21} 13 to 27 inches, reddish-brown (5YR 4/4) silty clay loam; weak, fine, subangular blocky structure; thin silt and clay films on peds; friable when moist, slightly sticky when wet; medium acid (pH 6.0); gradual, wavy lower boundary; 12 to 16 inches thick.
- B_{22} 27 to 40 inches, dark-red (2.5YR 3/6) silty clay loam; moderate, medium, blocky structure; thin, discontinuous clay films; friable when moist, sticky when wet; strongly acid (pH 5.2); clear, wavy lower boundary; 10 to 15 inches thick.
- D_1 40 to 46 inches, dark-red (2.5YR 3/6) very shaly silty clay with common patchy, black (N 2/0) coatings, probably of manganese; moderate, medium, blocky structure; firm when moist, sticky when wet; strongly acid (pH 5.2); gradual, wavy lower boundary; 5 to 8 inches thick.
- D_2 46 inches +, dark reddish-brown (2.5YR 3/4) very shaly silty clay with common patchy, black (N 2/0) coatings, probably of manganese; moderate, medium, platy structure that breaks to angular blocky structure; very firm when moist; very strongly acid (pH 5.0); grades to more consolidated bedrock with increasing depth.

Depth to bedrock ranges from 34 to 60 inches. The color of the surface layer ranges from light brown to red or dark red; the more reddish areas are more eroded. The texture of the subsoil ranges from silty clay loam to silty clay.

The permeability and the available moisture capacity of the Bucks soils are moderate. The soils are moderate in fertility, and they are acid throughout the profile in areas that have not been limed. These soils are free of stones, and they are easy to till. They are used mostly for cultivated crops.

Bucks silt loam, 3 to 8 percent slopes, moderately eroded (BxB2).—The profile of this soil is the same as the profile described as typical for the series. Nearly all of the soil is cultivated, but a few areas are in pasture or trees.

Included with this soil in mapping are a few areas near the Schuylkill River in which the surface layer and subsoil are lighter colored than those in the typical Bucks soil. In the included areas the lower part of the subsoil contains rounded pebbles of quartz. The profile in these areas is generally deeper than in the typical Bucks soil.

If properly managed, Bucks silt loam, 3 to 8 percent slopes, moderately eroded, is well suited to all of the crops commonly grown in the area. Because of the moderately low fertility and high acidity of this soil, however, large amounts of lime and fertilizer are needed if alfalfa is to be grown satisfactorily. Diversion terraces and contour stripcropping are needed to control erosion. Growing grasses and legumes every 3 or 4 years in the cropping system also helps to control erosion.

Red oak, white oak, tulip-poplar, black oak, hickory, and walnut grow well on this soil.

The soil is in capability unit IIe-2; woodland group 1; and group 3 for building sites.

Butlertown Series

The Butlertown series consists of moderately well drained soils on coastal plain silt. The surface layer of these soils is dark grayish-brown silt loam. The subsoil is a yellowish-brown silt loam that becomes mottled and more compact with increasing depth. The solum is free of gravel and rock.

These inextensive soils are in Delaware County. They occupy a strip of land about 3 miles wide along the Delaware River near Chester. The areas have an elevation of 125 feet or less. The native vegetation was a forest made up of various kinds of hardwoods, chiefly white oak, red oak, chestnut, and tulip-poplar.

The Butlertown soils are near the Beltsville soils, but, because they are approaching well drained, they are better drained than those soils. Also, depth to the fragipan is greater than in the Beltsville soils, which have a fragipan at a depth between 15 and 20 inches.

Typical profile of Butlertown silt loam, 0 to 3 percent slopes, slightly eroded, in an idle field:

- A_p 0 to 8 inches, dark grayish-brown (2.5YR 4/2) silt loam; weak, fine, granular structure; friable when moist; pH 5.2; gradual, wavy lower boundary; 7 to 12 inches thick.
- A_3 8 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, crumb structure; friable when moist; pH 5.2; clear, wavy lower boundary; 2 to 5 inches thick.
- B_{21} 10 to 20 inches, yellowish-brown (10YR 5/8) silt loam; moderate, medium to coarse, blocky and subangular blocky structure; thin, discontinuous coatings of clay on the surfaces of peds; friable to firm when moist, slightly sticky when wet; pH 5.4; clear, wavy lower boundary; 9 to 12 inches thick.
- B_{22g} 20 to 34 inches, yellowish-brown (10YR 5/6) silt loam; a few, faint mottles of pale brown (10YR 6/3); moderate, medium to thick, platy and blocky structure; firm when moist; gradual, wavy lower boundary; pH 5.4; 12 to 15 inches thick.
- B_{23m} 34 to 50 inches, light yellowish-brown (10YR 6/4) silt loam; a few, fine, distinct mottles of light gray (10YR 7/2); moderate, medium to thick, platy and somewhat blocky structure; firm to very firm when moist, slightly sticky when wet; pH 5.4; this horizon rests on reddish coarse sand and gravel at a depth between 5 and 6 feet.

The fragipan varies in depth and compactness. It also varies in the intensity of the mottling.

These soils have moderately slow permeability and moderate available moisture capacity. In areas that have not been limed, they are strongly acid.

Butlertown silt loam, 0 to 3 percent slopes (ByA).—The profile of this soil is the same as the profile described as typical for the series.

This soil is well suited to truck crops and to the general farm crops commonly grown in the area. It is easy to cultivate and is moderately fertile. The permeability and available moisture capacity are moderate.

If this soil is cultivated, contour tillage is needed to control erosion. Growing grasses and legumes every third year adds organic matter to the soil, improves the structure, and helps reduce erosion. Red oak, white oak, black oak, walnut, and hickory grow well on this soil.

The soil is in capability unit IIw-1; woodland group 1; and group 3 for building sites.

Butlertown silt loam, 3 to 8 percent slopes, moderately eroded (ByB2).—Except that material from the subsoil has been mixed with the remaining original surface layer, the profile of this soil is similar to the profile described as typical for the series.

This soil is well suited to the truck crops and general farm crops commonly grown in the area. It is easy to cultivate and is moderately productive. The soil has moderate available moisture capacity.

If this soil is cultivated, contour stripcropping and diversion terraces are needed to control erosion. Growing grasses and legumes every 3 or 4 years improves the structure of the soil and also helps to control erosion. Red oak, white oak, black oak, hickory, beech, and walnut grow well on this soil.

The soil is in capability unit IIe-6; woodland group 1; and group 3 for building sites.

Calvert Series

The Calvert series is made up of deep, poorly drained soils of the uplands. The soils have a grayish-brown, very dark grayish-brown, or black surface layer. Their subsoil is mottled dark gray and yellowish brown. It is mostly plastic but becomes waxy with increasing depth. The subsoil is underlain by partially weathered serpentine. The native vegetation was mainly black oak and pine of low grade, but it included an occasional white oak.

The Calvert soils are near soils of the Conowingo, Chrome, Aldino, and Neshaminy series. They have a mottled surface layer, unlike the Conowingo soils, which have mottling in the lower part of the subsoil. The Calvert soils are deeper than the Chrome and Aldino soils and are not so well drained as those soils. They are similar in depth to the Neshaminy soils, which are well drained and have a dark-brown or reddish-brown subsoil that is free of mottling.

Typical profile of Calvert silt loam, 0 to 3 percent slopes:

A_p 0 to 9 inches, grayish-brown (2.5YR 5/2) silt loam; a few, fine, distinct mottles of dark brown (7.5YR 4/4); weak, fine, granular structure; friable when moist; medium acid (pH 5.8); clear, wavy lower boundary; 7 to 9 inches thick.

B_1 9 to 13 inches, gray (N 5/0) silty clay loam; a few, medium, distinct mottles of dark reddish brown (5YR 3/3); moderate, thick, platy structure that breaks to blocky structure; friable when moist, slightly sticky and plastic when wet; medium acid (pH 5.6); clear, wavy lower boundary; 3 to 5 inches thick.

B_{21} 13 to 23 inches, gray (5Y 5/1) silty clay; many, coarse, distinct mottles of strong brown (7.5YR 5/8); moderate, medium to coarse, blocky structure; continuous clay films on peds; firm when moist, sticky and plastic when wet; medium acid (pH 5.8); gradual, wavy lower boundary; 10 to 14 inches thick.

B_{22} 23 to 34 inches, gray (5Y 5/1) silty clay; a few, medium, distinct mottles of strong brown (7.5YR 5/8); 60 to 80 percent of this layer has a gray color; moderate, medium, blocky structure; continuous clay films on peds; firm when moist, sticky and plastic when wet; slightly acid (pH 6.2); gradual, irregular lower boundary; 10 to 13 inches thick.

B_{23} 34 to 46 inches, gray (5YR 5/1) silty clay loam; a few, fine, faint mottles; contains many small flakes of mica that glisten when the soil is pressed between the fingers; moderate, coarse, subangular blocky structure; firm when moist, slightly sticky when wet; slightly acid (pH 6.4); 10 to 20 inches.

The depth to bedrock ranges from 3 to 5 feet. Because of a fairly high, fluctuating water table in winter and spring, the surface of this soil is often covered with water during those seasons. In summer, however, the water table is lower, and the surface layer is then dry and compact.

Although the heavy-textured subsoil retains moisture well, the available moisture capacity is fairly low. The low inherent fertility of the soils and their poor aeration, caused by the very slow internal drainage, lower productivity.

Calvert silt loam, 0 to 3 percent slopes (CaA).—The profile of this soil is the same as the profile described as typical for the series.

This soil is not well suited to cultivated crops, but it can be used for hay or pasture. If it is used for hay or pasture, grasses and legumes that tolerate wetness are suited. Open drainage ditches are needed to drain off excess surface water during wet periods. Applying lime and fertilizer according to the needs indicated by soil tests will increase yields. White oak, black oak, hickory, and beech are suited to this soil.

The soil is in capability unit Vw–1; woodland group 11; and group 12 for building sites.

Calvert silt loam, 3 to 8 percent slopes (CaB).—Except that the profile of this soil is shallower, it is otherwise similar to the profile described as typical for the series.

This soil is better suited to pasture or hay than to cultivated crops. Grasses and legumes that grow well on a poorly drained soil should be planted. Open drainage ditches will help to lower the water table and to remove excess surface and subsurface water. If drainage is improved, the soil will be better aerated and plant nutrients will become more readily available. Crops on this soil respond well to applications of lime and fertilizer if the soil is drained. White oak, black oak, hickory, and beech grow well on this soil.

This soil is in capability unit VIw–2; woodland group 11; and group 12 for building sites.

Calvert silt loam, 3 to 8 percent slopes, moderately eroded (CaB2).—This soil has a thinner surface layer than that in the profile described as typical for the series, and it is better aerated.

This soil is better suited to hay crops and pasture than to crops that require tillage. Grasses and legumes that tolerate wetness are the plants that are suited. Applying

lime and fertilizer will help to maintain the vigor of the plants and will increase yields. Open drainage ditches can be used to lower the water table and make the soil more favorable for plants. White oak and black oak are suited to this soil, and hickory, red maple, and beech are fairly well suited.

This soil is in capability unit VIw–2; woodland group 11; and group 12 for building sites.

Chester Series

The Chester series is made up of deep, well-drained, productive soils. The surface layer of these soils is dark brown. The subsoil is strong brown to yellowish red and is friable.

These soils are underlain mainly by schist and gneiss, but in places they are underlain by anorthosite, quartz monzonite, granodiorite, or other igneous rocks. The soils developed from schist are micaceous in the lower part of the B horizon but are more micaceous in the layer just beneath; depth to the parent material, or C horizon, is generally 36 inches. The soils developed on igneous rocks are nearly level, have a deep profile, and are slightly to moderately eroded.

The native vegetation on these soils consisted of various kinds of hardwoods, mainly white oak, red oak, black oak, hickory, tulip-poplar, wild cherry, walnut, ash, and maple.

The Chester soils are near soils of the Glenelg, Manor, Glenville, and Worsham series. These soils all formed on similar parent materials. The Chester soils are deeper than the Glenelg or Manor soils, which are also well drained. They are better drained than the Glenville soils, which are moderately well drained, and the Worsham soils, which are poorly drained.

Typical profile of Chester silt loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, medium, granular structure; friable when moist; medium acid (pH 6.0); clear, wavy lower boundary; 9 to 10 inches thick.

B_1 8 to 12 inches, strong-brown (7.5YR 5/6) silty clay loam; weak, fine, subangular blocky structure; thin clay films; friable when moist; slightly sticky and plastic when wet; neutral (pH 6.6); clear, wavy lower boundary; 3 to 5 inches thick.

B_{21} 12 to 21 inches, strong-brown (7.5YR 5/6) silty clay loam; weak, medium, subangular and angular blocky structure; prominent coatings of clay; friable when moist, slightly sticky and plastic when wet; neutral (pH 6.7); clear, wavy lower boundary; about 10 percent, by volume, is fragments of schist; 7 to 11 inches thick.

B_{22} 21 to 26 inches, yellowish-red (5YR 4/8), micaceous silty clay loam; about 20 percent, by volume, is fragments of schist; weak, thin, platy structure; friable when moist; slightly sticky and slightly plastic when wet; neutral (pH 6.9); clear, wavy lower boundary; 4 to 6 inches thick.

B_3 26 to 33 inches, yellowish-red (5YR 4/8), micaceous silt loam; weak, very thin, platy or subangular blocky structure; very thin, distinct clay films; friable when moist; neutral (pH 7.0); abrupt, wavy lower boundary; 6 to 9 inches thick.

C_1 33 to 37 inches, reddish-brown (5YR 4/4), micaceous silt loam; weak, medium, platy structure that breaks to thin, platy structure; many coatings of manganese; friable when moist; neutral (pH 6.9); abrupt, wavy lower boundary; 5 to 6 inches thick.

C_2 37 to 49 inches, reddish-brown (5YR 4/4), micaceous loam; structureless (saprolite); friable when wet; neutral (pH 7.0); 12 inches thick.

C_3 49 to 64 inches; reddish-brown (5YR 4/4), micaceous loam; structureless (saprolite); very friable when moist; neutral (pH 7.0); 15 inches thick.

The C_1 horizon is heavier than the other horizons in the subsoil and contains little mica.

Depth to the parent material ranges from 32 to 40 inches. The color of the surface layer ranges from dark brown to grayish brown. The Chester soils are generally slightly acid to medium acid in areas that are not limed frequently.

These soils have moderate to moderately rapid permeability. Their available moisture capacity is moderate or moderately high. The Chester soils are easy to work. Crops on these soils respond well if lime and fertilizer are added.

Chester silt loam, 0 to 3 percent slopes (CdA).—This soil is not extensive. Most of it is wooded and has little or no erosion. The surface layer is covered with a thin mat of leached leaf mold. Underlying the leaf mold is an A_1 horizon, 4 inches thick, of very dark grayish-brown (10YR 3/2) silt loam. The silt loam has weak, fine, granular structure and is friable. Just below it is an A_2 horizon, 5 to 7 inches thick, of dark-brown (7.5YR 4/2), friable silt loam that has moderate, medium, subangular blocky structure.

Underlying the A_2 horizon is a layer, 3 to 5 inches thick, of dark-brown (7.5YR 4/4), firm silty clay loam that has moderate, medium, subangular blocky structure. The B_{21} horizon, underlying the B_1, is dark yellowish-brown (10YR 4/4), fairly firm silty clay loam that has moderate, medium, subangular structure. Except that it is very strongly acid, the profile below the B_{21} horizon is like that described as typical for the series.

This soil is suited to all of the crops grown locally including orchard and truck crops. The soil has high available moisture capacity, is moderately fertile, and is easy to work. To control erosion, contour cultivation is needed in fields that are tilled. Keeping a cover crop on areas that are tilled and growing a sod of grasses and legumes once every 4 or 5 years are necessary to add organic matter and improve the structure of the soil. White oak, red oak, black oak, walnut, tulip-poplar, ash, and hickory are suited to this soil.

The soil is in capability unit I–1; woodland group 1; and group 1 for building sites.

Chester silt loam, 0 to 3 percent slopes, moderately eroded (CdA2).—Except that part of the original surface layer has been lost through erosion, the profile of this soil is similar to the one described as typical for the series. In a few places most of the surface layer has been removed mechanically to provide casing soil for growing mushrooms.

This soil has fairly high available moisture capacity. Fertility is moderately high, and the soil is easy to work. Aeration is good, and roots penetrate easily.

This soil is well suited to all of the farm crops, truck crops, and tree fruits commonly grown. A cover crop is needed during the fall and winter months to help protect the soil from erosion. A sod of grasses and legumes is needed about 2 years out of every 4 or 5 years to add organic matter to the soil, improve the structure, and reduce erosion. Red oak, white oak, some black oak, tulip-poplar, hickory, and walnut are well suited to this soil.

The soil is in capability unit IIe–2; woodland group 1; and group 1 for building sites.

Chester silt loam, 3 to 8 percent slopes (CdB).—Nearly all of this soil is wooded, and the surface is covered with a thin layer of leaf mold. The profile of this soil is like that described for Chester silt loam, 0 to 3 percent slopes.

If this soil were cleared for farming, it would be suited to all the crops grown locally, including truck crops and tree fruits. It has high available moisture capacity, is easy to till, and is moderately productive. To reduce erosion, contour cultivation is needed on areas that are tilled. A sod of grasses and legumes is needed 2 years out of every 4 or 5 to add organic matter and to improve the structure of the soil. A cover crop is needed during the fall and winter months to protect the soil. Red oak, white oak, tulip-poplar, hickory, and walnut are well suited to this soil.

This soil is in capability unit IIe–2; woodland group 1; and group 1 for building sites.

Chester silt loam, 3 to 8 percent slopes, moderately eroded (CdB2).—The profile of this soil is the same as the profile described as typical for the series. The soil has moderate available moisture capacity, and it is moderately permeable. Aeration is good, and roots can penetrate easily.

This soil is well suited to general farm crops, tree fruits, and truck crops. Contour stripcropping and diversion terraces are needed to control erosion in areas that are tilled. A sod crop of grasses and legumes is needed 2 out of every 4 years. The sod crop will reduce erosion, add organic matter, and improve the structure of the soil. White oak, red oak, black oak, tulip-poplar, wild cherry, hickory, and walnut all grow well on this soil.

The soil is in capability unit IIe–2; woodland group 1; and group 1 for building sites.

Chester silt loam, 3 to 8 percent slopes, severely eroded (CdB3).—Nearly all of the original surface layer of this soil has been removed mechanically or has been lost through erosion. The present plow layer consists mostly of material from the upper part of the original subsoil. In many places near Kennett Square and West Grove, the surface layer has been removed to provide casing soil for growing mushrooms. Both the surface layer and subsoil are shallower than those in the profile described as typical for the series. In most places depth to the parent material is only 28 to 30 inches.

Contour stripcropping and diversion terraces are needed on this soil to control erosion. Grasses and legumes are needed in the cropping system every third year to build up the organic matter and to improve the available moisture capacity of the soil. Applications of lime and fertilizer are required to help established grasses and legumes. In a few areas trees will provide a satisfactory cover. White pine, Scotch pine, Norway spruce, and Virginia pine grow well on this soil.

The soil is in capability unit IIIe–2; woodland group 1; and group 1 for building sites.

Chester silt loam, 8 to 15 percent slopes (CdC).—Nearly all of this soil is wooded, and the surface is covered with a thin layer of leaf mold. Beneath the leaf mold is the A_1 horizon, which consists of 3 to 5 inches of dark grayish-brown (10YR 4/2), friable silt loam that has weak, fine, granular structure. The A_2 horizon, underlying the A_1, is a layer, 4 to 6 inches thick, of dark-brown (7.5YR 4/2), friable silt loam that has moderate, medium, subangular blocky structure. The B_1 horizon, underlying the A_2, is 2 to 4 inches thick. It consists of dark-brown (7.5YR 4/4) silty clay loam that has moderate, medium, subangular blocky structure. The B_1 horizon has thin, continuous clay films on the peds and firm consistence. The part of the profile below it is similar to the lower part of the profile described as typical for the series.

This soil is well suited to trees, and most of it is wooded. In areas that have been cleared, general farm crops, pasture crops, and orchards grow well. Contour stripcropping and diversion terraces are needed on areas that are tilled. A sod crop of grasses and legumes should be grown every third year to improve the structure and aeration of the soil, and to reduce erosion. White oak, red oak, black oak, tulip-poplar, hickory, and walnut grow well on this soil.

The soil is in capability unit IIIe–2; woodland group 3; and group 2 for building sites.

Chester silt loam, 8 to 15 percent slopes, moderately eroded (CdC2).—This soil has lost at least 50 percent of its original surface layer through erosion, and material from the upper part of the subsoil has been mixed with the remaining surface layer by plowing. The profile is thinner than that in the profile described as typical for the series, but, otherwise, the two profiles are similar.

In most places the permeability of this soil is moderately rapid, aeration is good, and the available moisture capacity is moderately high. The soil is moderately fertile and is easy to work.

This soil is moderately well suited to the crops commonly grown in the area, including truck crops and tree fruits. Contour stripcropping and diversion terraces are needed to reduce runoff and to help control erosion. A sod of grasses and legumes is needed in the cropping system every third and fourth year. The sod provides additional protection for the soil and adds organic matter. White pine, Scotch pine, Norway spruce, tulip-poplar, walnut, white oak, red oak, and black oak grow well on this soil.

The soil is in capability unit IIIe–2; woodland group 3; and group 2 for building sites.

Chester silt loam, 8 to 15 percent slopes, severely eroded (CdC3).—This soil has lost nearly all of its original surface layer through erosion. The present surface layer consists mostly of material from the original subsoil, which was mixed with the remaining surface soil by plowing. Gullies 1 to 2 feet deep occur in many places.

The available moisture capacity of this soil is moderately low. Permeability is moderately slow, and the soil is moderately low in fertility.

This soil is better suited to a permanent sod of either pasture or hay than to crops that require tillage. Fertilizer and lime are needed for new seedings and to help maintain yields. They should be applied according to the needs indicated by soil tests. Hardwood trees of various kinds are well suited to this soil.

The soil is in capability unit IVe-2; woodland group 3; and group 2 for building sites.

Chester very stony silt loam, 0 to 8 percent slopes (CgB).—Except that it contains stones, the profile of this soil is similar to the one described as typical for the series. The numerous large stones make the soil unsuitable for cultivation. Nearly all of the areas are in trees. If cleared, the soil has only limited use for pasture. Red

oak, white oak, black oak, hickory, cherry, and beech grow fairly well on this soil.

The soil is in capability unit VIs–1; woodland group 1; and group 5 for building sites.

Chester very stony silt loam, 8 to 15 percent slopes (CgC).—The profile of this soil is shallower over bedrock than the one described as typical for the series. Numerous boulders and stones of various sizes make the soil unsuitable for cultivation, but it can be used for pasture. White oak, red oak, black oak, and tulip-poplar grow well on this soil, and hickory, beech, and wild cherry grow fairly well.

This soil is in capability unit VIs–1; woodland group 3; and group 6 for building sites.

Chewacla Series

The Chewacla series consists of deep, moderately well drained soils. The alluvial sediments were washed from soils developed on uplands from materials weathered from gneiss, schist, quartzite, anorthosite, and quartz monzonite. The surface layer of these soils is dark brown, and the subsoil is yellowish brown or dark brown. The native vegetation was a forest made up of red oak, white oak, black oak, ash, tulip-poplar, hickory, and maple.

The Chewacla soils are near the Congaree and Wehadkee soils. They are not so well drained as the Congaree soils, and, unlike those soils, have a mottled subsoil. They are better drained than the Wehadkee soils, which have a mottled, dark surface layer. Only one soil of the series—Chewacla silt loam—is mapped in these two counties.

Typical profile of Chewacla silt loam:

A_p 0 to 9 inches, dark-brown (10YR 3/4) silt loam; weak, fine, crumb structure; friable; strongly acid (pH 5.4); clear, smooth lower boundary; 7 to 9 inches thick.

C_1 9 to 15 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; strongly acid (pH 5.4); gradual, wavy lower boundary; 5 to 7 inches thick.

C_2 15 to 24 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, subangular blocky structure; firm; strongly acid (pH 5.4); gradual, wavy lower boundary; 8 to 12 inches thick.

C_3 24 to 30 inches, brown (10YR 5/3) silt loam; few, medium, faint mottles of light brownish-gray (10YR 6/2); moderate, medium, subangular blocky structure; firm; medium acid (pH 5.8); gradual, wavy lower boundary; 4 to 6 inches thick.

C_4 30 inches +, yellowish-brown (10YR 5/6) silt loam; common, medium, faint mottles of light brownish gray (10YR 6/2) that become distinct and coarse with increasing depth; weak, fine, subangular blocky structure; friable; medium acid (pH 5.8); flakes of mica are common in the subsoil.

Depth to mottling ranges from 12 to 30 inches, and the texture and degree of mottling in the deeper layers varies considerably. Stratification of the sandy and silty materials occurs in some places, mostly along small streams that are subject to frequent overflow.

The available moisture capacity is moderate, and permeability is moderate. The supply of plant nutrients and organic matter is good. The Chewacla soils are free of stones. They are easy to till and can be tilled within a wide range of moisture content.

Chewacla silt loam (Ch).—The profile of this soil is the same as that described for the series.

This soil occurs along streams where it is flooded occasionally. The soil is productive and is well suited to the crops commonly grown in the area. Restricted drainage and the hazard of floods during winter and spring, however, restrict the growth of some crops. Much of the soil is used for pasture.

White oak, red oak, walnut, hickory, tulip-poplar, and ash grow well on this soil.

The soil is in capability unit IIw–2; woodland group 7; and group 13 for building sites.

Chrome Series

The soils of the Chrome series are shallow to moderately deep and are well drained. Their surface layer is a dark-colored, gravelly silty clay loam. The subsoil, a dark yellowish-brown clay or silty clay, is sticky when wet and hard when dry. Just beneath the subsoil is a thin layer of olive-green, channery, waxy silty clay that rests on the parent rock of acid serpentine. The native vegetation was a forest made up chiefly of scrub white oak, red oak, blackjack oak, stunted cedar, and dwarfed white pine.

These soils are nearly level to very steep, but are predominantly gently sloping or moderately sloping. They are mostly in the southwestern part of Chester County, known locally as the barrens. However, scattered, small areas occur north and south of West Chester. In Delaware County the areas are scattered from Lima northeastward to Newtown Square.

The Chrome soils are near soils of the Conowingo, Aldino, and Calvert series, all of which formed from similar parent material. They are shallower and better drained than the Conowingo soils, and, unlike those soils, are free of mottling in the subsoil. Their surface layer is not so dark as that of the Aldino soils, and the Chrome soils lack the compact claypan that occurs in many places in the Aldino soils. The Chrome soils are shallower and better drained than the Calvert soils, and the color of their surface layer differs. The Calvert soils have a grayish-brown, very dark grayish-brown, or black surface layer.

Typical profile of Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 7 inches, dark yellowish-brown (10YR 4/3) gravelly silty clay loam; weak, fine and medium, granular structure; friable when moist and slightly plastic when wet; slightly acid (pH 6.4); clear, wavy lower boundary; 5 to 8 inches thick.

B_2 7 to 15 inches, dark yellowish-brown (10YR 3/4) silty clay; strong, very fine, prismatic and moderate, fine, angular blocky structure; clay films on peds; firm when moist, sticky and plastic when wet; medium acid (pH 5.8); clear, wavy lower boundary; 6 to 10 inches thick.

C 15 inches +, dark yellowish-brown, waxy clay; partly weathered rocks of serpentine; 75 to 90 percent, by volume, consists of rock.

Depth to the parent material ranges from 6 to 30 inches in these soils. In a few places in Delaware County, these soils are underlain by serpentine that contains a greater proportion of metapyroxenite and metaperidotite than the bedrock underlying the typical soil. In these places the profile is dark red.

These soils have moderately slow permeability. The fairly heavy texture of the subsoil and the shallowness of the profile restrict the available moisture capacity. In most places there are stones on or near the surface. The steep areas and a few areas on ridgetops where the soils are very shallow are severely eroded. In these places the

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soil material is washed away soon after it weathers from the serpentine.

Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded (CkB2).—The profile of this soil is the same as the one described as typical for the series. Included with this soil are a few areas in which there is severe erosion. In these areas the soil consists of a mixture of soil material and fragments of rock in a layer, 2 to 5 inches thick, that lies directly on serpentine. The vegetation on these areas is sparse. It consists mainly of broomsedge, povertygrass, and false redtop, but includes an occasional pine of low grade.

In places where Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded, is 15 to 18 inches deep, corn, small grain, hay, and other general farm crops are grown. The soil has moderately low available moisture capacity and is not suited to deep-rooted crops.

Diversion terraces and contour stripcropping are needed to control erosion in fields that are tilled. Constructing diversion terraces, however, is likely to be difficult in places because of the shallowness to rock. A cropping system in which grain is grown for 2 years and then is followed by 2 or 3 years of hay is needed to help maintain the content of organic matter and improve the structure of the soil. Pitch pine, larch, Scotch pine, and Norway spruce are suitable for this soil.

The soil is in capability unit IIe–5; woodland group 13; and group 7 for building sites.

Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded (CkC2).—The profile of this soil is thinner than the profile described as typical for the series. The present surface layer is made up of material from the subsoil that has been mixed with the remaining surface soil by plowing.

This soil has low available moisture capacity and is moderately low in fertility. In most places it is easy to work.

This soil is well suited to general farm crops, including hay crops and pasture. Because the profile is shallow, the soil is not suited to deep-rooted crops. Contour stripcropping and diversion terraces are needed to control erosion and prevent runoff. Constructing diversion terraces, however, is likely to be difficult in places because of shallowness to rock. Growing a sod of grasses and legumes 2 years out of 4 helps to keep the soil in good tilth and also controls erosion. Black oak, pitch pine, Norway spruce, white pine, and Scotch pine grow well on this soil.

The soil is in capability unit IIIe–4; woodland group 15; and group 8 for building sites.

Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded (CkC3).—This soil has a thinner surface layer and subsoil than those in the profile described as typical for the series. The entire profile is shallow over bedrock. In many places the profile is less than 8 inches thick and fragments of serpentine are mixed with the surface soil. Many areas have been burned over frequently and are severely eroded. The soil is low in available moisture capacity and in fertility. It can be used for hay and pasture if adequate amounts of lime and fertilizer are applied. Pines and hardwoods of low grade grow on this soil, but they seldom reach normal height.

This soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded (CkD2).—Most of this soil is forested. Much of the leaf mold normally on the surface of a forested soil has been burned off, and only a very thin layer or none of the leaf mold remains.

The surface layer consists of 1 inch of very dark brown (10YR 2/2) silt loam that has weak, fine, granular structure and is friable. Just beneath is a layer, 6 inches thick, of dark yellowish-brown (10YR 4/4) silty clay loam. The silty clay loam has moderate, fine, subangular blocky structure but breaks to granular structure and is slightly sticky. Underlying this layer is a horizon, about 3 inches thick, of dark yellowish-brown (10YR 3/4) silty clay that has moderate, very fine, prismatic and moderate, fine, angular blocky structure. The silty clay is firm when moist and sticky and plastic when wet. The underlying material is mostly weathered serpentine.

This soil has low available moisture capacity. Its best use is probably as woodland. If the soil is cleared, keeping the areas in hay or permanent pasture will help to control erosion. A permanent cover is necessary because of the shallow profile and steep slopes.

This soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded (CkD3).—The profile of this soil is thinner than that described as typical for the series. Most of the original surface layer has been removed by erosion. As a result of frequent burning, the stand of trees and grass is thin in most places.

This soil is not suited to cultivated crops. A permanent cover of plants is needed to control erosion.

The soil is in capability unit VIe–2; woodland group 15; and group 8 for building sites.

Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded (CkE2).—This soil has a thinner surface layer and subsoil than those in the profile described as typical for the series. All of this soil is wooded and should remain in trees.

This soil is in capability unit VIIe–1; woodland group 17; and group 9 for building sites.

Conestoga Series

The Conestoga series consists of deep, well-drained soils of uplands. The soils developed from calciferous schist, micaceous limestone, or marble. The surface layer is dark-brown silt loam. The subsoil is dark yellowish-brown or yellowish-brown silty clay loam. The native vegetation was a forest, consisting chiefly of white oak, red oak, tulip-poplar, hickory, black oak, and beech.

These soils are mostly in Chester Valley. Chester Valley is a narrow strip of land that extends from Atglen near the western edge of the county, northeastward through Coatesville. It leaves the county near Valley Forge State Park. The few areas near Doe Run, West Grove, and Avondale are underlain by marble.

The Conestoga soils are near the Hollinger, Bedford, Lawrence, Guthrie, and Hagerstown soils, all of which developed on lime-bearing schist or limestone. The Conestoga soils are deeper than the Hollinger soils. Unlike the Bedford and Lawrence soils, they lack mottling in the lower part of the subsoil. The Conestoga and Guthrie soils are similar in depth, but the Guthrie soils are poorly drained and have mottling near the surface. The Conestoga soils do not have so much clay in the subsoil as the Hagerstown soils, nor do they have a reddish

color in the lower part of the subsoil like the Hagerstown soils.

Typical profile of Conestoga silt loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 8 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable when moist; medium acid (pH 6.0); clear, wavy lower boundary; 7 to 9 inches thick.

B_{21} 8 to 17 inches, yellowish-red (5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable to firm when moist; medium acid (pH 6.0); gradual, irregular lower boundary; 8 to 10 inches thick.

B_{22} 17 to 31 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium to coarse, subangular blocky structure; thin, continuous clay films on peds; firm when moist, sticky and slightly plastic when wet; slightly acid; (pH 6.5); gradual, irregular boundary; 12 to 15 inches thick.

B_{23} 31 to 40 inches, yellowish-brown (10YR 5/8) silty clay loam; moderate, medium to coarse, subangular blocky structure; firm when moist, sticky and slightly plastic when wet; neutral (pH 7.0); gradual, irregular lower boundary; 8 to 10 inches thick.

C 40 to 60 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, fine crumb structure; very friable to loose when moist; slightly acid (pH 6.2); gradual, wavy lower boundary; 15 to 25 inches thick; there are numerous flakes and fragments of schist in this horizon.

Depth to the C horizon ranges from 36 to 60 inches, but generally the depth is about 36 inches. The texture of the subsoil ranges from silt loam to silty clay loam. In some places the substratum is micaceous silt loam, but in others it is fine sandy loam. In places the soils are underlain by marble, and the subsoil contains many quartz crystals.

The Conestoga soils are moderately permeable, and they have moderately high available moisture capacity. These soils are moderately productive. They are easily worked and are well aerated, but they are very erodible.

Conestoga silt loam, 0 to 3 percent slopes (CmA).—This soil has a somewhat thicker surface layer than the one in the profile described as typical for the series. It has a layer of leaf litter on the surface.

This soil has moderately high available moisture capacity. It is moderate to high in productivity.

Included with this soil in mapping are a few areas that are slightly to moderately eroded.

Much of Conestoga silt loam, 0 to 3 percent slopes, is wooded or is not used for crops. Nevertheless, all of the general farm crops, tree fruits, and truck crops grown in the area grow well on this soil. If the soil is tilled, contour cultivation is needed to control erosion. Also, a sod of grasses and legumes is needed every 4 or 5 years to add organic matter and to improve the structure of the soil. A cover crop is desirable to control erosion during the winter and spring months. Red oak, white oak, black oak, and tulip-poplar are well suited to this soil, and hickory and walnut are fairly well suited.

This soil is in capability unit I–1; woodland group 2; and group 1 for building sites.

Conestoga silt loam, 0 to 3 percent slopes, moderately eroded (CmA2).—The profile of this soil is similar to the profile described as typical for the series. Included with the soil are a few nearly level areas that are not eroded and that have a surface layer 10 to 12 inches thick.

Conestoga silt loam, 0 to 3 percent slopes, moderately eroded, has moderately high available moisture capacity and is moderate to high in fertility. The soil is easy to work.

Most of this soil is cultivated; all of the general farm crops, tree fruits, and truck crops grown locally grow well on it. Contour cultivation is needed to control erosion in areas that are tilled. A sod of grasses and legumes is needed 2 years out of every 4 to add organic matter to the soil and to improve its structure. A cover crop is also needed to control erosion during the winter and spring months. Red oak, white oak, black oak, and tulip-poplar are well suited to this soil, as are hickory and walnut.

This soil is in capability unit IIe–1; woodland group 2; and group 1 for building sites.

Conestoga silt loam, 3 to 8 percent slopes, moderately eroded (CmB2).—The profile of this soil is the same as the profile described as typical for the series. The soil has moderately high available moisture capacity and good permeability and aeration. Included with it are a few areas that are only moderately well drained.

Conestoga silt loam, 3 to 8 percent slopes, moderately eroded, is well suited to all the general farm crops grown locally and to tree fruits and truck crops. The soil is highly erodible. Contour stripcropping and diversion terraces are needed to control erosion in fields that are tilled. Grasses and legumes, grown every 3 or 4 years, also help to reduce erosion. They improve the structure of the soil and add organic matter. White oak, red oak, black oak, tulip-poplar, wild cherry, hickory, and walnut grow well on this soil.

The soil is in capability unit IIe–1; woodland group 2; and group 1 for building sites.

Conestoga silt loam, 8 to 15 percent slopes, moderately eroded (CmC2).—The profile of this soil is generally shallower than the profile described as typical for the series. This soil is moderate in available moisture capacity and has moderately rapid permeability. Roots penetrate fairly easily, and aeration is good. The soil is moderately productive and is easy to work, but it is highly erodible. Included with this soil in mapping are a few areas that are slightly or severely eroded.

Conestoga silt loam, 8 to 15 percent slopes, moderately eroded, is well suited to the farm crops commonly grown and to tree fruits and truck crops. Contour stripcropping and diversion terraces are needed to control erosion. Growing grasses and legumes in the cropping system every third and fourth year gives added protection and also adds organic matter to the soil. White oak, red oak, black oak, tulip-poplar, walnut, and hickory grow well on this soil.

The soil is in capability unit IIIe–1; woodland group 4; and group 2 for building sites.

Conestoga silt loam, 8 to 15 percent slopes, severely eroded (CmC3).—The profile of this soil is thinner than the one described as typical for the series. Depth to the C horizon is generally about 30 inches. The soil has lost nearly all of its original surface layer through erosion, and material from the upper part of the subsoil has been mixed with the remaining surface layer by plowing. The available moisture capacity is moderate, and permeability is moderate.

This soil is better suited to permanent vegetation than to crops that require tillage. A cropping system is needed in which close-growing crops are grown at least four-fifths of the time. The soil is well suited to the

grasses and legumes commonly grown in the area. Lime and fertilizer are needed to help maintain good yields. White oak, red oak, and black oak grow well on this soil, and chestnut oak, tulip-poplar, and beech grow fairly well.

This soil is in capability unit IVe–1; woodland group 4; and group 2 for building sites.

Congaree Series

The Congaree series consists of deep, well-drained soils of the flood plains. The areas are along streams that drain uplands in which the soils formed mainly from materials weathered from schist, gneiss, anorthosite, and quartz monzonite. The Congaree soils have a thick, light-brown, silty surface layer underlain by stratified silty or loamy material. Most areas are flooded occasionally and receive fresh deposits of silty material. The areas are mostly on the flood plains of Brandywine Creek and its tributaries, but some are scattered along other streams in both counties. The native vegetation consisted chiefly of white oak, red oak, elm, hickory, beech, cottonwood, tulip-poplar, and an undergrowth of vines and grasses.

The Congaree soils are near soils of the Chewacla and Wehadkee series, which are also on flood plains. They are better drained than those soils. The Chewacla soils are moderately well drained, and the Wehadkee are poorly drained. Only one soil of this series—Congaree silt loam—is mapped in these two counties.

Profile of Congaree silt loam:

A_p 0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; medium acid (pH 6.0); clear, wavy lower boundary; 8 to 10 inches thick.

C_1 9 to 19 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable when moist; strongly acid (pH 5.4); gradual, wavy lower boundary; 9 to 12 inches thick.

C_2 19 to 27 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable when moist, slightly sticky when wet; gradual, wavy lower boundary; strongly acid (pH 5.4); 8 to 10 inches thick.

C_3 27 to 46 inches, dark-brown (10YR 4/3), micaceous silt loam; moderate, medium, subangular blocky structure; friable when moist, slightly sticky when wet; clear, wavy lower boundary; strongly acid (pH 5.4); 18 to 24 inches thick.

C_4 46 inches +, reddish-yellow (7.5YR 7/6), micaceous silt loam that is mottled with olive gray (5Y 5/2).

In places the profile has layers of stratified sand and silt. In some places it contains more mica than the typical profile, and the color of the different layers is more reddish. Depth to mottling ranges from 36 to about 60 inches.

The Congaree soils have moderate to good available moisture capacity and moderately rapid permeability. They are easy to work, but in some places there are a few stones on the surface. Because of the hazard of overflow, mainly along Brandywine Creek, the use of these soils for clean-tilled crops is limited. The soils are used principally for pasture or hay crops.

Congaree silt loam (Cn).—The profile of this soil is the same as the profile described as typical for the series. The soil is fertile and is well aerated.

This soil is suitable for cultivated crops, but, because it occurs in small areas along streams where it is likely to be flooded, it is nearly all used for pasture. The floodwaters are shallow and remain for only short periods. Applying lime and fertilizer increases the quality and yield of the pastures. Frequent mowing is necessary to control weeds and to improve the carrying capacity of the pastures. A cover crop is needed during the winter and early in spring on areas that are tilled. The cover crop keeps the soil from washing during occasional periods of high water.

This soil is in capability unit I–2; woodland group 1; and group 13 for building sites.

Conowingo Series

The Conowingo series consists of moderately deep to deep, moderately well drained to somewhat poorly drained soils underlain by serpentine. The surface layer of these soils is olive colored. The subsoil is mottled yellowish brown and olive gray and is underlain by partially weathered rock.

The native vegetation was white oak, red oak, black oak, chestnut oak, hickory, and walnut. The second-growth stands consist mostly of pines and hardwoods of poor quality.

The Conowingo soils are near the Chrome, Aldino, and Calvert soils, which formed on similar parent material. The Conowingo soils are not so well drained as the Chrome soils. The Conowingo soils are better drained than the Calvert soils, which are deep and poorly drained.

Typical profile of Conowingo silt loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 9 inches, olive (5Y 4/3) silt loam; weak, fine, granular structure; friable when moist; strongly acid (pH 5.4); clear, smooth lower boundary; 8 to 10 inches thick.

B_{21} 9 to 13 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; thin clay films on peds; friable when moist, slightly sticky when wet; strongly acid (pH 5.0); clear, wavy lower boundary; 3 to 5 inches thick.

B_{22} 13 to 19 inches, yellowish-brown (10YR 5/8) silty clay loam; common, fine to medium, distinct mottles of olive gray (5Y 5/2); moderate, medium to coarse, blocky structure; thin coatings of clay on peds; friable to firm when moist, sticky when wet; very strongly acid (pH 4.8); clear, wavy lower boundary; 5 to 8 inches thick.

B_{23} 19 to 36 inches, dark yellowish-brown (10YR 4/4) silty clay loam that is mottled with olive gray (5Y 5/2); moderate, medium to coarse, blocky structure; firm when moist, slightly plastic and sticky when wet; a few small mica flakes; strongly acid (pH 5.2); gradual, wavy lower boundary; 15 to 20 inches thick.

C 36 inches +, dark yellowish-brown (10YR 4/4) clay loam; moderate, coarse, blocky structure; firm when moist; medium acid (pH 5.8); very distinct coatings of manganese; partially weathered serpentine.

The color of the surface layer ranges from light gray to olive gray in these soils, and that of the subsoil, from pale yellow to yellowish brown. Mottling is at a depth between 15 and 25 inches. The depth to parent material ranges from 18 to 36 inches, but bedrock is generally at a depth between 30 and 40 inches. In a few places the manganese coatings are more distinct in the lower part of the subsoil than they are in the typical profile described.

These soils have moderate available moisture capacity and moderately slow permeability. They are moderately fertile, but they need lime.

Conowingo silt loam, 0 to 3 percent slopes (CoA).—The surface layer of this soil is thicker in most places than that in the profile described as typical for the series, and

it contains more organic matter. There has also been less erosion.

This soil is easy to work. It is suitable for most crops, except for those that are likely to be damaged by an occasional high water table. Contour cultivation is needed to control erosion in areas that are tilled. Open drains can be used to carry off the excess water. The soil needs to be kept under a hay crop or permanent cover at least 2 years out of 4. White pine, red pine, Norway spruce, and black locust grow well on this soil.

The soil is in capability unit IIIw–2; woodland group 7; and group 10 for building sites.

Conowingo silt loam, 3 to 8 percent slopes, moderately eroded (CoB2).—The profile of this soil is the same as that described as typical for the series.

Except for alfalfa and other deep-rooted plants that do not tolerate wetness, this soil is suited to the general farm crops commonly grown in this area. Diversion terraces and contour stripcropping are needed to control erosion in fields that are cultivated. A cropping system suitable for this soil will include a mixture of grasses and legumes grown at least 50 percent of the time. The grasses and legumes add organic matter to the soil and improve the structure of the surface layer and subsoil. White oak, white pine, red pine, Norway spruce, black locust, and larch grow well on this soil.

The soil is in capability unit IIIw–2; woodland group 7; and group 10 for building sites.

Croton Series

The Croton series consists of poorly drained soils on uplands. The soils are underlain by Triassic red and gray shale and sandstone. They occur only in the northern part of Chester County. The native vegetation was a hardwood forest made up of white oak, red oak, black oak, beech, maple, and hickory.

These soils have a surface layer of dark-brown silt loam that is mottled with gray. The subsoil is a mottled yellowish-brown and reddish-brown silty clay loam. A claypan that in most places occurs at a depth between 15 and 22 inches keeps the subsoil waterlogged much of the time.

The Croton soils are near the Readington, Penn, and Bucks soils, all of which formed from similar parent material. They have a darker surface layer than the Readington soils and are not so well drained. Unlike the Penn and Bucks soils, which are well drained and free of mottling in the substratum, the Croton soils have mottling near the surface.

Typical profile of Croton silt loam, 0 to 3 percent slopes:

A_p 0 to 9 inches, dark-brown (10YR 3/3) and dark-gray (10YR 4/1) silt loam; a few fine, faint mottles; weak, fine, crumb structure; friable when moist; medium acid (pH 5.6); clear, smooth lower boundary; 8 to 10 inches thick.

B_{1g} 9 to 14 inches, mottled yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) silt loam; weak, fine, subangular blocky structure; thin clay films on peds; friable when moist; medium acid (pH 5.9); clear, wavy lower boundary; 4 to 6 inches thick.

B_{21g} 14 to 18 inches, distinctly mottled yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) silty clay loam; weak, medium, subangular blocky structure; clay films on the surfaces of peds; friable to firm when moist, slightly sticky when wet; medium acid (pH 5.8); clear, wavy lower boundary; 3 to 5 inches thick.

B_{22g} 18 to 30 inches, distinctly mottled light-brown (7.5YR 6/4), reddish-brown (5YR 4/4), and gray (5YR 6/1) silty clay loam; moderate, medium, platy structure that breaks to subangular blocky structure; firm when moist (claypan), sticky and plastic when wet; strongly acid (pH 5.2); gradual, wavy lower boundary; 10 to 15 inches thick.

B_{23g} 30 to 38 inches, distinctly mottled light reddish-brown (5YR 6/3) and reddish-yellow (7.5YR 6/6) silty clay; common, medium, distinct mottles; moderate, medium, blocky and somewhat platy structure; clay films on peds; very firm when moist (compact layer or claypan), sticky and plastic when wet; very strongly acid (pH 5.0); clear, wavy lower boundary; 7 to 10 inches thick.

C 38 inches +, partly weathered red shale; most of the fragments of shale have a cover of light gray.

In places where the soil is shallower than normal, the subsoil has a pinkish cast. In a few low-lying areas, the profile is deeper than the profile described as typical because deposits have washed in from higher areas. These soils are predominantly gray or dark gray in areas that are near the Brecknock soils. The thickness of the claypan ranges from 12 to 24 inches.

The Croton soils are moderately low in productivity. Permeability is slow and aeration is poor. In most places excess water stands on the surface or the water table is high most of the time. In periods of dry weather, the available moisture capacity is low.

Croton silt loam, 0 to 3 percent slopes (CrA).—The profile of this soil is the same as the profile described as typical for the series.

Mapped with this soil are small areas of a very poorly drained soil that is waterlogged most of the year. In these areas there is an old, buried soil that has a surface layer stained with organic matter. This buried soil underlies varying depths of lighter colored overwash. The areas in which it occurs are near Harmonyville.

Croton silt loam, 0 to 3 percent slopes, is not well suited to tilled crops and is best used for hay or pasture. Tilth is fair to poor. Open ditches are needed to remove the excess water in both the surface layer and subsoil and to improve aeration. Because of the compact subsoil, tile drainage is generally inadequate. Grasses and legumes that tolerate wetness are better suited to this soil than other crops. If the soil is used for crops, bedding is needed to improve the drainage and thus increase yields. Maple, cottonwood, hickory, and ash are suited to this soil.

The soil is in capability unit IVw–1; woodland group 11; and group 12 for building sites.

Croton silt loam, 3 to 8 percent slopes (CrB).—The profile of this soil is somewhat shallower over bedrock than the one described as typical for the series. Drainage is also somewhat better.

This soil has slow internal drainage. During dry periods, the available moisture capacity is low.

If this soil is used for crops, it should be kept in grasses and legumes most of the time. If it is used for hay or pasture, grasses and legumes that tolerate wetness are the best to grow. Diversion terraces or other practices are needed to drain off the excess water, to help control erosion, and to improve yields. Black oak, red oak, cottonwood, maple, ash, hickory, and elm grow well on this soil.

This soil is in capability unit IVw–2; woodland group 11; and group 12 for building sites.

Edgemont Series

The Edgemont series consists of moderately deep, well-drained soils on uplands. The soils formed mainly in materials weathered from quartzite, but partly in materials weathered from quartz schist. They have a dark grayish-brown surface layer and a yellowish-brown or strong-brown subsoil. The native vegetation was white oak, red oak, black oak, tulip-poplar, hickory, and beech.

These soils are on the lower slopes of the Piedmont Plateau. They are mainly north of the Great Valley in Chester County. The principal areas are Barren Hill, near Compass; Welsh Mountains and Thomas Hill, east and west of Elverson in the northwestern part of the county; and north Valley Hills, adjacent to the Great Valley.

The Edgemont soils are near the Glenelg, Chester, Glenville, and Worsham soils. The profile of the Edgemont soils is lighter textured and lighter colored than the profiles of the Glenelg and Chester soils. The Edgemont soils are better drained than the Glenville and Worsham soils. The Glenville soils are moderately well drained, and the Worsham soils are poorly drained.

Typical profile of Edgemont channery loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 4 inches, dark grayish-brown (10YR 4/2) channery loam; contains a few stones that range from 1 inch to 3 inches in diameter; weak, fine to medium, granular structure; friable when moist; strongly acid (pH 5.0); clear, wavy lower boundary; 3 to 5 inches thick.

A_3 4 to 9 inches, yellowish-brown (10YR 5/4) silt loam; occasional fragments of sandstone about 2 inches in diameter; moderate, fine, granular structure; discontinuous clay films on peds; friable when moist; strongly acid (pH 5.2); clear, wavy lower boundary; 4 to 6 inches thick.

B_{21} 9 to 18 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; clay films on peds; friable to firm when moist, slightly sticky when wet; strongly acid (pH 5.4); clear, wavy lower boundary; 8 to 10 inches thick.

B_{22} 18 to 25 inches, dark-brown (7.5YR 4/4) silt loam; weak, medium, granular structure; friable when moist; medium acid (pH 5.6); gradual lower boundary; 5 to 9 inches thick.

C 25 to 50 inches, yellowish-red (5YR 4/8) loam or sandy loam; weak, fine, granular structure to loose, fine, single grain; friable to very friable when moist; medium acid (pH 6.0); gradual, irregular lower boundary; 20 to 30 inches thick.

The texture of the surface layer ranges from loam to silt loam. The texture of the subsoil ranges from silty clay loam to loam.

These soils have low available moisture capacity. Permeability is moderately rapid to rapid. The soils are low in fertility. Most of the areas are wooded.

Edgemont channery loam, 3 to 8 percent slopes (EcB).—Most areas of this soil are wooded. The surface layer is covered with a thin layer of organic material, about 1 inch thick. Just beneath is a horizon of very dark gray loam, 4 to 5 inches thick. The profile below this horizon is similar to the part below 4 inches in the profile described as typical for the series.

Included with this soil are small areas in which the texture of the surface layer is sandy loam.

Edgemont channery loam, 3 to 8 percent slopes, is well suited to all of the farm crops grown locally. Contour stripcropping, diversion terraces, and a cropping system in which grasses and legumes are grown every third year are needed to control erosion in areas that are tilled. White oak, red oak, black oak, chestnut oak, beech, and hickory grow fairly well on this soil.

This soil is in capability unit IIe–4; woodland group 1; and group 1 for building sites.

Edgemont channery loam, 3 to 8 percent slopes, moderately eroded (EcB2).—The profile of this soil is the same as the profile described as typical for the series, but, in a few places, stones in the profile interfere somewhat with tillage. The soil has moderately low available moisture capacity, and it is moderately low in fertility.

Included with this soil are a few areas in which the parent material contains small amounts of feldspar and mica.

Edgemont channery loam, 3 to 8 percent slopes, moderately eroded, is suited to all the general farm crops grown locally. Diversion terraces and contour stripcropping are needed to control erosion in areas that are tilled. A cropping system is needed in which the soil is kept under a cover of grasses and legumes 2 years out of 4. The sod formed by the grasses and legumes improves the structure of the soil and helps to control erosion. Red oak, white oak, and black oak grow well on this soil, and tulip-poplar, hickory, walnut, and beech grow fairly well.

This soil is in capability unit IIe–4; woodland group 1; and group 1 for building sites.

Edgemont channery loam, 8 to 15 percent slopes (EcC).—Most areas of this soil are wooded. The surface layer has a thin cover of leaf mold. Just beneath the leaf mold is an A_1 horizon, about 4 inches thick, of very dark grayish-brown (10YR 3/2) loam that has weak, fine, granular structure. The A_2 horizon, underlying the A_1, is about 5 inches thick and consists of yellowish-brown (10YR 5/4), friable silt loam that has moderate, very fine, subangular blocky structure. The layers below the A_2 horizon are similar to those for the typical profile.

Included with this soil are several areas in which the texture of the surface layer is sandy loam.

Edgemont channery loam, 8 to 15 percent slopes, is well suited to trees. If it is cleared, it is well suited to the farm crops grown locally and to pastures and orchards.

Contour stripcropping and diversion terraces are needed in areas that are tilled. Growing grasses and legumes every third and fourth year helps to control erosion and improves the structure of the soil. White oak, red oak, black oak, tulip-poplar, hickory, and beech grow well on this soil.

This soil is in capability unit IIIe–3; woodland group 3; and group 2 for building sites.

Edgemont channery loam, 8 to 15 percent slopes, moderately eroded (EcC2).—The profile of this soil is shallower over bedrock and contains more fragments of quartz than the profile described as typical for the series. This soil has lost at least 50 percent of its original surface layer through erosion. Material from the upper part of the subsoil has been mixed with the remaining surface soil to form the present surface layer.

In most places this soil is fairly easy to work. The available moisture capacity is moderately low, and the soil is moderately low in fertility.

General farm crops can be grown on this soil. Contour stripcropping and diversion terraces are needed to help control erosion. A cropping system in which grasses and legumes are grown at least 2 years in 4 helps maintain the content of organic matter and provides additional pro-

tection from erosion. White oak, red oak, black oak, tulip-poplar, hickory, and beech grow well on this soil.

The soil is in capability unit IIIe-3; woodland group 3; and group 2 for building sites.

Edgemont channery loam, 8 to 15 percent slopes, severely eroded (EcC3).—The profile of this soil is thinner than the profile described as typical for the series, and it contains many fragments of quartz. Depth to the C horizon is generally about 18 inches. This soil has lost nearly all of its original surface layer through erosion. The present plow layer consists chiefly of material from the former subsoil. Gullies are frequent. Because of its shallow profile and low content of organic matter, this soil has moderately low available moisture capacity.

This soil is better suited to long-term hay crops or to pasture than to tilled crops. Diversion terraces are needed to control erosion. Growing grasses and legumes to provide a permanent cover of sod helps improve the structure of the soil, adds organic matter, and helps to make the soil more permeable. White oak, red oak, black oak, hickory, and beech are the trees that grow well on this soil.

This soil is in capability unit IVe–2; woodland group 3; and group 2 for building sites.

Edgemont channery loam, 15 to 25 percent slopes (EcD).—Nearly all of this soil is forested, and a layer of leaf mold, 1 inch thick, covers the surface. The leaf mold is underlain by dark grayish-brown (10YR 4/2) loam. The loam has weak, fine, granular structure, is friable, and is strongly acid. Just beneath this A_1 horizon is a layer, about 4 inches thick, of dark-brown (10YR 4/3) loam that has weak, fine, granular structure, is very friable, and is strongly acid. At a depth below 8 inches, the profile is similar to the one described as typical for the series.

This soil has moderate available moisture capacity. It is moderately permeable and has good aeration.

Included with this soil are a few areas of a soil formed on gneiss and monzonite. This included soil has a surface layer of sandy loam and a subsoil of stony loam.

If Edgemont channery loam, 15 to 25 percent slopes, is cleared, it is suited to the crops commonly grown in the area. Contour stripcropping and a protective cover of vegetation are needed to control erosion. Growing grasses and legumes in the cropping system at least 60 percent of the time helps to control erosion, increases the content of organic matter, and improves the structure of the soil. This soil is also well suited to permanent pasture if lime and fertilizer are applied according to the needs indicated by soil tests. White oak, red oak, black oak, hickory, and beech grow well on this soil.

The soil is in capability unit IVe–2; woodland group 3; and group 2 for building sites.

Edgemont channery loam, 15 to 25 percent slopes, moderately eroded (EcD2).—The profile of this soil is shallower than the one described as typical for the series. Most of the original surface layer has been lost through erosion. The present surface layer consists of a mixture of the remaining surface soil and material from the upper part of the subsoil.

In most places there are many quartz stones in the profile; in a few areas the stones interfere somewhat with cultivation.

This soil has moderately low available moisture capacity. Permeability is moderately rapid, and water and air move readily through the soil.

This soil is best kept in permanent vegetation, but most general farm crops can be grown. Stripcropping and diversion terraces are needed, however, to control erosion. A cropping system in which grasses and legumes are grown at least 75 percent of the time is required. The sod formed by the grasses and legumes prevents erosion and helps maintain the content of organic matter.

This soil is in capability unit IVe–2; woodland group 3; and group 2 for building sites.

Edgemont channery loam, 15 to 25 percent slopes, severely eroded (EcD3).—The profile of this soil is shallower than that described as typical for the series. Nearly all of the original surface layer has been lost through erosion, and there are gullies in most places. Fragments of rock are numerous, both in the surface layer and subsoil. In some places there is little profile development below a depth of 15 inches.

Most of this soil was cleared at one time, but now the areas are mainly covered with brush and second-growth trees. The areas that have been kept cleared should be maintained in a permanent sod of pasture or hay crops. Lime and fertilizer are needed to maintain the sod and to improve the quality of the grasses and legumes. This soil is well suited to trees. Much of it probably will eventually revert to woodland.

This soil is in capability unit VIe–1; woodland group 3; and group 2 for building sites.

Edgemont channery loam, 25 to 35 percent slopes (EcE).—The profile of this soil is shallower than the one described as typical for the series. It has a thin layer of organic material about 1 inch thick on the surface.

This soil is well suited to trees. White oak, red oak, black oak, chestnut oak, beech, hickory, and walnut grow well on it.

This soil is in capability unit VIe–1; woodland group 5; and group 9 for building sites.

Edgemont channery loam, 25 to 35 percent slopes, moderately eroded (EcE2).—This soil has a thinner surface layer and subsoil than the profile described as typical for the series. It also contains more fragments of rock. Most of the soil is wooded. Cattle have been permitted to roam through the woods, and in many places they have destroyed the understory.

This soil is well suited to trees, but it can also be used for pasture. The soil is in capability unit VIe–1; woodland group 5; and group 9 for building sites.

Edgemont very stony loam, 0 to 8 percent slopes (EdB).—Except that the surface of this soil is very stony, is covered with 1 or 2 inches of leaf mold, and the upper 2 inches of mineral soil is dark grayish-brown very stony loam, the profile is similar to that described as typical for the series.

The many large stones on the surface and throughout the profile make the soil unsuitable for cultivation. The soil has only a limited use for pasture. It is well suited to trees, and all of it is wooded. The trees require protection from grazing. Harvest cutting, removal of imperfect and diseased trees, and other good woodland conservation practices are also needed.

This soil is in capability unit VIs–1; woodland group 1; and group 5 for building sites.

Edgemont very stony loam, 8 to 25 percent slopes (EdD).—The profile of this soil is shallower than the profile described as typical for the series, and in most places there is a thin layer of organic material on the

surface. In addition, there are many large stones in the surface layer and subsoil.

This soil is well suited to trees, and all of the areas are wooded. It has only a limited use as pasture.

This soil is in capability unit VIs–1; woodland group 3; and group 6 for building sites.

Edgemont very stony loam, 25 to 60 percent slopes (EdF).—The profile of this soil is shallower and stonier than the profile described as typical for the series. In a few places there is a thin layer of leaf mold on the surface. There are many large stones on the surface of this soil, and in several places the bedrock outcrops. In many places the areas are very steep and are called escarpments. Stone quarries and sandpits are common.

This soil is best used for trees and for shrubs that provide food for wildlife. The soil is not likely to erode if the areas are kept in trees. Harvest cutting, removal of diseased trees, and other good woodland conservation practices are needed.

This soil is in capability unit VIIs–1; woodland group 5; and group 9 for building sites.

Glenelg Series

The Glenelg series consists of moderately deep, well-drained soils of uplands. The soils developed in material weathered mainly from granite, gneiss, and mica schist. Their surface layer is dark-brown silt loam. Their subsoil is dark-brown to strong-brown silt loam, and it contains a little more clay than the surface layer. In some places there are flat channery fragments, as much as 2 inches across, in the surface layer; slightly larger fragments are in the subsoil. Beneath the subsoil is strong-brown or reddish-brown loam that contains many bright fragments of mica.

Except in the Great Valley and in the area underlain by red shale in the northern part of Chester County, the Glenelg soils are distributed fairly widely throughout Chester and Delaware Counties. In Chester County, however, they are more extensive south of the Great Valley than in the northern half of the county.

The native vegetation was a forest made up chiefly of white oak, red oak, black oak, tulip-poplar, and beech.

Glenelg soils are near the Chester, Manor, Glenville, and Worsham soils, all of which formed on similar parent materials. The Glenelg soils are deeper than the Manor soils, but they are not so deep as the Chester soils. They are better drained than the Glenville soils, which are moderately well drained, and the Worsham, which are poorly drained.

Typical profile of Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field:

A_p 0 to 8 inches, dark-brown (7.5YR 3/2) channery silt loam; weak, fine, granular structure; friable; pH 6.6; about 20 percent of the material, by volume, consists of fragments of quartz and schist; abrupt, smooth lower boundary; 7 to 9 inches thick.

B_{21} 8 to 15 inches, dark-brown (7.5YR 4/4) heavy silt loam; weak, medium, subangular blocky structure; partial clay films on peds; friable; pH 6.8; gradual, wavy lower boundary; 6 to 8 inches thick.

B_{22} 15 to 21 inches, dark-brown (7.5YR 4/4) heavy silt loam; weak, medium, subangular blocky structure; partial clay films on peds; friable; pH 6.6; gradual, wavy lower boundary; 4 to 8 inches thick.

B_3 21 to 26 inches, strong-brown (7.5YR 5/6), micaceous silt loam; weak, medium, subangular blocky structure; a few clay films on peds; friable; pH 6.4; clear, irregular lower boundary; 2 to 10 inches thick.

C_1 26 to 32 inches, strong-brown (7.5YR 5/6), micaceous loam; structureless, except for streaks of saprolite that have platy structure; friable; pH 6.2; clear, wavy lower boundary; 4 to 10 inches thick.

C_2 32 to 42 inches, reddish-brown, micaceous loam that is streaked with gray; shows laminated structure of the parent schist, although weathered; friable; pH 6.2.

These soils range from 18 to 34 inches in depth to the C horizon, but they are dominantly 20 to 30 inches deep. Their subsoil ranges from silt loam to silty clay loam in texture and from yellowish brown to reddish brown in color. In some places these soils are darker, have more clay in the subsoil, and resemble the Neshaminy soils, except that the Neshaminy soils are deeper. In many places in the north-central part of Chester County, the Glenelg soils are underlain by graphite gneiss, anorthosite, gabbro, granodiorite, or quartz monzonite. These areas are near the areas of Neshaminy soils.

The Glenelg soils have moderate available moisture capacity. Permeability and fertility are also moderate. In areas that have not been limed, the soils are acid throughout the profile. Consequently, alfalfa does not grow satisfactorily unless lime is added.

Glenelg channery silt loam, 0 to 3 percent slopes (GeA).—This nearly level soil is on broad ridges. The surface layer is thicker and the solum is deeper than in the profile described as typical for the series. Depth to the C horizon is between 24 and 30 inches.

This soil is easy to work. It has moderate available moisture capacity and is moderately productive. The soil is well suited to all the general farm crops, truck crops, tree fruits, and forage crops commonly grown in the area. Growing a mixture of grasses and legumes every few years will improve tilth and return organic matter to the soil. White oak, red oak, black oak, tulip-poplar, hickory, white pine, Scotch pine, and Norway spruce are well suited.

This soil is in capability unit I–1; woodland group 1; and group 5 for building sites.

Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded (GeA2).—In most places this soil has lost part of its original surface layer through erosion. In some places, however, the surface layer has been removed to use as casing soil for growing mushrooms.

This soil is easy to work. It has moderate available moisture capacity and is moderately fertile.

The soil is suited to all of the general farm crops, truck crops, and tree fruits commonly grown in the area. Contour cultivation is needed to control erosion in fields that are tilled. Growing a sod crop of grasses and legumes every 3 years or oftener will reduce erosion, improve the structure of the soil, and add organic matter. Red oak, white oak, black oak, walnut, tulip-poplar, white pine, Scotch pine, and Norway spruce are well suited to this soil.

The soil is in capability unit IIe–2; woodland group 1; and group 5 for building sites.

Glenelg channery silt loam, 3 to 8 percent slopes (GeB).—Most of this soil is wooded, and the surface layer is covered with a thin mat of leached leaf mold. Just beneath the leaf mold is an A_1 horizon, 3 to 6 inches thick, of very dark grayish-brown (10YR 3/2) channery silt loam that has weak, very fine, crumb structure. The A_2 horizon is 4 to 8 inches thick and consists of dark-brown (7.5YR 4/4) gritty silt loam. It has moderate, fine and medium, subangular blocky structure. Underlying the A_2

horizon is a B_1 layer, 3 to 5 inches thick, of dark-brown (7.5YR 4/4), channery, gritty silt loam. The B_1 horizon has moderate, fine and medium, subangular blocky structure, and there are partial clay films on the peds; it has firm consistence and is strongly acid. The part of the profile below the B_1 layer is like that at a depth below 8 inches in the profile described as typical for the series.

This soil is suited to all of the general farm crops, truck crops, and fruits commonly grown in the area. Contour stripcropping and diversion terraces are needed to protect areas that are tilled from erosion. A sod crop of grasses and legumes, grown every third year, or oftener, will provide further protection.

Red oak, white oak, black oak, tulip-poplar, hickory, Scotch pine, white pine, and Norway spruce are well suited to this soil.

This soil is in capability unit IIe–2; woodland group 1; and group 5 for building sites.

Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded (GeB2).—The profile of this soil is the same as that described as typical for the series. The soil has moderate available moisture capacity, and it is moderately fertile.

Included with the soil are a few areas of Sassafras and Glenelg loams.

Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded, is well suited to the general farm crops, truck crops, and tree fruits commonly grown in the area. Most of it is easy to cultivate, but in a few places there are many channery fragments that interfere with cultivation.

Diversion terraces and contour stripcropping are needed to control erosion in areas that are tilled. A sod crop of grasses and legumes should be grown at least 1 year out of 3. The sod will help to control erosion, improve the structure of the soil, and add organic matter.

Red oak, white oak, black oak, tulip-poplar, hickory, walnut, white pine, Scotch pine, and Norway spruce are well suited to this soil.

The soil is in capability unit IIe–2; woodland group 1; and group 5 for building sites.

Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded (GeB3).—The profile of this soil is similar to the profile described as typical for the series, but it is shallower. In most places depth to the parent material is only 18 to 20 inches.

This soil has little or none of its original surface layer left. In most places the present plow layer consists of dark-brown, heavy silt loam from the former subsoil. In many places near Kennett Square, Toughkenamon, and West Grove, nearly all of the original surface layer has been removed to provide casing soil for growing mushrooms. The soil has moderately low available moisture capacity.

Included with the soil are a few areas of Sassafras and Glenelg loams.

Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded, is subject to serious sheet and gully erosion. A permanent cover of trees or of grasses and legumes is needed to help protect it from further erosion. Red oak, white oak, black oak, tulip-poplar, white pine, Scotch pine, and Norway spruce grow well on this soil.

The soil is in capability unit IIIe–2; woodland group 1; and group 5 for building sites.

Glenelg channery silt loam, 8 to 15 percent slopes (GeC).—Most areas of this soil are wooded. The surface layer is covered with a thin mat of leaf mold. Just beneath the leaf mold is an A_1 horizon, 3 to 6 inches thick, of dark grayish-brown (10YR 4/2) channery silt loam that has weak, very fine, crumb structure. The A_2 horizon is 4 to 8 inches thick, and consists of dark-brown (10YR 4/3) gritty silt loam that has moderate, fine and medium, subangular blocky structure. Underlying the A_2 horizon is a B_1 horizon, 3 to 5 inches thick, of dark-brown (7.5YR 4/4), gritty channery silt loam. The B_1 horizon is firm and has moderate, fine and medium, subangular blocky structure. The peds are partially coated with clay.

Except that it is strongly acid, the part of the profile beneath the B_1 layer is like that at a depth below 8 inches in the profile described as typical for the series.

This soil is well suited to trees, and about 90 percent of it is wooded. If cleared, the soil would be well suited to general farm crops, pasture, and tree fruits. If the soil is tilled, contour stripcropping and diversion terraces are needed to control erosion. Growing a sod crop of grasses and legumes 2 years out of 4 improves the structure of the soil and gives added protection from erosion. White oak, red oak, black oak, hickory, tulip-poplar, and walnut trees are well suited to this soil.

The soil is in capability unit IIIe–2; woodland group 3; and group 6 for building sites.

Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded (GeC2).—The profile of this soil is thinner and contains more fragments of schist than the profile described as typical for the series, but, otherwise, the two profiles are similar. The present surface layer contains material from the subsoil that has been mixed with the remaining surface soil.

In most places this soil is easy to work. It has moderate available moisture capacity and is moderately fertile.

Included with this soil are a few small areas of a Sassafras loam. Also included are a few areas resembling Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded, except that the texture of the surface layer is loam and the soil is shallower.

Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded, is well suited to the general farm crops, truck crops, and tree fruits commonly grown in the area, and it is also suited to pasture. Contour stripcropping and diversion terraces will help to control erosion. Growing a sod of grasses and legumes 2 years out of 4 improves the structure of the soil, adds organic matter, and provides additional protection from erosion. White oak, red oak, black oak, tulip-poplar, walnut, hickory, white pine, and Scotch pine grow well on this soil.

The soil is in capability unit IIIe–2; woodland group 3; and group 6 for building sites.

Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded (GeC3).—The entire profile of this soil is shallow as the result of erosion. The present plow layer consists almost entirely of material from the former subsoil. In a few places gullies, 1 to 3 feet deep, are less than 100 feet apart.

The available moisture capacity of this soil is moderately low. Permeability is moderately slow, and the soil is low in fertility.

Included with this soil are a few areas of a Sassafras loam. Also included are a few areas similar to Glenelg

channery silt loam, 3 to 8 percent slopes, moderately eroded, except that the texture of the surface layer is loam and the soil is shallower.

A cover of permanent vegetation should be kept on Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded. This soil is suited to all of the grasses and legumes commonly grown in the area, but more fertilizer is required before reseeding than is needed on Glenelg soils that are less eroded.

This soil is in capability unit IVe-2; woodland group 3; and group 6 for building sites.

Glenelg channery silt loam, 15 to 25 percent slopes (GeD).—Most of this soil is forested and has a litter of hardwood leaves on the surface. The mat of leaves is underlain by a layer, 1 inch thick, of dark yellowish-brown (10YR 3/4) silt loam that has weak, fine, crumb structure. Just beneath is a horizon, about 8 inches thick, of yellowish-brown (10YR 5/6) silt loam. This horizon has weak, fine, subangular blocky structure and is friable. The part of the profile below a depth of 8 inches is like that described as typical for the series.

This soil has moderate available moisture capacity. It is moderately permeable, and air and water move through the profile readily. The entire profile is strongly acid. The pH ranges from 5.2 in the surface layer to 5.4 in the C horizon.

Included with this soil are small areas of a Chester silt loam that has slopes of 15 to 25 percent.

More than 90 percent of Glenelg channery silt loam, 15 to 25 percent slopes, is wooded and has never been plowed. This soil is not well suited to crops, mainly because of its strong slopes and susceptibility to erosion. If the soil is cleared and lime and fertilizer are added, it is suitable for pasture or hay. Many areas are not easily accessible and are likely to remain in forest.

This soil is in capability unit IVe–2; woodland group 3; and group 6 for building sites.

Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded (GeD2).—Except that it is thinner, the profile of this soil is similar to the one described as typical for the series. Depth to parent material ranges from 18 to 22 inches. There are numerous fragments of schist in the lower part of the subsoil.

This soil has moderately rapid permeability. Air and water move readily through the profile. The soil has moderate to moderately low available moisture capacity, and it is moderately productive.

Included with this soil are a few areas of Chester silt loam, 15 to 25 percent slopes, moderately eroded. The profile of this included soil is thicker than the typical profile described for the Glenelg series, and it contains fewer fragments of rock.

Most general farm crops can be grown on Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded. Contour strips and diversion terraces are needed, however, to help control erosion. A cropping system that includes a sod of grasses and legumes, grown at least 75 percent of the time, is required to prevent erosion and return organic matter to the soil.

This soil is in capability unit IVe–2; woodland group 3; and group 6 for building sites.

Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded (GeD3).—The profile of this soil is shallower than the one described as typical for the series. There are a few shallow gullies in some areas.

Included with this soil are some severely eroded areas of a Chester silt loam.

All of Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded, has been cleared, and nearly all of it has been cultivated. Now, about half of the acreage is in pasture, and about 15 percent is wooded.

This soil is in capability unit VIe–1; woodland group 3; and group 6 for building sites.

Glenelg channery silt loam, 25 to 35 percent slopes (GeE).—The profile of this soil is shallower than the one described as typical for the series, and the surface layer and subsoil are thinner. All of this soil is wooded, but the soil can be used for pasture if it is cleared.

This soil is in capability unit VIe–1; woodland group 5; and group 9 for building sites.

Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded (GeE3).—The profile of this soil is shallower than the one described as typical for the series. Most of the original surface layer has been lost through erosion, and material from the upper part of the B horizon has been mixed with the remaining surface soil to form the present plow layer. Gullies are common. Because of severe erosion, the available moisture capacity is lower than that of the typical soil.

Nearly all of this soil has been cleared. Now, however, some areas are covered with young trees and some have a mixture of brush and pasture. Still others are used for permanent pasture. This soil should be kept in trees.

The soil is in capability unit VIIe–1; woodland group 5; and group 9 for building sites.

Glenelg silt loam, 0 to 3 percent slopes, severely eroded (GgA3).—This soil has little, if any, of its original surface layer left. The original surface layer has been removed to provide casing soil for use in growing mushrooms.

The soil has moderately rapid permeability, but its available moisture capacity is moderately low.

To protect this soil from severe sheet and gully erosion, a sod of grasses and legumes should be established soon after the surface soil has been removed. Applying large amounts of barnyard manure or disking spent mushroom soil into the soil to form a surface layer will give some protection until a cover of sod can be established.

This soil is best used for pasture or hay crops. Large amounts of lime and fertilizer are needed to supply nutrients so that a dense cover of plants will grow. Locust, white pine, Scotch pine, Virginia pine, and Norway spruce will grow on this soil.

The soil is in capability unit IVe–5; woodland group 13; and group 5 for building sites.

Glenelg silt loam, 3 to 8 percent slopes, severely eroded (GgB3).—The surface layer of this soil has been removed to provide casing soil for use in mushroom houses. Otherwise, the profile is similar to the one described as typical for the series. The subsoil ranges from 14 to 20 inches in thickness, and in many places it contains 15 to 25 percent, by volume, of fragments of schist.

This soil is better used for pasture or hay crops than for tilled crops. Large amounts of lime and fertilizer are needed before seeding grasses and legumes. Diversion terraces will help to control runoff and will hold the water long enough so that it can soak into the soil. Locust, white pine, Norway spruce, Virginia pine, and Scotch pine will grow on this soil.

The soil is in capability unit IVe–5; woodland group 13; and group 5 for building sites.

Glenelg very stony silt loam, 15 to 25 percent slopes (GmD).—This soil has a thin litter of leaves on the surface. It is very stony and has a thinner profile, but, otherwise, the profile is similar to the one described as typical for the series. The numerous large stones on the surface and in this soil make it unsuitable for cultivation.

This soil has been kept in forest. White oak, red oak, black oak, tulip-popular, hickory, beech, and walnut grow well, and wild cherry grows fairly well.

The soil is in capability unit VIs–1; woodland group 3; and group 6 for building sites.

Glenelg very stony silt loam, 25 to 35 percent slopes (GmE).—This soil has a thin litter of leaves on the surface. It is stony and has a shallower profile than the profile described as typical for the series.

The numerous large stones on the surface and in this soil make it unsuitable for cultivation. The soil has been kept in forest. White oak, red oak, black oak, tulip-poplar, hickory, walnut, and beech are well suited.

This soil is in capability unit VIIs–1; woodland group 5; and group 9 for building sites.

Glenville Series

The Glenville series consists of deep, moderately well drained soils of uplands. The soils developed in material weathered mainly from granite, schist, and gneiss. The surface layer is very dark brown or dark grayish brown. The subsoil is yellowish-brown or strong-brown, mottled silty clay loam or heavy silt loam. The soils are distributed throughout the two counties. They are on low-lying areas in the uplands and around the heads of streams, where the water table is high in the subsoil for long periods. The native forest consisted chiefly of red oak, hickory, elm, ash, walnut, and tulip-poplar.

The Glenville soils are near the Chester, Glenelg, Manor, and Worsham soils. They have mottling in the subsoil and are not so well drained as the Chester soils, which are also deep. The Glenville soils are deeper than the Glenelg and Manor soils. They are better drained than the Worsham soils, which have mottling at or near the surface.

Typical profile of Glenville silt loam, 0 to 3 percent slopes:

- A_p 0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; neutral (pH 7.2); abrupt, smooth lower boundary; 8 to 10 inches thick.
- B_1 10 to 16 inches, yellowish-brown (10YR 5/4), heavy silt loam; weak, medium, subangular blocky structure; thin clay films on peds; friable; very strongly acid (pH 4.8); clear, wavy lower boundary; 4 to 8 inches thick.
- B_{21g} 16 to 22 inches, brown (10YR 5/3) silty clay loam; a few, medium, faint mottles of yellowish brown (10YR 5/6); weak, medium, prismatic structure that breaks to weak, medium, blocky structure; thin clay films on the peds; firm; very strongly acid (pH 4.8); gradual, wavy lower boundary; 4 to 8 inches thick.
- B_{22g} 22 to 30 inches, strong-brown (7.5YR 5/6), light silty clay loam; common, medium, distinct mottles of light brown (7.5YR 6/4) and brown (7.5YR 5/2); moderate, medium, prismatic structure that breaks to medium, blocky structure; clay films on the faces of prisms; firm; gradual, wavy lower boundary; 6 to 10 inches thick.
- B_{23g} 30 to 40 inches, reddish-yellow (7.5YR 7/6) and light brownish-gray (10YR 6/2) silt loam; moderate, medium, prismatic structure that breaks to moderate, medium, blocky structure; very firm; very strongly acid (pH 4.8); gradual, wavy lower boundary; 8 to 12 inches thick.
- B_{3g} 40 to 50 inches, strong-brown (7.5YR 5/6) and gray (10YR 6/1) silt loam; common, coarse, distinct mottles; weak, fine, blocky to weak, medium, platy structure; a few thin clay films; firm; abrupt, wavy lower boundary; 8 to 12 inches thick.
- C_{1g} 50 to 70 inches, strong-brown (7.5YR 5/6) and gray (10YR 6/1) loam; common, coarse, prominent mottles; a few fragments of schist; weak, thick, platy structure; friable; very strongly acid (pH 4.8); abrupt, wavy lower boundary; 18 to 24 inches thick.

70 inches +, bedrock of schist.

In a few places the texture of the subsoil is silty clay loam throughout the profile. Depth to the bedrock ranges from 3 to 6 feet. Mottling is at a depth ranging from 15 to 30 inches. In some places there is a weak claypan in the subsoil. The dominant parent materials are mica schist and gneiss, but a few areas are underlain by granite. In these areas the texture of the subsoil is generally more clayey than that in the typical profile.

The Glenville soils have moderately high fertility, but their permeability is moderately slow. The available moisture capacity is moderately high, and moisture remains in them for fairly long periods. Areas that are not limed are strongly to very strongly acid. The soils are easy to work and are free of stones in most places.

Glenville silt loam, 0 to 3 percent slopes (GnA).—The profile of this soil is the same as the one described as typical for the series. In a few areas the soil has been stripped of its surface layer to provide casing soil for growing mushrooms. In these areas the profile is thinner and mottling is nearer the surface than in the profile described as typical of the series.

Glenville silt loam, 0 to 3 percent slopes, is well suited to most general farm crops. Occasionally, however, the water table is high, and, therefore, this soil is not suited to deep-rooted plants that do not tolerate wetness. Contour tillage is needed to help control erosion. Growing a sod of grasses and legumes every 3 or 4 years in the cropping system will improve the structure of the soil and add organic matter. Red oak, black oak, white oak, ash, maple, and tulip-poplar grow well on this soil.

The soil is in capability unit IIw–1; woodland group 7; and group 10 for building sites.

Glenville silt loam, 3 to 8 percent slopes (GnB).—Most of this soil is wooded, and the surface layer is covered with a thin litter of hardwood leaves and twigs. Just beneath the litter is a black mull of decayed or well-rotted leaves and roots.

Underlying the mull is an A_1 horizon, 5 inches thick, of dark-brown silt loam that is friable and has weak, thin, platy and weak, fine, granular structure. Beneath the A_1 horizon is an A_2 horizon, 6 to 9 inches thick, consisting of yellowish-brown fine silt loam that has weak, medium, subangular blocky structure. In this horizon there are a few, thin clay films on the surfaces of peds. The profile below the A_2 horizon is similar to the profile described as typical of the series at a depth below 16 inches.

If cleared, this soil is suited to most farm crops grown in the area. However, because the water table is high for long periods, the soil is not suited to deep-rooted legumes and grasses that do not tolerate wetness. Contour stripcropping and diversion terraces are needed to control erosion. A sod of grasses and legumes is needed every 3 or 4 years to add organic matter to the soil and

to improve the structure. Red oak, white oak, ash, red maple, hickory, and walnut are well suited to this soil.

This soil is in capability unit IIe–6; woodland group 7; and group 10 for building sites.

Glenville silt loam, 3 to 8 percent slopes, moderately eroded (GnB2).—The profile of this soil is somewhat shallower than the one described as typical for the series, but it is similar in other respects. This soil has moderately slow permeability. It is moderate in available moisture capacity and natural fertility.

This soil is suited to most farm crops grown in the area. It is wet, however, for long periods and is not suited to deep-rooted plants that do not tolerate wetness. Stripcropping and diversion terraces are needed to control erosion. Growing a hay crop every third year will help to control erosion and to maintain good structure. White oak, red oak, tulip-poplar, black oak, hickory, and ash grow well on this soil.

The soil is in capability unit IIe–6; woodland group 7; and group 10 for building sites.

Glenville silt loam, 8 to 15 percent slopes, moderately eroded (GnC2).—The profile of this soil is thinner than the one described as typical for the series. More than half of the original surface layer has been lost through erosion, and material from the subsoil has been mixed with the remaining surface layer. This soil has moderate available moisture capacity. It is moderately slowly permeable and is moderately fertile.

Diversion terraces and stripcropping are needed to help control erosion. The soil needs to be kept under a sod of grasses and legumes at least 50 percent of the time. The sod helps to control erosion, adds organic matter to the soil, and improves the structure. White oak, red oak, black oak, hickory, ash, and tulip-poplar are well suited.

This soil is in capability unit IIIe–5; woodland group 7; and group 11 for building sites.

Glenville very stony silt loam, 0 to 8 percent slopes (GsB).—This soil is stony; it generally has a thin layer of organic material, or mull, on the surface; and the topmost 5 inches consists of dark-brown very stony silt loam. Otherwise, the profile is similar to the one described as typical for the series.

This soil is well suited to use as woodland. The many large stones on the surface make it unsuitable for cultivation. It has only a limited use for pasture.

This soil is in capability unit VIs–2; woodland group 7; and group 10 for building sites.

Guthrie Series

The Guthrie series consists of deep, poorly drained soils on limestone or calcareous schist. The surface layer is very dark gray silt loam, and the subsoil is mottled with light brownish gray, greenish gray, and brown. Mottling begins in the lower half of the surface layer and becomes more prominent and distinct with increasing depth. The water table is high during most of the year.

These soils occur in Chester County. They are mainly in the Great Valley, but several other areas are scattered throughout the county. The native vegetation consisted of red maple, ash, white oak, red oak, hickory, and walnut.

The Guthrie soils are near the Hollinger, Conestoga, Bedford, Lawrence, and Hagerstown soils. These soils are all underlain by calcareous schist, Cockeysville marble, dolomitic limestone, or other limy materials. They are wetter than the Hollinger soils, which are shallow, or the Conestoga and Hagerstown soils, which are deep. The Guthrie soils have mottling at or near the surface and are wetter than the Bedford and Lawrence soils. Depth to mottling in the Bedford and Lawrence soils varies, and there is mottling only in the subsoil. Only one soil of this series—Guthrie silt loam—is mapped in these two counties.

Typical profile of Guthrie silt loam:

A_p 0 to 4 inches, very dark gray (5YR 3/1) silt loam; a few fine, distinct mottles of olive gray (5YR 5/2) and very dark brown (10YR 2/2); weak, fine, crumb structure; friable when moist; strongly acid (pH 5.4); clear, smooth lower boundary; 3 to 6 inches thick.

A_3 4 to 9 inches, olive-gray (5YR 5/2) and dark-gray (5Y 4/1) silt loam; common, medium, distinct mottles of yellowish brown; weak, fine, crumb structure; friable when moist; medium acid (pH 5.6); clear, wavy lower boundary; 3 to 5 inches thick.

B_{21g} 9 to 18 inches, light brownish-gray (2.5Y 6/2) silty clay loam; common, coarse, distinct mottles of yellowish brown (10YR 6/6); moderate, medium, subangular blocky structure; thin clay films on the surfaces of peds; slightly sticky and plastic when wet; strongly acid (pH 5.4); gradual, wavy lower boundary; 9 to 14 inches thick.

B_{22g} 18 to 27 inches, greenish-gray (5BG 6/1) silty clay loam; many, coarse, prominent mottles of strong brown (7.5YR 5/6); moderate, medium, platy structure that breaks to blocky structure; thin, discontinuous clay films on the surfaces of peds; friable when moist; medium acid (pH 6.0); gradual, irregular lower boundary; 7 to 12 inches thick.

B_{23g} 27 to 36 inches, greenish-gray (5BG 6/1) silt loam; many, coarse, prominent mottles of yellowish brown (10YR 5/4); contains many small flakes of mica; common, medium, blocky structure; friable when moist; neutral (pH 6.8); gradual, wavy lower boundary; 5 to 10 inches thick.

C_1 36 to 50 inches, light grayish-brown to brown (10YR 5/3) silt loam; common, coarse, distinct mottles; friable when moist; neutral (pH 6.6).

The mottles in the subsoil vary considerably in abundance, size, and color. Depth to parent material ranges from 3 to as much as 5 feet in a few places. The water table is high for prolonged periods. Consequently, there is an excessive amount of water available for plants to use, and the soil is poorly aerated.

Guthrie silt loam (Gu).—The profile of this soil is the same as the one described as typical for the series.

This soil is better suited to permanent pasture than to hay crops, although in some places hay is grown with varying degrees of success. Artificial drainage by open ditches and bedding will help to remove the excess water. If drainage is improved, the soil will be better aerated and plant nutrients will become more readily available. Pastures on this soil respond well and the yields are generally of good quality if the soil is drained and lime and fertilizer are added. Plants that tolerate wetness grow better than other kinds of plants. Cottonwood, ash, hickory, walnut, white oak, red oak, and red maple grow well on this soil.

The soil is in capability unit IVw–1; woodland group 12; and group 12 for building sites.

Hagerstown Series

The Hagerstown series consists of deep, well-drained soils that are underlain by limestone. The surface layer is dark-brown silt loam. The subsoil, a strong-brown silty clay loam, has a few fragments of limestone scattered

through it. The subsoil has blocky and somewhat prismatic structure. It is underlain by yellowish-red silty clay loam that contains many partially weathered fragments of quartz and limestone. The native vegetation consisted of white oak, red oak, tulip-poplar, hickory, walnut, and ash.

These soils are mostly in Chester Valley. The Valley ranges from 1 to 2 miles in width and extends from Atglen, near the western boundary of Chester County, through Coatesville and Downingtown to the eastern boundary, near Valley Forge.

The Hagerstown soils are near the Conestoga, Bedford, Lawrence, and Guthrie soils. They are darker than the Conestoga soils, and their subsoil is heavier textured. They are better drained than the Bedford, Lawrence, and Guthrie soils. The Bedford and Lawrence soils have mottles in the subsoil. The surface layer of the Hagerstown soils is lighter colored than that of the Guthrie, and mottling in the Guthrie soil is shallow.

A typical profile of Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded:

- A_p 0 to 8 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable when moist; neutral (pH 6.6); clear, wavy lower boundary; 7 to 9 inches thick.
- B_1 8 to 13 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, subangular blocky structure; thin clay films on the surfaces of peds; friable when moist; slightly sticky when wet; slightly acid (pH 6.5); clear, wavy lower boundary; 4 to 6 inches thick.
- B_{21} 13 to 26 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, blocky structure; clay films on the surfaces of peds; firm when moist, slightly sticky and slightly plastic when wet; neutral (pH 6.6); clear, irregular boundary; 10 to 15 inches thick.
- B_{22} 26 to 35 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, angular blocky structure; thin clay films on the surfaces of peds; firm when moist, sticky when wet; gradual, wavy lower boundary; 8 to 10 inches thick.
- B_{23} 35 to 53 inches, yellowish-red (5YR 5/8) silty clay loam; moderate, medium, blocky structure; firm when moist; a few thin clay films; slightly acid (pH 6.2); clear, wavy lower boundary; 15 to 20 inches thick.
- C 53 inches +, yellowish-red (5YR 5/8) silty clay loam streaked with yellowish brown (10YR 5/6); contains between 5 and 10 percent, by volume, of fragments of quartz and limestone; moderate, medium blocky structure; friable when moist; slightly acid (pH 6.4).

Bedrock outcrops in a few places and in some places depth to the bedrock is more than 10 feet. The subsoil ranges from silt loam to clay loam in texture and from strong brown to reddish brown in color. In most places the parent material is dolomite or magnesium limestone.

The permeability of these soils is moderate, and the available moisture capacity is moderately high. The soils are easy to work and are productive.

Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded (HaA2).—The profile of this soil is somewhat deeper to the C horizon than the one described as typical for the series, but, otherwise, it is similar. Some areas have a layer of deposition; others have little or no erosion.

Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded, has moderately high available moisture capacity. It is easy to work and is productive.

The soil is well suited to most of the general farm crops and truck crops grown in the area. Plants and crops that require a very acid soil are not suited. Cultivating on the contour helps to control erosion. Disking the corn stubble into the soil in fall and growing grasses and legumes 25 to 50 percent of the time help to maintain the content of organic matter and also help to prevent erosion. Red oak, white oak, tulip-poplar, hickory, and walnut are well suited to this soil.

The soil is in capability unit IIe–1; woodland group 2; and group 1 for building sites.

Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded (HaB2).—The profile of this soil is the same as that described as typical for the series. The soil is moderately permeable, has moderate available moisture capacity, and is productive.

This soil is well suited to the general farm crops grown in the area. Diversion terraces and contour stripcropping are needed to help control erosion in areas that are tilled. Growing a hay crop every 3 or 4 years also helps to control erosion and adds organic matter to the soil. A cover of sod is needed in the natural drainageways.

This soil is in capability unit IIe–1; woodland group 2; and group 1 for building sites.

Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded (HaC2).—Except that this soil is shallower to bedrock in most places, it is similar to the one described as typical for the series. The profile ranges from 30 to 60 inches in thickness. The soil has moderate available moisture capacity and is productive. It is easy to work, and in most places it is free of stones.

This soil is well suited to the general farm crops grown in the area. Diversion terraces and contour stripcropping are needed on fields that are tilled. Sodded waterways are needed to remove the excess water that accumulates in depressions and to prevent gullying. A sod crop of grasses and legumes should be grown 2 out of 4 years. Red oak, white oak, black oak, hickory, tulip-poplar, ash, and walnut are better suited to this soil than other kinds of trees.

This soil is in capability unit IIIe–1; woodland group 4; and group 2 for building sites.

Hagerstown silt loam, 8 to 15 percent slopes, severely eroded (HaC3).—The profile of this soil is shallower than the one described as typical for the series, and depth to bedrock is less. Otherwise, the two profiles are similar. Most of the original surface layer of this soil has been lost through erosion, and material from the upper part of the subsoil has been mixed with the remaining surface soil.

The available moisture capacity of this soil is moderate to moderately low, and permeability is moderately low. The soil is moderate to low in productivity.

This soil is better suited to a permanent cover of vegetation than to tilled crops. Large amounts of plant nutrients are required every few years to help maintain grasses and legumes. White oak, red oak, black oak, hickory, walnut, tulip-poplar, and ash are well suited to this soil.

The soil is in capability unit IVe–1; woodland group 4; and group 2 for building sites.

Hollinger Series

The Hollinger series consists of well-drained soils of uplands that are shallow to parent material. The soils have a dark-brown surface layer and a thin, yellowish-brown subsoil. Underlying the subsoil is dark yellowish-brown, weathered schist. The native vegetation was a forest

made up of various kinds of hardwoods, mainly red oak, white oak, black oak, hickory, and tulip-poplar.

The Hollinger soils are near areas of Hagerstown, Conestoga, Bedford, Lawrence, and Guthrie soils. The profile of the Hollinger soils is thinner than those of the deep, well-drained Hagerstown and Conestoga soils. The Hollinger soils are shallower over parent material, but they are better drained than the Bedford, Lawrence, and Guthrie soils.

A typical profile of Hollinger silt loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; medium acid (pH 6.0); clear, smooth boundary; 7 inches thick.

B_2 7 to 19 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, fine, subangular blocky structure; friable; medium acid (pH 6.2); clear, wavy boundary; 10 to 15 inches thick.

C_1 19 to 26 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; weak, fine, granular structure; friable to loose; slightly acid (pH 6.4); gradual, wavy boundary; 8 to 10 inches thick; many small flakes of mica.

C_2 26 to 60 inches, olive-brown (2.5Y 4/4) fine sandy loam; structureless; loose; slightly acid (pH 6.4).

In places the parent material of these soils is dolomitic limestone instead of calcareous schist. Variations in the soils are chiefly in the depth to parent material. In a few areas, most of which are underlain by dolomitic limestone, depth to bedrock is less than 20 inches. Limestone is near the surface in a few places.

These soils have moderately rapid permeability and moderately low available moisture capacity. Leaching is moderately rapid, and productivity is low.

Hollinger silt loam, 3 to 8 percent slopes, moderately eroded (HoB2).—The profile of this soil is the same as the one described as typical for the series. The available moisture capacity of the soil is moderately low, and permeability is moderately rapid. Except in the very shallow areas, this soil is easy to cultivate.

This soil is suited to most farm crops grown in the area. Diversion terraces and contour stripcropping are needed to help control excess water and to prevent erosion. Including a sod crop of grasses and legumes in the cropping system helps to maintain good tilth. Red oak, white oak, black oak, chestnut oak, beech, hickory, and ash are well suited.

This soil is in capability unit IIe–5; woodland group 14; and group 7 for building sites.

Hollinger silt loam, 8 to 15 percent slopes, moderately eroded (HoC2).—This soil is shallower to parent material than the one described as typical for the series. About 50 percent of the original surface layer has been removed through erosion. There is an occasional shallow gully in some places.

This soil has moderately rapid permeability. It is low in fertility and in available moisture capacity. The soil should be protected by stripcropping, using diversion terraces, and keeping a sod crop on the area at least 50 percent of the time. White oak, red oak, black oak, hickory, beech, and tulip-poplar are suited.

This soil is in capability unit IIIe–4; woodland group 16; and group 8 for building sites.

Hollinger silt loam, 8 to 15 percent slopes, severely eroded (HoC3).—This soil has lost nearly all of its original surface layer through erosion, but, otherwise, the profile is similar to the one described as typical for the series. Material from the subsoil has been mixed with the remaining surface layer. In most places depth to the parent material is less than 15 inches.

This soil has low available moisture capacity. Permeability is moderately rapid, and productivity is low. A permanent cover of grasses and legumes is needed to protect the soil from further erosion. Red oak, white oak, black oak, beech, hickory, and walnut grow fairly well on this soil.

The soil is in capability unit IVe–4; woodland group 16; and group 8 for building sites.

Hollinger silt loam, 15 to 25 percent slopes, severely eroded (HoD3).—The B horizon of this soil is thinner than that of the profile described as typical for the series. Depth to the parent material is generally 10 to 12 inches. Otherwise, the two profiles are similar. Almost all of the original surface layer has been lost through erosion, and material from the subsoil has been mixed with the remaining surface soil by plowing.

This soil is permeable, but it has low available moisture capacity. It is not well suited to deep-rooted plants. The soil is better suited to pasture, trees, or other permanent cover than to tilled crops.

This soil is in capability unit VIe–2; woodland group 16; and group 8 for building sites.

Hollinger silt loam, 25 to 35 percent slopes, severely eroded (HoE3).—The profile of this soil is shallower than the one described as typical for the series. Nearly all of the original surface layer has been lost through erosion, and the subsoil is also thinner. Depth to the parent material is generally 10 inches. Permeability is moderate, but the available moisture capacity is low. This soil is probably better suited to use as woodland than to other uses.

This soil is in capability unit VIIe–1; woodland group 17; and group 9 for building sites.

Lansdale Series

The Lansdale series consists of moderately deep to deep soils that are well drained. The soils formed on uplands in material weathered from gray shale and sandstone. They have a dark surface layer and a brown or yellowish-brown subsoil. In most places the surface layer is a sandy loam, and the subsoil, a sandy clay loam. The native vegetation consisted of white oak, red oak, black oak, tulip-poplar, hickory, walnut, and beech.

The Lansdale soils are near the Penn, Readington, and Croton soils. They are somewhat deeper than the Penn soils, and their subsoil is yellowish, rather than reddish, as is typical of the subsoil of Penn soils. They are less red than the Readington soils and contain less clay. The Lansdale soils are lighter colored than the Croton soils, which are poorly drained, and they are free of mottling in the surface layer.

A typical profile of a Lansdale sandy loam, on a slope of 6 percent, in a cultivated field:

A_p 0 to 10 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; friable; medium acid (pH 5.8); 8 to 10 inches thick.

B_{21} 10 to 24 inches, yellowish-brown (10YR 5/6) sandy clay loam; moderate, medium, subangular blocky structure; clay films on peds; friable; strongly acid (pH 5.4); 12 to 15 inches thick.

B_{22} 24 to 32 inches, light yellowish-brown (10YR 6/4) loam; moderate, medium, blocky structure; thin clay

films on peds; friable; strongly acid (pH 5.2); 7 to 10 inches thick.

C_1 32 inches +, yellowish-brown (10YR 5/6) silt loam that contains partially weathered fragments of shale; bedrock or solid shale generally is at a depth between 3 and 4 feet.

In most places the texture of the surface layer is sandy loam, but in a few small areas the surface layer has a finer texture. The subsoil ranges from loam to silty clay loam in texture and from yellowish brown to light reddish brown in color. Depth to the parent material ranges from 25 to 40 inches.

These soils have moderate available moisture capacity and are moderately permeable to water, air, and roots. They are easy to work and are moderately productive.

In Chester and Delaware Counties, the Lansdale soils occupy small areas that are closely intermingled with areas of Penn soils. Therefore, they are mapped with Penn soils in undifferentiated units and are called Penn and Lansdale sandy loams. Descriptions of the mapping units follow the description of the Penn series in this report.

Lawrence Series

The Lawrence series consists of deep, somewhat poorly drained soils of uplands. The soils are underlain by dolomite and by fine to coarse, crystalline limestone. Their surface layer is dark grayish-brown silt loam, and their subsoil is mottled, yellowish-brown silty clay loam. The subsoil is underlain by limestone at a depth between 4 and 6 feet. The soils are on gentle slopes, around the heads of streams, and in low-lying areas in Chester Valley. They are near Doe Run and Toughkenamon and in a few other areas scattered throughout Chester County. The native vegetation was a forest consisting of oak, hickory, walnut, and ash.

The Lawrence soils are near Hollinger, Conestoga, Bedford, and Guthrie soils, all of which have similar parent material. They are more poorly drained than the Hollinger, Conestoga, and Bedford soils, and they have mottling in the subsoil. The Lawrence soils are better drained than the Guthrie.

Typical profile of Lawrence silt loam, 0 to 3 percent slopes:

A_p 0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium to coarse, granular structure; friable when moist; neutral (pH 7.0); clear, wavy lower boundary; 7 to 10 inches thick.

B_2 8 to 14 inches, light yellowish-brown (2.5Y 6/4) silty clay loam; moderate, medium to coarse, blocky structure; thin clay films on peds; firm when moist, slightly sticky when wet; slightly acid (pH 6.5); clear, wavy lower boundary; 5 to 7 inches thick.

B_{2g} 14 to 20 inches, light brownish-gray (2.5Y 6/2) silty clay loam; common, medium mottles of yellowish brown (10YR 5/8); moderate, medium, blocky structure; thin clay films on peds; firm when moist, slightly sticky when wet; clear, wavy lower boundary; 5 to 8 inches thick.

B_{22g} 20 to 40 inches, brown (7.5YR 3/4) silty clay; common, medium, distinct mottles of light brownish gray (2.5Y 6/2); moderate, thin, platy structure that breaks to moderate, fine, blocky structure; firm when moist, sticky and plastic when wet; very strongly acid (pH 5.0); gradual, wavy lower boundary; 15 to 24 inches thick.

B_{23g} 40 to 58 inches, brownish-yellow (10YR 6/8) silty clay loam; many, medium, distinct mottles of grayish brown (10YR 5/2); moderate, medium, blocky structure; firm when moist; strongly acid (pH 5.5).

Depth to mottling ranges from 12 to 20 inches. In some places there are concretions of iron and manganese and the lower B horizon is dark reddish brown. The depth to bedrock varies according to the kind of parent material, but in most places bedrock is at a depth of 5 or 6 feet. These soils are moderately permeable. They have high available moisture capacity, and they are highly leached and acid. Productivity is moderately high.

Lawrence silt loam, 0 to 3 percent slopes (LaA).—The profile of this soil is the same as the one described as typical for the series.

This soil has an occasional high water table. It is suited to general farm crops, except deep-rooted plants that do not tolerate wetness. Open drainage ditches can be used to help remove the excess surface water that accumulates during wet periods. Growing a hay crop of suitable plants 2 years out of 4 will help to maintain fertility and prevent loss of soil. Contour cultivation is needed also to help control erosion. Red oak, white oak, black oak, ash, maple, and tulip-poplar grow well.

This soil is in capability unit IIIw–1; woodland group 10; and group 12 for building sites.

Lawrence silt loam, 3 to 8 percent slopes (LaB).—The profile of this soil is somewhat shallower than the one described as typical for the series. The water table is high in this soil for several weeks at a time. Nevertheless, the soil is well suited to the small grain and hay crops grown in the area, except for deep-rooted plants and other plants that do not tolerate wetness.

Graded stripcropping and diversion terraces are needed to help prevent erosion. Growing a sod of grasses and legumes 2 years out of 4 will help to maintain the fertility of the soil. Red oak, white oak, black oak, ash, tulip-poplar, hickory, and walnut grow well on this soil.

The soil is in capability unit IIIw–1; woodland group 10; and group 12 for building sites.

Lehigh Series

The Lehigh series consists of moderately deep soils that are moderately well drained. These soils have formed in material weathered from metamorphosed Triassic shale and sandstone that is near or adjacent to diabase dikes. The surface layer is very dark gray. The subsoil is gray or bluish gray and is mottled in the lower part. The colors in the subsoil cannot all be attributed to restricted drainage. Much of the color was derived from the fragments of various kinds of rock that make up the parent material. The native vegetation consisted mostly of white oak, red oak, black oak, hickory, walnut, and beech. The Lehigh soils are all in the northern part of Chester County.

The Lehigh soils are near the Brecknock, Croton, and Montalto soils. Unlike the Brecknock soils, they have mottling in the lower part of the subsoil. They are better drained than the Croton soils, which are poorly drained and have a gray surface layer. They are not so deep as the Montalto soils, which have no mottling in the subsoil.

Typical profile of Lehigh silt loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 9 inches, very dark gray (N 3/0) silt loam that has a few fragments of slate on the surface; weak, fine, granular structure; friable when moist; neutral (pH 6.6); clear, wavy lower boundary; 8 to 10 inches thick.

B_1 9 to 15 inches, dark-gray (5Y 4/1) silt loam; weak, fine, subangular blocky structure; friable when moist;

neutral (pH 6.8); gradual, wavy lower boundary; 5 to 7 inches thick.

B_{21} 15 to 20 inches, gray (5Y 5/1) and olive-brown (2.5Y 4/4) silty clay loam; a few, fine, distinct mottles; moderate, medium, blocky structure; thin clay films on peds; firm when moist, slightly sticky when wet; slightly acid (pH 6.4); clear, wavy lower boundary; 4 to 6 inches thick.

B_{22g} 20 to 26 inches, gray (N 5/0) silty clay; many, common, distinct mottles of olive (5Y 4/4); moderate, medium, angular blocky structure; firm when moist, slightly sticky when wet; strongly acid (pH 5.4); clear, irregular lower boundary; 5 to 8 inches thick.

B_{3g} 26 to 30 inches, bluish-gray (5B 5/1) and olive-brown (2.5Y 4/4) silty clay loam; many, coarse, prominent mottles; sticky and plastic when wet; strongly acid (pH 5.2); gradual, irregular lower boundary; 3 to 5 inches thick.

C 30 inches +, bluish-gray (5B 5/1), very dark brown (10YR 2/2), and black (10YR 2/1) very shaly silty clay loam that grades to slightly weathered, broken, blue shale at a depth of 36 inches; moderate, medium, somewhat platy structure that breaks to blocky structure; firm when moist, slightly sticky when wet; strongly acid (pH 5.2).

In a few places there are more fragments of slate in the surface layer than in the typical soil, and the fragments are more numerous and are larger than those in the subsoil. The texture of the surface layer is generally silt loam or silty clay loam. The subsoil is generally silty clay loam and contains many baked fragments of shale. Depth to the partially weathered C horizon ranges from 24 to 36 inches, and depth to mottling in the subsoil ranges from 15 to 30 inches.

The Lehigh soils are low in available moisture capacity and in natural fertility. Because of the slow internal drainage and poor aeration of the soils, deep-rooted crops do not grow well on them.

Lehigh silt loam, 3 to 8 percent slopes (LeB).—The profile of this soil is deeper than the one described as typical for the series, but, otherwise, the two profiles are similar. In most places there is a litter of leaves, 1 to 2 inches thick, on the surface. In a few places a small amount of the surface soil has been removed through erosion.

If this soil is cultivated, graded stripcropping and diversion terraces are needed to help control erosion. A cover crop of grasses and legumes is needed in the cropping system 50 percent or more of the time. The sod adds organic matter to the soil and improves the structure and aeration. White oak, red oak, black oak, hickory, and beech grow well on this soil.

The soil is in capability unit IIIw–2; woodland group 7; and group 10 for building sites.

Lehigh silt loam, 3 to 8 percent slopes, moderately eroded (LeB2).—The profile of this soil is the same as the one described as typical for the series. The soil has moderate available moisture capacity and is slowly permeable. It is strongly acid and has moderate natural fertility.

This soil can be used for tilled crops, but it is better used for pasture or hay. If grain and hay crops are included in the cropping system, diversion terraces and graded stripcropping are needed to help control erosion and prevent excessive runoff. Growing a sod of grasses and legumes 50 percent of the time also helps to control erosion and to maintain the content of organic matter. White oak, red oak, black oak, chestnut oak, beech, and hickory are the main trees that grow on this soil.

The soil is in capability unit IIIw–2; woodland group 7; and group 10 for building sites.

Lehigh silt loam, 8 to 15 percent slopes, severely eroded (LeC3).—The profile of this soil is shallower than the one described as typical for the series, but, otherwise, it is similar. Most of the original surface layer has been lost through erosion, and material from the subsoil has been mixed with the remaining surface soil by plowing. The available moisture capacity is moderately low.

A permanent sod of suitable grasses and legumes is needed to help protect this soil from erosion. White oak, red oak, black oak, chestnut oak, beech, and hickory are the principal trees that grow on this soil.

The soil is in capability unit IIIe–5; woodland group 7; and group 11 for building sites.

Lehigh very stony silt loam, 0 to 8 percent slopes (LhB).—Except that it is stony, the profile of this soil is like the one described as typical for the series. The many large stones on the surface and throughout the profile make the areas unsuitable for cultivation. The soil has only limited use for pasture, but it is suitable for use as woodland. White oak, red oak, beech, and hickory grow well on this soil.

The soil is in capability unit VIs–2; woodland group 7; and group 10 for building sites.

Lehigh very stony silt loam, 8 to 25 percent slopes (LhD).—The profile of this soil is shallower and contains more stones than the profile described as typical for the series. The many large stones on and in this soil make it unsuitable for cultivation. The soil has only limited use for pasture, but it is suited to use as woodland. White oak, black oak, red oak, beech, and hickory grow well.

This soil is in capability unit VIs–2; woodland group 7; and group 11 for building sites.

Lindside Series

The Lindside series consists of deep, moderately well drained soils on flood plains. The soils formed in sediments washed from areas underlain by limestone. They are mostly in Chester Valley. Their natural fertility is high. The surface layer of these soils is very dark grayish brown. Their subsoil is brown or yellowish red and is mottled with light brown or gray. The native vegetation consisted of ash, hickory, cottonwood, white oak, red oak, and tulip-poplar.

The Lindside soils are near the Hagerstown, Conestoga, Lawrence, Guthrie, and Melvin soils. They are not so well drained as the Hagerstown and Conestoga soils, and, unlike those soils, they have mottling in the lower part of the subsoil. They are better drained than the Lawrence, Guthrie, and Melvin soils and have mottling at a greater depth. Only one soil of this series—Lindside silt loam—is mapped in Chester and Delaware Counties.

Typical profile of Lindside silt loam:

A_p 0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; medium acid (pH 6.0); clear, smooth lower boundary; 8 to 10 inches thick.

C_1 9 to 15 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; friable; medium acid (pH 6.0); gradual, wavy lower boundary; 5 to 7 inches thick.

C_2 15 to 24 inches, brown (10YR 5/3) silt loam; common, fine, distinct mottles of light brownish gray (10YR 6/2); weak, fine, subangular blocky structure; thin,

discontinuous films of silt on peds; friable; medium acid (pH 5.8); gradual, wavy lower boundary; 8 to 10 inches thick.

D_1 24 to 50 inches, yellowish-red (5YR 5/6) silt loam; common, medium, distinct mottles of gray (10YR 5/1); thick, platy structure that breaks to pieces that subdivide into moderate fine, subangular blocky structure; firm; strongly acid (pH 5.2).

The variations in this soil are in the thickness and color of the horizons. The texture of the subsoil ranges from loam to silty clay loam. The parent material consists of alluvium washed from the Hagerstown or Conestoga soils. In a few places the alluvium has been transported for short distances through areas of soils underlain by mica, schist, or quartzite.

The Lindside soils are moderately permeable. They have high available moisture capacity and are moderately high in fertility. In most places the soils are free of stones. They are saturated for prolonged periods and have mottles in the lower part of the subsoil. In most places they are subject to occasional and light overflow and deposition.

Lindside silt loam (Ls).—The profile of this soil is the same as the profile described as typical for the series.

This soil is used mostly for pasture or hay, but corn and small grain also grow well. The soil is productive and has high available moisture capacity. Ash, sycamore, hickory, white oak, red oak, and tulip-poplar grow well on this soil.

The soil is in capability unit IIw–2; woodland group 8; and group 13 for building sites.

Made Land

Made land consists of areas in which the soil has been covered by other materials or from which the soil has been moved about or removed to provide materials for urban or industrial development. Because the areas consist of variable materials, they have not been given a capability classification or a woodland suitability classification. They have, however, been included in the groups for building sites.

Made land, gravelly materials (Ma).—This miscellaneous land type consists of areas in which the profile of the normal soil has been destroyed or covered by earthmoving equipment used for urban or industrial development. In these areas the soil materials consist of sand, gravel, and clay in various mixtures, but gravelly materials predominate. This mapping unit is in group 1 for building sites.

Made land, silt and clay materials (Mc).—This miscellaneous land type consists of areas in which the profile of the normal soil has been destroyed or covered by earthmoving equipment. In most places the exposed materials consist of silt and clay, but small areas of sandy and gravelly materials are intermingled with the silt and clay This unit is in group 3 for building sites.

Made land, gabbro and diabase materials (Md).—This miscellaneous land type consists of areas that have been graded or filled and the profile of the normal soil destroyed or covered. Large, grayish-brown boulders of diabase, and coarse-grained, salt-and-pepper colored boulders of gabbro make up most of the mass of material; the rest consists mainly of a mixture of reddish silty clay loam or clay from the subsoil and gray to brown silt loam from the surface layer. This mapping unit is in group 3 for building sites.

Made land, schist and gneiss materials (Me).—This miscellaneous land type consists of areas in which the profile of the normal soil has been destroyed or covered by earthmoving equipment used for urban or industrial development. In these areas the soil material consists of a mixture of grayish-brown material from the surface layer, silt loam from the subsoil, and partially weathered micaceous schist and gneiss rocks. This unit is in group 1 for building sites.

Made land, sanitary land fill (Mf).—This miscellaneous land type is made up of alternate layers of soil material and trash and has been compacted by heavy equipment. It is in group 5 for building sites.

Manor Series

The Manor series consists of shallow, well-drained soils of uplands. The soils occur in both Chester and Delaware Counties, but in Chester County they are more common south of Chester Valley. The parent material of these soils is mostly mica, schist, and gneiss. The schist is fairly soft and weathers easily. The soils formed on schist appear to be deep, but, actually, they have little development in the B horizon. The soils formed on gneiss are shallow over bedrock in many places.

The Manor soils have a dark-brown surface layer. Their subsoil is yellowish red or yellowish brown and is micaceous. In many places the soil has a slippery or greasy feeling caused mainly by the abundance of mica that it contains. The native forest consisted mostly of red oak, white oak, chestnut, hickory, black oak, tulip-poplar, and beech.

The Manor soils are near the deep, well-drained Chester soils and the moderately deep, well-drained Glenelg soils. They are also near the Glenville and Worsham soils, but they are shallower and better drained than those soils.

Typical profile of Manor loam, 8 to 15 percent slopes, moderately eroded:

A_p 0 to 7 inches, dark-brown (10YR 4/3) loam; weak, fine, granular structure; very friable; very strongly acid (pH 5.0); clear, smooth lower boundary; 6 to 8 inches thick.

B_2 7 to 13 inches, yellowish-red (5YR 4/8) loam; weak, fine, granular structure; friable; strongly acid (pH 5.2); gradual, wavy lower boundary; 5 to 8 inches thick.

B_3 13 to 21 inches, yellowish-brown (10YR 5/6), smooth loam; weak, fine, subangular blocky structure; friable; strongly acid (pH 5.4); gradual, wavy lower boundary; 8 to 12 inches thick.

C 21 to 50 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam containing yellow (10YR 7/6) lenses that are ⅛ inch thick; weak, medium, somewhat platy structure that breaks to weak, fine, granular structure; loose to very friable; medium acid (pH 5.6).

The texture of the surface layer is loam or light silt loam. The color of the surface layer ranges from pale brown to dark grayish brown, and that of the subsoil, from yellowish brown to reddish brown. Depth to bedrock ranges from 15 inches in some places that are underlain by gneiss to between 8 and 10 feet in soils that are underlain by mica schist.

In most places the subsoil is very micaceous and is underlain by highly weathered mica schist. The mica schist is interspersed with partially disintegrated fragments of rock. In some areas near South Valley Hills, where the underlying rocks are albite-chlorite schist, 40 to 60 percent of the profile, by volume, consists of frag-

ments of schist. The fragments vary in size. They are as much as 3 or 4 inches across and ½ inch to 2 inches thick.

Manor loam, 0 to 3 percent slopes, moderately eroded (MgA2).—In this soil depth to the C horizon is greater than in the profile described as typical for the series. In most places, however, part of the original surface layer has been lost through erosion. In a few places the surface layer has been removed for use as casing soil in mushroom houses.

Manor loam, 0 to 3 percent slopes, moderately eroded, is easy to work. It has moderate to low available moisture capacity, and its productivity is moderately low.

If this soil is managed properly, most farm crops grow fairly well on it. Contour cultivation is needed to help control erosion. A cropping system is needed in which grasses and legumes are grown every 3 or 4 years. Large amounts of lime and fertilizer are required. Red oak, black oak, chestnut oak, hickory, and tulip-poplar grow well on this soil.

The soil is in capability unit IIs–1; woodland group 13; and group 5 for building sites.

Manor loam, 3 to 8 percent slopes, moderately eroded (MgB2).—Except that depth to parent material is greater, the profile of this soil is similar to the one described as typical for the series. The soil has lost about 50 percent of its original surface layer through erosion.

Most of this soil is easy to work. It has moderate to low available moisture capacity and is moderately to highly permeable.

This soil is moderately well suited to the general farm crops grown in the area. Contour stripcropping and diversion terraces will help to control erosion. Growing a sod crop of grasses and legumes at least 50 percent of the time also helps to control erosion and increases the supply of organic matter in the soil. Red oak, white oak, black oak, tulip-poplar, and hickory grow well on this soil.

The soil is in capability unit IIe–5; woodland group 13; and group 5 for building sites.

Manor loam, 3 to 8 percent slopes, severely eroded (MgB3).—This soil has lost nearly all of the original surface layer through erosion, and part of the subsoil has been mixed with the remaining surface soil. Otherwise, the profile is similar to the one described as typical for the series. In a few places the surface layer has been removed to provide casing soil for use in mushroom houses.

This soil can be used for small grain, but it is better suited to hay or pasture. If the soil is cultivated, it should be tilled on the contour to help control erosion. Diversion terraces would be needed. The soil is well suited to a permanent cover of hay or pasture. Large amounts of fertilizer and lime are needed for adequate yields. The lime and fertilizer should be applied according to the needs indicated by soil tests. Red oak, black oak, chestnut oak, and hickory grow fairly well on this soil.

The soil is in capability unit IIIe–4; woodland group 13; and group 5 for building sites.

Manor loam, 8 to 15 percent slopes (MgC).—Most of this inextensive soil is wooded. It has a layer of leaf mold, about 1 inch thick, on the surface. Just beneath the leaf mold is an A_1 horizon, 2 inches thick, of dark grayish-brown loam that is very friable and contains many roots. The A_2 horizon, underlying the A_1, consists of dark-brown silt loam, 4 to 6 inches thick that contains 15 to 20 percent, by volume, of fragments of schist. The profile underlying the A_2 horizon is similar to the one described as typical for the series, except that the depth to parent material is between 20 and 24 inches.

This soil is moderately permeable and has moderate available moisture capacity. If cleared, it is well suited to hay or pasture. Its use for row crops and small grain is limited. If this soil is used for tilled crops, contour stripcropping and diversion terraces are needed to control erosion. A hay crop is needed 2 years out of 4 to help maintain organic matter in the soil. Red oak, black oak, white oak, beech, chestnut oak, and hickory grow fairly well on this soil.

The soil is in capability unit IIIe–4; woodland group 15; and group 6 for building sites.

Manor loam, 8 to 15 percent slopes, moderately eroded (MgC2).—The profile of this soil is the one described as typical for the series.

This soil is fairly well suited to the general farm crops grown in this area. Its available moisture capacity, however, is moderately low to low. During dry periods, crops grown on this soil are among the first in the area to be damaged by lack of moisture.

The soil is well suited to permanent pasture. If it is used for cultivated crops, contour stripcropping and diversion terraces are needed to help control erosion. Growing a sod of grasses and legumes 50 percent of the time also helps to control erosion and adds organic matter to the soil. Red oak, white oak, black oak, hickory, and beech grow well on this soil.

The soil is in capability unit IIIe–4; woodland group 15; and group 6 for building sites.

Manor loam, 8 to 15 percent slopes, severely eroded (MgC3).—The profile of this soil is shallower, in most places, than the profile described as typical for the series. Nearly all of the original surface layer has been washed away, and material from the upper part of the subsoil has been mixed with the remaining surface layer. Gullies are common.

In several places the surface layer of this soil has been removed to provide casing soil for use in mushroom houses. In these areas gullies form soon after the surface layer is removed unless practices are applied immediately to protect the soil.

This soil needs a permanent sod of hay or pasture to help control erosion. To obtain a satisfactory cover, lime and fertilizer should be applied before seeding, according to the needs indicated by soil tests. Black oak, chestnut oak, red oak, beech, and hickory are suited.

This soil is in capability unit IVe–4; woodland group 15; and group 6 for building sites.

Manor loam, 15 to 25 percent slopes (MgD).—This soil is nearly all forested. On the surface is a layer of leaf mold about 1 inch thick. Just beneath the leaf mold is a layer of dark grayish-brown loam, about 2 inches thick, that is very friable and contains many roots. Underlying this layer is an A_2 horizon, 4 to 6 inches thick, of dark-brown silt loam that contains 15 to 20 percent, by volume, of fragments of schist. The profile below the A_2 horizon is similar to the one described as typical for the series.

This soil has moderately low available moisture capacity. It is easily penetrated by air, moisture, and plant roots.

Because of its strong slopes and susceptibility to erosion, the soil is not well suited to cultivated crops. This soil needs a permanent cover of sod or trees. If it is cleared for pasture, a large amount of lime and fertilizer

are needed for satisfactory yields. White oak, red oak, black oak, beech, hickory, and tulip-poplar are suited to this soil.

The soil is in capability unit IVe–4; woodland group 15; and group 6 for building sites.

Manor loam, 15 to 25 percent slopes, moderately eroded (MgD2).—The profile of this soil is shallower than the profile described as typical for the series, but, otherwise, it is similar. Most of this soil is wooded or in pasture. In areas that have been cleared, between 50 and 75 percent of the original surface layer has been lost through erosion.

This soil is well suited to permanent hay or pasture. Lime and fertilizer are required to obtain adequate yields. Red oak, white oak, black oak, beech, tulip-poplar, and hickory are the dominant kinds of trees that grow on this soil.

This soil is in capability unit IVe–4; woodland group 15; and group 6 for building sites.

Manor loam, 15 to 25 percent slopes, severely eroded (MgD3).—The profile of this soil is shallower than the one described as typical for the series, and gullies are common. Practically all of this soil has been cleared and was cultivated at one time. Permeability is moderately high, but the available moisture capacity is low.

This soil is not well suited to corn or small grain, but it is fairly well suited to permanent pasture or trees. Large amounts of fertilizer and lime are needed for plants to grow vigorously. White pine, Virginia pine, Banks pine, and pitch pine are suited to this soil.

The soil is in capability unit VIe–2; woodland group 15; and group 6 for building sites.

Manor loam and channery loam, 25 to 35 percent slopes (MhE).—The profile of this soil is shallower over bedrock than the profile described as typical for the series, and there is a mat of leaves, about 1 inch thick, on the surface. The mat is underlain by a layer, 6 to 7 inches thick, of grayish-brown loam that has granular structure. This layer contains many fragments of rock that occupy from 40 to 60 percent of the soil mass. The profile beneath this horizon is similar to the profile described as typical for the series.

This soil has not been cleared and is used as woodland. It is well suited to trees. If cleared, it has only a limited use for pasture. Red oak, white oak, black oak, chestnut oak, beech, and hickory grow fairly well on this soil.

This soil is in capability unit VIe-2; woodland group 17; and group 9 for building sites.

Manor loam and channery loam, 25 to 35 percent slopes, severely eroded (MhE3).—The profile of this soil is shallower over bedrock than the one described as typical for the series. It is shallow to very shallow. The present surface layer is mostly material from the former subsoil. In a few places bedrock is near the surface, and there are a few rock outcrops. In a few other areas, 40 to 60 percent of the profile consists of fragments of rock. The number of rocks increases with increasing depth.

This soil is probably best suited to use as woodland. It has steep slopes, is droughty, and is low in fertility. Furthermore, the areas are inaccessible to farm machinery, and erosion is difficult to control. White pine, red pine, Virginia pine, Banks pine, and pitch pine grow fairly well on this soil.

The soil is in capability unit VIIe-1; woodland group 17; and group 9 for building sites.

Manor soils, 35 to 60 percent slopes (MkF).—These soils are shallow. Most of the areas are wooded and have a thin layer of leaf mold, about one-half inch thick, on the surface. In most places the soils are only slightly to moderately eroded, but a few areas have been cleared and have become severely eroded. There are numerous fragments of rock in the surface layer and throughout the profile. In eroded areas the subsoil is very thin. The available moisture capacity is fairly low, but permeability is rapid to very rapid.

These soils are not suited to cultivated crops or pasture. They are well suited to trees, which are needed to provide a permanent cover. Red oak, white oak, black oak, chestnut oak, beech, and hickory grow fairly well on these soils if the areas are not severely eroded. In areas that are severely eroded, red pine, Virginia pine, Banks pine, white pine, and pitch pine can be grown.

This soil is in capability unit VIIe-1; woodland group 17; and group 9 for building sites.

Manor very stony loam, 0 to 8 percent slopes (MmB).—Except that it is stony and is thicker, 20 to 24 inches to the C horizon, the profile of this soil is similar to the one described as typical for the series. There is a layer of leaf mold, about 1 inch thick, on the surface. The leaf mold is underlain by a layer, 2 to 3 inches thick, of dark grayish-brown loam that contains many small roots. Beneath this layer is the A_2 horizon, which is 4 to 8 inches thick and consists of dark-brown silt loam that contains a few fragments of schist.

The many large stones on the surface make this soil unsuitable for cultivation. In some places, however, the soil has a limited use for pasture. Red oak, white oak, black oak, beech, and hickory are fairly well suited.

This soil is in capability unit VIIs-1; woodland group 13; and group 5 for building sites.

Manor very stony loam, 8 to 25 percent slopes (MmD).—This soil has a thin layer of leaf mold, about 1 inch thick, on the surface. Just beneath the leaf mold is a layer, 1 to 2 inches thick, of dark grayish-brown loam that is very friable and contains many roots. Underlying this layer is an A_2 horizon, 5 to 7 inches thick, of dark-brown silt loam that contains, by volume, 15 to 20 percent of fragments of schist. The profile beneath the A_2 horizon is similar to the one described as typical for the series.

The many large stones on the surface and in the profile of this soil make cultivation impractical. Some areas, if cleared, can be used for pasture, providing the stones are not so numerous as to prevent the control of woody and undesirable kinds of plants. White oak, red oak, black oak, tulip-poplar, hickory, and beech are well suited to this soil.

This soil is in capability unit VIIs–1; woodland group 15; and group 6 for building sites.

Manor very stony loam, 25 to 60 percent slopes (MmF).—This soil has a thin layer of leaf mold, about 1 inch thick, on the surface. The leaf mold is underlain by 1 to 2 inches of dark grayish-brown loam that is very friable and contains many small roots. Just beneath this layer is a horizon, 3 to 6 inches thick, of dark-brown silt loam 20 to 25 percent of which, by volume, consists of fragments of schist. Depth to the C horizon ranges from 15 to 20 inches.

The many large stones make this soil unsuitable for cultivation or for use as pasture. The soil is probably

best suited to use as woodland. White oak, red oak, black oak, beech, and hickory grow well on this soil.

The soil is in capability unit VIIs–1; woodland group 17; and group 9 for building sites.

Melvin Series

The Melvin series consists of deep, poorly drained soils on flood plains. The soils have a surface layer of dark-gray silt loam. Their subsoil is light brownish-gray or dark yellowish-brown, mottled silty clay loam. These inextensive soils occur in a few areas in Chester Valley. They are along streams that drain areas of Hagerstown and Conestoga soils. The native vegetation was hardwoods, chiefly elm, ash, red maple, hickory, and sycamore.

These soils are near soils of the Lindside series, which are moderately well drained. The Melvin soils have mottling at or near the surface, and the Lindside soils have mottling only in the lower part of the subsoil. Only one soil—Melvin silt loam—is mapped in these two counties.

Typical profile of Melvin silt loam:

A_p 0 to 7 inches, dark-gray (10YR 4/1) silt loam; weak, fine, crumb structure; friable when moist; slightly acid (pH 6.6); clear, wavy lower boundary; 7 inches thick.

C_1 7 to 12 inches, olive-gray (5Y 5/2) silt loam; a few, fine, faint mottles of light olive gray (5Y 6/2); weak, fine, crumb structure; friable when moist; slightly acid (pH 6.6); gradual, wavy lower boundary; 4 to 6 inches thick.

C_{2g} 12 to 16 inches, light brownish-gray (2.5Y 6/2) silty clay loam; a few, fine, distinct mottles of dark yellowish brown (10YR 4/4); weak, medium, subangular blocky structure; thin, discontinuous clay films; slightly sticky when wet; neutral (pH 6.8); gradual, wavy lower boundary; 3 to 6 inches thick.

D_{1g} 16 to 24 inches, yellowish-brown (10YR 5/6) silty clay loam; many, coarse, distinct mottles of light brownish gray (2.5Y 6/2); contains many pebbles of quartz and fragments of schist that in places are as small as a pea, but range in size to as large as a black walnut; moderate, medium, blocky structure; continuous clay films on peds; sticky and slightly plastic when wet; neutral (pH 7.0); gradual, wavy lower boundary; 7 to 10 inches thick.

D_2 24 inches +, contains 40 to 60 percent, by volume, of fine fragments of quartz and schist.

The color and texture of the soil material varies within short distances, depending on the kind of sediments that have been deposited by floodwaters. The thickness of the various horizons varies according to the length of time the soil has been flooded and the intensity of the floods that deposit the sediments. Depth to the water table is generally between 16 and 28 inches.

The available moisture capacity is high, and permeability is moderate to rapid. In most places the high water table restricts the development of plant roots and movement of air through the soils.

Melvin silt loam (Mn).—The profile of this soil is the same as the one described as typical for the series.

This soil is better suited to pasture than to tilled crops. The water table is high, and the soil is subject to frequent flooding. Therefore, grasses and legumes that tolerate wetness are suitable kinds of plants to grow.

Where slopes are sufficient, open drains can be used to help remove excess water from the surface layer and subsoil. If the soil is drained, plant nutrients will become more readily available.

This soil is in capability unit VIw-1; woodland group 12; and group 13 for building sites.

Montalto Series

The Montalto series consists of moderately deep to deep, well-drained soils of uplands. The soils have formed from materials weathered mostly from Triassic diabase rock. The surface layer is very dark gray silt loam. The subsoil, a strong-brown or reddish-brown silty clay loam, contains more clay than the surface layer. There are numerous stones of various sizes on the surface of these soils. The native vegetation was a forest made up mainly of white oak, red oak, and black oak, but it included some beech and tulip-poplar.

The Montalto soils are in the northwestern part of Chester County. They are north of Elverson, Warwick, and Knauertown, and in a few scattered areas in the northern half of Chester County where diabase dikes are exposed. The soils are not extensive in these two counties, but generally they can be recognized by the large diabase boulders on the surface.

The Montalto soils are near the Watchung, Mount Lucas, Neshaminy, Lehigh, and Brecknock soils. They are better drained than the Watchung soils, which are poorly drained. They also lack mottling at or near the surface, which is common in the Watchung soils. The Montalto soils are better drained than the Mount Lucas soils, which are moderately well drained, have grayish colors in the subsoil, and are more highly leached than the Montalto soils.

The subsoil of the Montalto soils is more clayey and is somewhat reddish and darker colored than that of the Neshaminy soils. The profile of the Montalto soils is less gray throughout than that of the Lehigh soils, which have mottling in the lower part of the subsoil. In contrast to the Brecknock soils, the Montalto soils have a reddish-brown subsoil, rather than a dark grayish-brown subsoil that contains hard fragments of slate that resemble porcelain.

Typical profile of Montalto very stony silt loam, 0 to 8 percent slopes:

A_{00} Recently fallen leaves and twigs.

A_0 ½ inch to 0, matted leaf mold.

A_1 0 to 2 inches, very dark gray (10YR 3/1) stony silt loam; weak, fine, granular structure; friable when moist; slightly acid (pH 6.2); clear, wavy lower boundary; about 2 inches thick.

A_2 2 to 4 inches thick, yellowish-brown (10YR 5/6) silt loam; weak, fine, granular structure; friable when moist; strongly acid (pH 5.4); clear, wavy lower boundary; 2 to 3 inches thick.

B_1 4 to 8 inches, strong-brown (7.5YR 5/8) silty clay loam; moderate, medium, blocky structure; thin films on peds; firm when moist, slightly sticky and plastic when wet; strongly acid (pH 5.2); gradual, wavy lower boundary; 3 to 5 inches thick.

B_{21} 8 to 26 inches, strong-brown (7.5YR 5/6) silty clay; moderate, medium, blocky structure; clay films on peds; firm when moist, sticky and plastic when wet; strongly acid (pH 5.4); gradual, irregular lower boundary; 15 to 20 inches thick.

B_{22} 26 to 40 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, blocky structure; a few, discontinuous clay films and numerous coatings of black manganese; firm when moist, sticky and plastic when wet; medium acid (pH 5.6); clear, wavy lower boundary; 12 to 16 inches thick.

C 40 to 52 inches, yellowish-red (5YR 5/6) gritty clay loam; moderate, medium, blocky and somewhat platy

structure; firm when moist, and slightly sticky when wet; medium acid (pH 5.8); gradual, wavy lower boundary; 10 to 14 inches thick.

D_r 52 inches +, diabase bedrock.

Depth to bedrock ranges from 36 to 54 inches. In a few places the color of the subsoil is reddish brown or dark red. The stones range in size from small in the profile to boulders that weigh as much as one-half ton. The boulders are on the surface.

The Montalto soils have moderate to low available moisture capacity. They have fairly high fertility, but stones limit their use.

Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded (MoB2).—In the profile of this soil, depth to the C horizon is less than in the profile described as typical for the series, and leaf litter has been mixed with the surface soil by cultivation. Otherwise, the two profiles are similar.

This soil has moderately slow permeability, and the available moisture capacity is moderate. It has a good supply of plant nutrients.

This soil is well suited to cultivated crops and apple orchards. The apple trees should be planted on the contour and the space between the rows seeded to sod crops. The cover of sod helps to control erosion and adds organic matter to the soil. White oak, red oak, tulip-poplar, hickory, and black oak are also well suited to this soil.

This soil is in capability unit IIe–3; woodland group 2; and group 3 for building sites.

Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded (MoC2).—Except that the stones have been removed from the surface and cultivation has mixed the layer of leaf mold with the surface layer, the profile of this soil is like the one described as typical of the series. About 50 percent of the original surface layer has been lost through erosion.

This soil has moderately low available moisture capacity. It is moderately high in fertility.

This soil is well suited to tree fruits, but it has only a limited use for general farm crops. Diversion terraces and contour stripcropping are needed to control erosion in areas that are tilled. A sod crop of grasses and legumes is needed 50 percent of the time to help control erosion and to maintain the content of organic matter. Red oak, white oak, black oak, hickory, and walnut, are well suited to this soil.

The soil is in capability unit IIIe–2; woodland group 4; and group 4 for building sites.

Montalto channery silt loam, 8 to 15 percent slopes, severely eroded (MoC3).—In this soil depth to the C horizon is less than in the profile described as typical for the series. The surface layer is mostly exposed subsoil. In a few places there are gullies that are less than 100 feet apart.

This soil has moderately slow permeability. Its available moisture capacity is moderately low.

The soil is better suited to permanent vegetation than to tilled crops. Most grasses and legumes grow well if adequate amounts of lime and fertilizer are applied. White oak, red oak, black oak, beech, and hickory also grow well.

This soil is in capability unit IVe–3; woodland group 4; and group 4 for building sites.

Montalto channery silt loam, 15 to 25 percent slopes, severely eroded (MoD3).—The profile of this soil is shallower than the one described as typical for the series. This soil has lost nearly all of its original surface layer, and the present plow layer consists mostly of material from the former subsoil. There are a few shallow gullies in some areas.

This soil needs to be protected by a sod of grasses and legumes 75 to 90 percent of the time to help control erosion and maintain the content of organic matter. The soil is not well suited to tilled crops, because it is too shallow to hold sufficient water for good yields. The subsoil has a heavy texture and low capacity for holding moisture; consequently, runoff is rapid.

This soil is in capability unit VIe–1; woodland group 4; and group 4 for building sites.

Montalto very stony silt loam, 0 to 8 percent slopes (MrB).—The profile of this soil is similar to the one described as typical for the series.

The many large boulders on the surface make this soil unsuitable for cropland. It has only limited use for pasture, but it is well suited to use as woodland. Red oak, white oak, chestnut oak, black oak, tulip-poplar, and hickory are the principal kinds of trees that grow on this soil.

The soil is in capability unit VIs–1; woodland group 2; and group 3 for building sites.

Montalto very stony silt loam, 8 to 25 percent slopes (MrD).—Except that it contains more stones and is somewhat shallower over bedrock, the profile of this soil is similar to the one described as typical for the series.

The many large boulders and stones on the surface make this soil unsuitable for cultivation. The soil has only limited use for pasture, but it is suited to use as woodland. White oak, red oak, black oak, chestnut oak, beech, and hickory are the principal kinds of trees that grow on this soil.

The soil is in capability unit VIs–1; woodland group 4; and group 4 for building sites.

Montalto very stony silt loam, 25 to 45 percent slopes (MrF).—Except that it is shallower over bedrock, the profile of this soil is similar to the one described as typical for the series.

This soil is suited to woodland and wildlife. The many large boulders and stones on the surface make it unsuitable for cultivated crops or for pasture.

This soil is in capability unit VIIs–1; woodland group 6; and group 9 for building sites.

Mount Lucas Series

The Mount Lucas series consists of moderately deep to deep soils that are moderately well drained to somewhat poorly drained. These soils developed on materials weathered from diabase. Their surface layer is very dark brown or dark grayish brown. The subsoil is yellowish brown to dark brown and is mottled. Just beneath the subsoil is partially weathered, dark grayish-brown, coarse and gritty diabase rock that gradually grades to solid rock. The native vegetation consisted mainly of red oak, white oak, black oak, and chestnut oak, but it included some hickory.

These soils occur only in the northern part of Chester County near Knauertown and Warwick. The soils are not extensive and are stony.

The Mount Lucas soils are near the Montalto and Watchung soils. They are not so well drained as the deep Montalto soils, which are well drained, but they are better drained than the Watchung soils, which are poorly drained. Only one soil of the series—Mount Lucas very stony silt loam, 0 to 8 percent slopes—is mapped in Chester and Delaware Counties.

Typical profile of Mount Lucas very stony silt loam, 0 to 8 percent slopes:

A_1 0 to 4 inches, very dark brown (10YR 2/2) very stony silt loam with many boulders on the surface; weak, fine, granular structure; friable when moist; strongly acid (pH 5.4); clear, wavy lower boundary; 3 to 5 inches thick.

A_2 4 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist, slightly sticky when wet; medium acid (pH 5.8); clear, smooth lower boundary; 2 to 4 inches thick.

B_1 7 to 12 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine and medium, subangular blocky structure; discontinuous clay films; slightly sticky and slightly plastic when wet; medium acid (pH 6.0); gradual, wavy lower boundary; 4 to 6 inches thick.

B_{21} 12 to 15 inches, pale-brown (10YR 6/3) silty clay loam; a few, fine, faint mottles; moderate, medium, blocky structure; continuous clay films; slightly sticky and plastic when wet; medum acid (pH 6.0); clear, wavy lower boundary; 3 to 6 inches thick.

B_{22} 15 to 24 inches, strong-brown (7.5YR 5/6) clay loam; common, coarse, distinct mottles of light brownish gray (10YR 6/2); moderate, medium, blocky and weak, prismatic structure; thick clay films on peds; sticky and plastic when wet; neutral (pH 6.6); 8 to 10 inches thick.

B_{23} 24 to 33 inches, dark-brown (10YR 4/3) silty clay loam; a few, distinct mottles of light brownish gray (10YR 6/2); moderate, medium to thick, platy structure that breaks to subangular blocky structure; firm when moist, slightly sticky when wet; neutral (pH 6.8); 8 to 12 inches thick.

C 33 to 45 inches, dark grayish-brown, coarse, gritty material that is mostly weathered from diabase.

The color of the subsoil ranges from yellowish brown to reddish brown. From 40 to 80 percent of the surface is covered by stones and boulders. Depth to mottling ranges from 12 to 20 inches.

The Mount Lucas soils are slowly permeable, and they have moderate available moisture capacity. These soils are only moderately productive. There are many large stones and boulders on the surface.

Mount Lucas very stony silt loam, 0 to 8 percent slopes (MsB).—The profile of this soil is the same as the one described as typical for the series.

Nearly all of this soil is covered with trees. This soil is unsuitable for cultivation because of the many large stones and boulders on the surface. It has only limited use for pasture, but it is well suited to use as woodland or for wildlife. White oak, red oak, black oak, ash, and red maple are the principal kinds of trees that grow on this soil.

The soil is in capability unit VIs–2; woodland group 8; and group 10 for building sites.

Neshaminy Series

The Neshaminy soils are deep and well drained. Their surface layer is dark brown and silty, but their subsoil, a reddish-brown silty clay loam, is underlain by red coarse sandy clay loam. The native forest consisted mainly of red oak, white oak, black oak, tulip-poplar, hickory, and walnut. On stony areas of these soils, there were also beech trees in the native stands.

These soils developed mainly from serpentine and from gabbro and granodiorite of Precambrian age. The most extensive Neshaminy soils developed from materials weathered from gabbro. If weathered, the gabbro is rust colored, but the surface of a piece of freshly broken gabbro is greenish gray. The granodiorite has a salt-and-pepper color.

Most of the Neshaminy soils are gently sloping, but their relief ranges from nearly level to steep. In Chester County most areas of these soils are north of the Great Valley. In Delaware County most of the areas are small and are scattered throughout the northwestern part of the county.

The Neshaminy soils are near the Manor, Chester, Glenville, Worsham, and Montalto soils. In a few places they are near the Chrome and Conowingo soils. The Neshaminy soils are deeper than the Manor soils, and they have a heavier texture. Their subsoil is redder than that of the Chester soils and contains more clay; it is not so sticky and plastic as that of the Montalto soils, nor is its structure so blocky. The Neshaminy soils are deeper than the Glenelg soils. They are better drained than the Glenville soils, which are moderately well drained, and they are also better drained than the Worsham soils, which are poorly drained. The Neshaminy soils are deeper than the Chrome soils and are better drained than the Conowingo.

Typical profile of Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded, in a field of alfalfa:

A_p 0 to 8 inches, dark-brown (10YR 3/3) gravelly silt loam; weak, fine, medium, subangular blocky structure; friable when moist; very slightly acid to neutral (pH 6.8); abrupt, smooth lower boundary; 6 to 8 inches thick.

B_1 8 to 13 inches, yellowish-red (5YR 4/6) silty clay loam; moderate, medium, blocky structure; firm when moist, slightly plastic when wet; neutral (pH 7.2); gradual, wavy lower boundary; 3 to 7 inches thick.

B_{21} 13 to 18 inches, reddish-brown (5YR 4/4) clay loam; moderate, medium, blocky structure; a few, dark coatings of manganese stains; firm when moist, plastic and sticky when wet; neutral (pH 7.2); gradual, wavy lower boundary; 3 to 7 inches thick.

B_{22} 18 to 22 inches, reddish-brown (5YR 4/4) silty clay loam; strong, medium, blocky structure; occasional dark coatings; firm when moist, plastic when wet; neutral (pH 7.2); gradual, irregular boundary; 2 to 6 inches thick.

B_{23} 22 to 28 inches, reddish-brown (5YR 4/4) silty clay loam; strong, medium, blocky structure; a few, dark-colored clay films on the surfaces of peds; firm when moist, plastic when wet; neutral (pH 7.2); gradual, irregular lower boundary; 4 to 10 inches thick.

B_3 28 to 37 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium, platy and moderate, medium, blocky structure; a few dark coatings; firm when moist, sticky when wet; neutral (pH 6.8); gradual, broken lower boundary; 4 to 12 inches thick.

C_1 37 to 48 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium, platy structure that breaks to blocky structure; firm when moist, sticky when wet; neutral (pH 6.8).

In some places the subsoil has a lighter hue (10YR) than that in the profile described as typical. The amount of rock in the subsoil ranges from 25 to 50 percent of the soil mass.

The Neshaminy soils are moderately permeable and have moderate available moisture capacity. They are

slightly acid to neutral. Alfalfa grows well on the gravelly soils; the stony soils are used mostly for pasture and forest.

Neshaminy gravelly silt loam, 0 to 3 percent slopes (NaA).—The surface layer of this soil is thicker than that in the profile described as typical for the series, and the profile is deeper over the C horizon. Depth to the parent material is 38 to 52 inches.

Because of the numerous stones in the profile, this soil is hard to work. The available moisture capacity is moderately high, and permeability is good. The soil is productive.

This soil is well suited to most truck crops, general farm crops, forage crops, and tree fruits grown in the area. Growing a mixture of grasses and legumes every 3 or 4 years improves the structure of the soil and adds organic matter. White oak, red oak, black oak, hickory, tulip-poplar, and ash grow well on this soil.

This soil is in capability unit I–1; woodland group 1; and group 3 for building sites.

Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded (NaB2).—The profile of this soil is the same as the one described as typical for the series.

This soil has moderately high available moisture capacity. It is moderately permeable and is productive.

This soil is well suited to the general farm crops, truck crops, and tree fruits commonly grown in the area. Diversion terraces and contour stripcropping are needed to help control erosion in areas that are tilled. Growing a mixture of grasses and legumes every few years and rotating them with other crops improves the structure of the soil and helps to control erosion. White oak, red oak, black oak, tulip-poplar, hickory, and ash are well suited to the soil.

This soil is in capability unit IIe–2; woodland group 1; and group 3 for building sites.

Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded (NaC2).—The surface layer of this soil is thinner than that in the profile described as typical for the series, and the profile is shallower. It contains more fragments of rock than the profile described. Material from the subsoil has been mixed with the remaining surface layer. Depth to parent material is 26 to 34 inches.

This soil has moderate available moisture capacity, and it is moderately permeable. The soil is fertile, but it contains rock fragments and gravel that interfere slightly with cultivation.

This soil is well suited to the general farm crops, tree fruits, and pasture crops commonly grown in the area. Contour stripcropping and diversion terraces will help to control erosion. Growing grasses and legumes 2 years out of 4 and rotating them with other crops helps to improve the structure of the soil and adds organic matter. White oak, red oak, tulip-poplar, walnut, and hickory grow well on this soil.

This soil is in capability unit IIIe-2; woodland group 3; and group 4 for building sites.

Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded (NaC3).—The profile of this soil is shallower over the C horizon than the one described as typical for the series. Most of the original surface layer has been lost through erosion, and material from the subsoil has been mixed with the thin remaining surface soil. Gullies occur in a few places.

The available moisture capacity of this soil is moderately low, and permeability is moderately slow.

This soil can be used to grow hay of grasses and legumes. Large amounts of plant nutrients are needed to get satisfactory yields. White oak, red oak, black oak, hickory, walnut, and beech are the kinds of trees that grow well on this soil.

This soil is in capability unit IVe-2; woodland group 3; and group 4 for building sites.

Neshaminy gravelly silt loam, 15 to 25 percent slopes (NaD).—This inextensive soil is nearly all in forest. It has a litter of hardwood leaves on the surface. The litter is underlain by a layer of dark-brown gravelly silt loam, about 1 inch thick, that has weak, fine, granular structure. Just beneath is a layer, 8 to 10 inches thick, of brown (7.5YR 5/2) gravelly silt loam that has weak, fine, granular structure. Below this horizon, the profile is similar to the one described as typical for the series.

This soil has moderate to high available moisture capacity. It has moderate permeability.

More than 95 percent of the acreage of this soil is wooded and has never been plowed. The soil is suitable for growing hay of grasses and legumes, but slopes are fairly steep and most areas are small and are not easily accessible. The areas, therefore, have remained in woodland.

This soil is in capability unit IVe–2; woodland group 3; and group 4 for building sites.

Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded (NaD3).—The profile of this soil is shallower than the one described as typical for the series, but, otherwise, the two profiles are similar. This soil has lost nearly all of its original surface layer through erosion. The present plow layer consists mostly of material from the former subsoil.

All of this soil has been cleared and is used mostly for pasture or hay. It needs to have large amounts of fertilizer added at the time of seeding. White oak, red oak, black oak, beech, and hickory grow well on this soil.

This soil is in capability unit VIe–1; woodland group 3; and group 4 for building sites.

Neshaminy very stony silt loam, 0 to 8 percent slopes (NsB).—The profile of this soil is like the one described as typical for the series, except that it is stony and has a thin layer of leaf mold on the surface. The leaf mold is underlain by a layer, 8 to 10 inches thick, of dark-brown very stony silt loam that has weak, fine, granular structure.

This soil is unsuitable for cultivation, because it contains too many large stones. It has only limited use for pasture. White oak, red oak, black oak, beech, and hickory grow well on the soil.

This soil is in capability unit VIs–1; woodland group 1; and group 3 for building sites.

Neshaminy very stony silt loam, 8 to 25 percent slopes (NsD).—The profile of this soil is shallower over bedrock than the profile described as typical for the series. It also contains stones and has a thin layer of leaf mold on the surface. The leaf mold is underlain by a layer, 6 to 8 inches thick, of very dark brown very stony silt loam.

Because of the many stones in the profile, this soil is not suited to cultivated crops. In places it has a limited use for pasture. Red oak, white oak, black oak, hickory, tulip-poplar, and ash are the kinds of trees that grow well.

This soil is in capability unit VIs–1; woodland group 3; and group 4 for building sites.

Neshaminy very stony silt loam, 25 to 45 percent slopes (NsF).—This soil has a thin layer of leaf mold on the surface. Its profile is shallower over bedrock than the profile described as typical for the series, and the surface layer is darker brown.

Because of the steep slopes and the many stones and boulders on the surface, this soil is not suited to cultivated crops or pasture. White oak, red oak, black oak, chestnut oak, hickory, and beech are the principal kinds of trees that grow on it.

This soil is in capability unit VIIs–1; woodland group 5; and group 9 for building sites.

Othello Series

The Othello series consists of deep, poorly drained soils of uplands. The soils formed in coastal plain deposits consisting of silty material over a sandy and gravelly substrata. They have a thin surface layer of dark grayish-brown silt loam. The A_2 horizon is mottled, grayish-brown silt loam, and the subsoil is mottled, brown or pale-brown silty clay loam. The substratum is coarse sand and fine gravel that is mixed with lenses and pockets of clay loam. The native vegetation was various kinds of hardwoods, chiefly red oak, red maple, white oak, elm, and beech. These soils are in low-lying or basinlike areas and in seepy areas around the heads of streams.

The Othello soils are near areas of Sassafras and Woodstown soils, which also formed on coastal plain material. The Othello soils have a darker surface layer than the Sassafras and Woodstown soils, and mottling is at or near the surface. In addition, they are less well drained, as the Sassafras soils are well drained and the Woodstown are moderately well drained.

Only one soil of this series—Othello silt loam—is mapped in Chester and Delaware Counties.

A typical profile of Othello silt loam:

A_0 ½ to 1 inch of black, rotted leaf mold.

A_1 0 to 1½ inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable when moist; strongly acid (pH 5.0); clear, wavy lower boundary; 1 to 2 inches thick.

A_{2g} 1½ to 8 inches, grayish-brown (10YR 5/2) silt loam; many, fine, distinct mottles of light olive gray (5Y 6/2); weak, fine, crumb structure; friable when moist; strongly acid (pH 5.0); clear, wavy lower boundary; 5 to 8 inches thick.

A_{3g} 8 to 12 inches, grayish-brown (10YR 5/2) silt loam; many, fine, distinct mottles of light olive gray (5Y 6/2); weak, fine, subangular blocky structure; friable when moist; strongly acid (pH 5.0); gradual, wavy lower boundary; 3 to 5 inches thick.

B_{1g} 12 to 15 inches, pale-brown (10YR 6/3) silty clay loam that is mottled with light brown (7.5YR 6/4) and light gray (5Y 7/2); weak, fine, subangular blocky structure; thin clay films on peds; slightly sticky when wet; strongly acid (pH 5.0); gradual, wavy lower boundary; 2 to 5 inches thick.

B_{2g} 15 to 29 inches, brown (10YR 5/3) silty clay loam that is mottled with light brownish gray (2.5Y 6/2); weak, fine, subangular blocky structure; thin, continuous coatings of clay; firm when moist; strongly acid (pH 5.0); gradual, wavy lower boundary; 8 to 10 inches thick.

C_1 29 inches +, coarse, gritty sand and small pebbles with pockets and lenses of clay loam.

In a few places the texture of the surface layer is loam. The texture of the subsoil ranges from silt loam to sandy clay loam, and in places there are lenses of silty clay that are 2 to 6 inches thick. The amount and intensity of mottling varies somewhat, depending on slope in the area, but the profile has some mottling throughout.

The Othello soils have moderately slow permeability and slow internal drainage. The water table is high most of the year. In summer, however, the water table drops, and the available moisture capacity is then moderately low. The soils are moderately productive and are strongly acid.

Othello silt loam (OtA).—The profile of this soil is the same as the one described as typical for the series. This soil is not extensive, and it is mostly in forest. The water table is high. As a result, the soil is poorly aerated and has slow permeability.

If cleared, this soil is used mostly for pasture. Open drainage ditches can be used to remove excess water. If the soil is drained, the water table will be lowered, aeration will be improved, and plant nutrients will be more readily available. Plants on this soil respond to applications of lime and fertilizer when the soil is drained. Black oak, beech, hickory, and red maple are the main kinds of trees that grow on this soil.

This soil is in capability unit IIIw–1; woodland group 11; and group 12 for building sites.

Penn Series

The Penn series is made up of shallow to moderately deep, well-drained soils of uplands. The soils have a surface layer of dark-red or reddish-brown, friable silt loam. The subsoil is about the same color as the surface layer, but it contains more clay. It is underlain by reddish-brown, partially weathered material and red and gray shale and arkosic sandstone. The native vegetation was a forest made up of various kinds of hardwoods, chiefly red oak and black oak, but it included some white oak and beech.

These soils are nearly level to steep, but most areas are gently sloping. The areas are scattered throughout the northeastern part of Chester County.

The Penn soils are near the Bucks, Readington, and Croton soils, all of which formed from similar parent material. They are shallower than the Bucks soils, but the color of the surface layer and subsoil is similar. The Penn soils lack the mottling in the deeper part of the subsoil that is typical of the moderately well drained Readington soils. Their surface layer is not so dark colored as that of the Croton soils, and their subsoil is free of the gray color that is typical of the subsoil in the Croton soils.

Typical profile of Penn silt loam, 8 to 15 percent slopes, moderately eroded:

A_p 0 to 9 inches, dark reddish-brown (2.5YR 3/4) silt loam; weak, fine to medium, subangular blocky structure; friable; pH 7.2+, limed; gradual, irregular lower boundary, the irregularities apparently caused by subsoiling; 8 to 10 inches thick.

B_{21} 9 to 13 inches, reddish-brown (2.5YR 4/4) silt loam; weak, medium, subangular blocky structure; prominent clay films on peds; friable; pH 6.8; gradual, wavy lower boundary; 1 to 6 inches thick.

B_{22} 13 to 21 inches, dark reddish-brown (2.5YR 3/4) silt loam; moderate, medium, subangular blocky structure; prominent clay films on peds; firm; pH 6.3; clear, wavy lower boundary; 5 to 8 inches thick.

B_3 21 to 24 inches, dark reddish-brown (5YR 3/3) loam; moderate, medium, platy structure; firm; pH 5.8; abrupt, wavy lower boundary; 1 to 5 inches thick.

C 24 to 33 inches, strong-brown (7.5YR 5/6) fine sandy loam and weathered sandstone; moderate, medium and thick, platy structure; friable; pH 5.2; the parent material is Triassic shale and arkosic sandstone that contains considerable weathered sandstone.

The depth to parent material and the texture of the profile vary within short distances because of stratification of the parent material. Depth to unweathered shale or sandstone ranges from 18 to 34 inches. The B horizon ranges from a few inches to as much as 15 inches in thickness.

In most places the surface layer is reddish-brown silt loam, but in a few places it is dark reddish-brown or brown loam. In some places erosion has removed most of the original surface layer and numerous fragments of shale have been brought to the surface by tillage. In these areas the soil is fairly shallow and depth to the parent material ranges from 8 to 14 inches.

Permeability to water, air, and roots is moderate to rapid, but the available moisture capacity is medium to low. In the severely eroded areas, these soils are droughty. The Penn soils are easy to work, but they are not naturally fertile. Crops on these soils respond well if lime and fertilizer are applied, but the soils have only moderate to poor capacity to retain plant nutrients. In places runoff is fairly rapid and shallow gullies have formed.

Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded (PeB3).—The profile of this soil is shallower than the one described as typical of the series, and it contains many fragments of red shale. Otherwise, the two profiles are similar. Depth to parent material ranges from 10 to 12 inches. The soil has low available moisture capacity.

Diversion terraces and contour stripcropping are needed on this soil to help control erosion in areas that are tilled. This soil is suited to grasses and legumes grown for permanent pasture or hay. Black oak, red oak, hickory, and beech grow well.

This soil is in capability unit IVe–4; woodland group 13; and group 7 for building sites.

Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded (PeC3).—The profile of this soil is shallower than the one described as typical for the series. In addition, the subsoil is very thin and contains many fragments of red shale. Otherwise, the two profiles are similar. Depth to parent material is generally about 10 inches.

This soil has rapid permeability, and its water-holding capacity is low. Productivity is moderate to low.

This soil is better suited to hay or permanent pasture than to cultivated crops. The areas require frequent applications of lime and fertilizer. Red oak, black oak, hickory, walnut, and beech are suited.

This soil is in capability unit VIe–2; woodland group 15; and group 8 for building sites.

Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded (PeD3).—The profile of this soil is thinner than the one described as typical for the series. It is 8 to 10 inches thick.

The permeability of this soil is rapid to very rapid. Because the soil is shallow, its available moisture capacity is low. Sheet erosion has been active on this soil, but there are few gullies.

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This soil is suited to trees. Black oak, chestnut oak, hickory, walnut, and beech are suited to it.

The soil is in capability unit VIIe–1; woodland group 15; and group 8 for building sites.

Penn silt loam, 3 to 8 percent slopes, moderately eroded (PmB2).—The profile of this soil is somewhat thicker than the one described as typical for the series, but, otherwise, the two profiles are similar. In a few places this soil has received deposits of silt washed from soils on higher slopes.

Most of this soil is easy to work. It has moderate available moisture capacity, and it is moderately low in natural fertility.

This soil is well suited to the general farm crops commonly grown in the area and to hay and pasture crops. Contour stripcropping and diversion terraces are needed to help control erosion. Growing grasses and legumes every 3 or 4 years helps to control erosion and adds organic matter to the soil. White oak, red oak, black oak, tulippoplar, walnut, and hickory grow well on this soil.

The soil is in capability unit IIe–5; woodland group 13; and group 7 for building sites.

Penn silt loam, 8 to 15 percent slopes, moderately eroded (PmC2).—The profile of this soil is the one described as typical for the series.

Most areas of this soil are easy to work. The soil has moderate available moisture capacity, and the natural fertility is moderate.

Included with this soil are a few areas that have a grayish-brown surface layer. The included areas have a slightly higher pH in the lower part of the subsoil than the profile described.

Penn silt loam, 8 to 15 percent slopes, moderately eroded, is well suited to the general farm crops grown in the area and to pasture and forage crops. Contour stripcropping and diversion terraces are needed to help control erosion. A hay crop of grasses and legumes is needed in the cropping system at least 50 percent of the time. The grasses and legumes provide additional control of erosion, improve the structure of the soil, and add organic matter.

White oak, red oak, black oak, beech, chestnut oak, hickory, and walnut grow well on this soil.

The soil is in capability unit IIIe–4; woodland group 15; and group 8 for building sites.

Penn silt loam, 8 to 15 percent slopes, severely eroded (PmC3).—Except that most of the original surface layer of this soil has been lost through erosion and the plow layer is mostly material from the subsoil, the profile is similar to the one described as typical for the series. Some areas have an occasional shallow gully.

This soil is moderately permeable to water, air, and roots, but, because it is shallow, the depth to which roots can penetrate is limited. The available moisture capacity of the soil is moderate to moderately low.

Included with this soil are a few areas in which the lower part of the subsoil is slightly less acid than that in the typical soil.

Penn silt loam, 8 to 15 percent slopes, severely eroded, is better suited to permanent vegetation than to tilled crops. Grasses and legumes grow fairly well, but they may be damaged by lack of moisture during the growing season. Using contour stripcropping and diversion terraces will help to conserve moisture. White oak, red oak,

black oak, hickory, beech, and walnut grow well on this soil.

The soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Penn silt loam, 15 to 25 percent slopes (PmD).—Most of this soil is in forest and has not been cleared. The surface layer is covered with a layer of decayed leaf mold, about 1 inch thick. Just beneath the leaf mold is an A_1 horizon, 3 to 4 inches thick, of dark reddish-brown silt loam. Underlying the A_1 horizon is a layer, 4 to 6 inches thick, of reddish-brown loam or silt loam. At a depth below 8 inches, the profile is similar to the one described as typical for the series.

This soil has moderate available moisture capacity. It is moderately permeable to water, air, and roots.

Included with this soil are a few areas in which the subsoil has a pH of about 6.0 to 6.5.

Because of strong slopes and susceptibility to erosion if it is not protected by vegetation, Penn silt loam, 15 to 25 percent slopes, is not well suited to crops. It is well suited to pasture if it is cleared and lime and fertilizer are added. White oak, black oak, red oak, hickory, walnut, and beech grow well on this soil.

This soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Penn silt loam, 15 to 25 percent slopes, moderately eroded (PmD2).—The profile of this soil is thinner than the one described as typical for the series, but, otherwise, it is similar.

This soil is permeable to water, air, and roots. The available moisture capacity is moderately low.

Included with this soil are a few areas in which the pH ranges from 6.0 to 6.5, which is higher than that in the typical soil.

Penn silt loam, 15 to 25 percent slopes, moderately eroded, is better suited to hay or pasture than to tilled crops. Nevertheless, some areas are used for crops. Grasses and legumes grown on this soil need lime and fertilizer. White oak, red oak, black oak, chestnut oak, beech, hickory, and walnut grow well.

This soil is in capability unit IVe–4; woodland group 15; and group 8 for building sites.

Penn very stony silt loam, 0 to 8 percent slopes (PnB).—Most of this soil is in forest. The profile is similar to the one described for Penn silt loam, 15 to 25 percent slopes. The numerous large stones on the surface make the soil unsuitable for crops. It has only limited use for pasture and is probably best suited to trees. White oak, red oak, black oak, tulip-poplar, hickory, and walnut grow well.

This soil is in capability unit VIIs–1; woodland group 13; and group 7 for building sites.

Penn very stony silt loam, 8 to 25 percent slopes (PnD).—The profile of this soil is similar to the profile described for Penn silt loam, 15 to 25 percent slopes. The many large stones on the surface and throughout the profile make the soil unsuitable for cultivation. The soil has limited use for pasture, but it is well suited to trees. White oak, red oak, black oak, tulip-poplar, hickory, and walnut grow well.

This soil is in capability unit VIIs–1; woodland group 15; and group 8 for building sites.

Penn very stony silt loam, 25 to 50 percent slopes (PnF).—The profile of this soil is somewhat shallower than the one described as typical for the series. In addition, there is a thin layer of leaf mold on the surface.

Because of steep slopes and the many large stones on the surface and in the subsoil, this soil is not suited to cultivated crops nor to pasture.

White oak, red oak, black oak, chestnut oak, beech, hickory, and walnut grow well.

This soil is in capability unit VIIs–1; woodland group 17; and group 9 for building sites.

Penn soils, 25 to 35 percent slopes, moderately eroded (PsE2).—These soils have a profile that is somewhat shallower than the one described as typical for the series. Furthermore, the surface layer ranges from loam to silt loam in texture, and, in a few areas, the subsoil has a higher content of lime.

Strong slopes make it difficult to use farm equipment on these soils, and they also make the soils susceptible to erosion. The soils, therefore, are better suited to pasture, trees, or other permanent vegetation than to tilled crops. White oak, red oak, black oak, beech, hickory, and walnut grow fairly well.

This mapping unit is in capability unit VIe–2; woodland group 17; and group 9 for building sites.

Penn soils, 25 to 35 percent slopes, severely eroded (PsE3).—These soils have a profile that is shallower than the one described as typical for the series, but, otherwise, their profile is similar. Practically all of the original surface layer has been lost through erosion.

These soils are permeable to water, air, and roots, but the shallow profile limits their available moisture capacity.

These soils are too steep for tilled crops. They are best used for permanent pasture or woodland. Black oak, chestnut oak, beech, and hickory grow well, and walnut grows fairly well.

This mapping unit is in capability unit VIIe–1; woodland group 17; group 9 for building sites.

Penn soils, 35 to 50 percent slopes (PsF).—These soils have a surface layer and subsoil that are thinner than those in the profile described as typical for the series. They have lost most of their original surface layer through erosion.

These soils are permeable to water, air, and roots, but the shallow profile limits the depth to which roots can penetrate and also limits the available moisture capacity.

Because of the steep slopes, these soils are not suited to crops and pasture. They are best used as woodland. Black oak, chestnut oak, beech, and hickory grow well on these soils, and walnut grows fairly well.

This mapping unit is in capability unit VIIe–1; woodland group 17; and group 9 for building sites.

Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded (PtB2).—Except that the surface layer is sandier and depth to parent material is greater, the profile of the soils in this undifferentiated mapping unit is similar to the one described as typical for the series. The areas are made up mostly of Penn soils, but there are a few scattered areas of Lansdale soils. A typical profile of a Lansdale sandy loam is described under the Lansdale series.

These soils have a subsoil of sandy loam or loam. They are very permeable to water, air, and roots. The available moisture capacity is moderate, and productivity is moderate.

These soils are well suited to the general farm crops grown in the area. Contour stripcropping and diversion

terraces are needed to help control erosion. Growing grasses and legumes every 3 or 4 years also helps to control erosion and helps maintain the productivity of the soils. White oak, red oak, black oak, tulip-poplar, walnut, and hickory grow well on these soils.

This mapping unit is in capability unit IIe–5; woodland group 1; and group 7 for building sites.

Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded (PtC2).—This undifferentiated mapping unit consists of varying proportions of Penn sandy loam and Lansdale sandy loam. In places the areas consist of equal proportions of these soils. In other places one of the soils may be almost lacking. Although the extent of each soil within the unit varies from one place to another, in most places the areas consist mainly of Penn sandy loam.

These soils are easy to work and are moderately productive. Their available moisture capacity is moderate.

The soils are well suited to the general farm crops grown in the area, and pasture and hay crops grow well. Stripcropping and diversion terraces help to control erosion. Growing grasses and legumes 2 out of 4 years also helps to control erosion and helps maintain the productivity of the soils. White oak, red oak, black oak, beech, chestnut oak, hickory, and black gum grow well on these soils.

This mapping unit is in capability unit IIIe–4; woodland group 3; and group 8 for building sites.

Penn and Lansdale sandy loams, 8 to 15 percent slopes, severely eroded (PtC3).—Except that these soils have lost most of their original surface layer and the subsoil contains more sand, the profile of these soils is similar to the one described as typical for the series. Also, in places, the surface layer is yellowish brown.

The available moisture capacity of these soils is moderate to moderately low. Permeability is moderate to rapid.

These soils are well suited to permanent vegetation. Grasses and legumes grow well if lime and fertilizer are added, but tilled crops are likely to be damaged by lack of moisture during the growing season. Contour stripcropping and diversion terraces are needed to help control erosion and conserve moisture. White oak, red oak, black oak, chestnut oak, hickory, and beech grow well on these soils.

This mapping unit is in capability unit IVe–4; woodland group 3; and group 8 for building sites.

Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded (PtD2).—These soils have a profile that is thinner than the one described as typical for the series. Also, the surface layer contains more sand.

These soils have moderate available moisture capacity, and permeability is moderate. At least 90 percent of the acreage consists of Penn soils, and only a few areas, of Lansdale soils.

These soils are better suited to pasture or hay than to tilled crops. Lime and fertilizer are needed if grasses and legumes are planted. White oak, red oak, black oak, beech, hickory, and walnut are well suited to these soils.

This mapping unit is in capability unit IVe–4; woodland group 3; and group 8 for building sites.

Readington Series

The Readington series consists of moderately deep to deep, moderately well drained soils of uplands. The soils formed from Triassic red shale, sandstone, and conglomerate. Their surface layer is dark grayish-brown silt loam. The subsoil is reddish-brown silty clay loam and is mottled at a depth between 24 and 32 inches. The substratum consists of red shale and sandstone. The native vegetation was mostly hardwoods, white oak, red oak, tulip-poplar, ash, hickory, and walnut.

These soils are in the northern part of Chester County. They are around the heads of streams, in depressions, and at the foot of slopes. The soils are mostly north of an area that runs from Warwick through Bucktown, Wilsons Corner, Kimberton, and Williams Corner to the Schuylkill River.

The Readington soils are near the Penn, Bucks, and Croton soils, which have formed on similar parent material. They are not so well drained as the moderately deep Penn or the deep Bucks soils, but they are better drained than the Croton soils.

A typical profile of Readington silt loam, 3 to 8 percent slopes, moderately eroded:

A_p 0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, crumb structure; friable when moist; medium acid (pH 5.6); abrupt, wavy lower boundary; 7 to 10 inches thick.

B_2 8 to 21 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; firm when moist, slightly sticky when wet; strongly acid (pH 5.2); clear, wavy lower boundary; 12 to 15 inches thick.

B_{22} 21 to 28 inches, reddish-brown (2.5YR 4/4) silty clay loam; a few, fine, faint mottles of pale red (10R 6/4); moderate, medium, subangular blocky structure; thin clay films on peds; firm to very firm when moist, sticky when wet; clear, irregular lower boundary; 6 to 9 inches thick.

B_{23} 28 to 38 inches, strong-brown (7.5YR 5/6) silty clay loam; many, fine, distinct mottles of reddish brown (2.5YR 4/4); moderate, medium, subangular blocky structure; clay films on peds; very firm when moist, sticky and slightly plastic when wet; very strongly acid (pH 5.0); gradual, irregular lower boundary; 10 to 20 inches thick.

C_1 38 to 60 inches, reddish-brown (5YR 4/4) silt loam or loam; contains 15 to 20 percent, by volume, of fragments of rock; weak, fine, subangular blocky structure; friable when moist; very strongly acid (pH 5.0).

The subsoil ranges from silty clay loam to clay loam in texture and from strong brown to reddish brown in color. Depth to mottling ranges from 15 to 32 inches, but mottling is generally at a depth between 24 and 30 inches. In most places bedrock is at a depth below 36 inches, but, in a few places, it is at a depth of about 30 inches. The sandstone in the parent material ranges from light gray to reddish in color, but most of the shale is red.

The permeability of these soils is moderately slow. The available moisture capacity is moderate to moderately high. Natural fertility is low. The water table is high for prolonged periods.

Readington silt loam, 0 to 3 percent slopes (RdA).—The profile of this soil is deeper than the one described as typical for the series. In a few areas the soil has received deposits of silt that were washed onto the areas from soils

on higher areas. The water table is high for prolonged periods.

Included with this soil are a few small areas in which the subsoil has a somewhat lighter color than that of the typical soil. Otherwise, the two profiles are similar.

Except for deep-rooted plants that do not tolerate wetness, Readington silt loam, 0 to 3 percent slopes, is suited to most of the farm crops grown in the area. Contour cultivation is needed to help control erosion. Growing a sod of grasses and legumes every 3 or 4 years helps to maintain the content of organic matter. Red oak, black oak, ash, and red maple grow well on this soil.

The soil is in capability unit IIw–1; woodland group 7; and group 10 for building sites.

Readington silt loam, 3 to 8 percent slopes (RdB).—Except that the surface layer is thicker and does not have an abrupt boundary, the profile of this soil is similar to the one described as typical for the series. In wooded areas there is a layer of leaf mold, 1 inch thick, on the surface.

This soil is suited to most farm crops grown locally. The water table is high for prolonged periods, however, and deep-rooted grasses and legumes that do not tolerate wetness are not suited. Contour stripcropping and diversion terraces are needed to help control erosion. A cover of suitable grasses and legumes is needed every 3 or 4 years. The sod helps control erosion and adds organic matter to the soil. Red oak, black oak, ash, hickory, and red maple are fairly well suited to this soil.

The soil is in capability unit IIe–6; woodland group 7; and group 10 for building sites.

Readington silt loam, 3 to 8 percent slopes, moderately eroded (RdB2).—The profile of this soil is the one described as typical for the series.

Except for deep-rooted plants that do not tolerate wetness for long periods, the soil is well suited to most farm crops grown in the area. Contour stripcropping and diversion terraces are needed to help control erosion. A hay crop is needed every 3 or 4 years to help control erosion and to help maintain organic matter in the soil. Red oak, black oak, ash, hickory, and walnut grow well on this soil.

The soil is in capability unit IIe–6; woodland group 7; and group 10 for building sites.

Rowland Series

The Rowland series consists of moderately deep to deep, moderately well drained soils on flood plains. The soils are underlain by Triassic red shale and sandstone. They have a surface layer of reddish-brown or dark reddish-brown silt loam. Their subsoil is dark reddish-brown sandy clay loam that is mottled with gray at a depth below 20 inches. The substratum consists of gray arkose sandstone and red shale. In a few places the stratified layers of sand and silt extend to a depth between 3 and 4 feet.

These soils are in the northern part of Chester County. The native vegetation consisted chiefly of red oak, white oak, ash, tulip-poplar, hickory, elm, walnut, and sycamore.

The Rowland soils are near the Bowmansville soil, which is also on flood plains. They are better drained than the Bowmansville soil; the Bowmansville soil is poorly drained.

A typical profile of Rowland silt loam:

- A_p 0 to 6 inches, dark reddish-brown (5YR 3/4) silt loam; weak, thick, platy structure that breaks to granular structure; friable when moist; medium acid (pH 5.6); clear, wavy lower boundary; 5 to 7 inches thick.
- C_1 6 to 17 inches, dark-red (2.5YR 3/6) silt loam; weak, fine, subangular blocky structure; friable when moist; strongly acid (pH 5.4); clear, smooth lower boundary; 9 to 13 inches thick.
- C_2 17 to 21 inches, dark reddish-brown (2.5YR 3/4) loam; weak, fine, granular structure; medium acid (pH 5.6); very friable when moist; clear, wavy lower boundary; 3 to 5 inches thick.
- D_1 21 to 27 inches, reddish-brown (5YR 4/4) sandy clay loam; a few, fine, distinct mottles of gray (5YR 5/1); weak, fine, subangular blocky structure; friable when moist; medium acid (pH 5.6); clear, wavy lower boundary; 4 to 8 inches thick.
- D_2 27 to 33 inches, strong-brown (7.5YR 5/6) coarse sandy clay loam; common, medium, distinct mottles of dark gray (N 4/0); moderate, medium, blocky structure; somewhat massive; slightly sticky when wet; strongly acid (pH 5.2); clear, wavy lower boundary; 5 to 7 inches thick.
- D_3 33 inches +, gray, arkose coarse sand and gravel.

The texture of the underlying material ranges from sandy clay to coarse sand. In some places the soil consists of stratified silt and sand. Depth to mottling ranges from 12 to 25 inches. The depth to the water table varies with the season, but the water table is generally at a depth of about 30 inches.

The permeability of these soils is moderately high, but the available moisture capacity is high. The soils have moderate to low natural fertility. Leaching has been fairly extensive, and the profile is medium acid to strongly acid.

Rowland silt loam (Ro).—The profile of this soil is the one described as typical for the series.

This soil lies along streams that overflow occasionally. It can be used for cultivated crops, but, in Chester and Delaware Counties, much of it is used for hay crops or permanent pasture. This soil is suited to grasses and legumes that do not have taproots. White oak, red oak, walnut, hickory, ash, and red maple grow well.

This soil is in capability unit IIw–2; woodland group 7; and group 13 for building sites.

Rowland silt loam, dark surface (Rp).—Except that the surface layer is generally black and the subsurface layer has a texture of silty clay loam in a few places, the profile of this soil is similar to the one described as typical for the series.

Most of this soil is along the Schuylkill River in the northern part of Chester County. The surface layer is darker than that in the profile described as typical for the series. This is caused by variations in the thickness of the deposits of coal screenings laid down during floods. The deposits range from 1 to 4 feet in thickness but are deepest near the stream. The areas where the deposits of coal screenings are deep generally are covered with brush or are wooded. In areas where the deposits are thin, the coal screenings have been mixed with lighter colored material from the original surface layer by plowing. Most of these areas are used for crops.

Most of the farm crops commonly grown in the area grow well on this soil if the deposits of screenings are thin and material from the original surface layer can be mixed with the coal screenings by plowing and by cultivating.

A hay crop is needed every 4 or 5 years to help maintain the content of organic matter. White oak, red oak, tulip-poplar, ash, and hickory are the main kinds of trees that grow on this soil.

The soil is in capability unit IIw–2; woodland group 11; and group 13 for building sites.

Sassafras Series

The Sassafras series consists of deep, well-drained soils that developed in coastal plain deposits. The soils have a surface layer of dark grayish-brown loam and a subsoil of strong-brown silty clay loam or sandy clay loam. Their substratum consists of very coarse sand and fine gravel. The native vegetation was mostly white oak, red oak, black oak, tulip-poplar, and hickory. These soils are not extensive. They occur in Delaware County near the Delaware State line, just east of U.S. Highway No. 202.

The Sassafras soils are near the Woodstown soils. They are better drained than those soils and are free of mottling. The Woodstown soils are moderately well drained and have mottling below a depth of 24 inches.

Typical profile of Sassafras loam, 3 to 8 percent slopes, moderately eroded:

- A_p 0 to 9 inches, dark grayish-brown (10YR 4/2) loam; weak, fine to medium, granular structure; friable; strongly acid (pH 5.2); abrupt, smooth lower boundary; 8 to 12 inches thick.
- B_1 9 to 16 inches, yellowish-brown (10YR 5/6) loam; weak, fine, subangular blocky structure, but medium, platy structure near the top of the horizon; a few clay films; friable; strongly acid (pH 5.2); gradual, wavy lower boundary; 6 to 8 inches thick.
- B_{21} 16 to 25 inches, strong-brown (7.5YR 5/8) heavy loam; weak to moderate, subangular blocky structure; partial clay films on peds; friable; medium acid (pH 5.9); gradual, wavy lower boundary; 7 to 11 inches thick.
- B_{22} 25 to 36 inches, strong-brown (7.5YR 5/6) silt loam; weak to moderate, medium, subangular blocky structure; a few, grayish-brown, partial clay films; friable; strongly acid (pH 5.5); clear, wavy lower boundary; 9 to 13 inches thick.
- B_{31} 36 to 43 inches, strong-brown (7.5YR 5/6) sandy loam; weak, medium, subangular blocky structure; partial clay films on peds; friable; medium acid (pH 5.8); abrupt, smooth lower boundary; 7 to 15 inches thick.
- D_1 43 to 55 inches, strong-brown (7.5YR 5/8) loamy coarse sand; weak, medium, granular structure; friable; medium acid (pH 5.8); abrupt, smooth lower boundary; 10 to 15 inches thick.
- D_2 55 to 63 inches, reddish-yellow (7.5YR 6/8) loamy coarse sand that contains some fine gravel; structureless; very friable; medium acid (pH 5.9); sediments are stratified.

The horizons in the subsoil range from sandy loam to sandy clay loam in texture. Depth to stratified sediments varies. In a few places 15 to 20 percent of the subsoil is gravel.

The permeability of these soils is moderately rapid to rapid, but the available moisture capacity is moderate. Leaching has been fairly active, and the natural fertility is moderately low. These soils are porous. They are generally easy to work.

Sassafras loam, 0 to 3 percent slopes (SaA).—The profile of this soil is somewhat deeper than the one described as typical for the series, but, otherwise, the two profiles are similar.

Included with this soil are a few areas in which the surface layer has a texture of gravelly sandy loam or gravelly loam. In the included areas, the profile is somewhat shallower than the typical profile described and contains more gravel.

Sassafras loam, 0 to 3 percent slopes, is well suited to the general farm crops grown in the area. A hay crop of grasses and legumes is needed every few years to maintain the content of organic matter and to improve the structure of the soil. Contour cultivation will help to control erosion. White oak, red oak, black oak, tulip-poplar, hickory, and beech grow fairly well on this soil.

The soil is in capability unit I–1; woodland group 1; and group 1 for building sites.

Sassafras loam, 3 to 8 percent slopes, moderately eroded (SaB2).—The profile of this soil is the one described as typical for the series.

Included with this soil are a few areas, too small to map separately, in which the surface layer is gravelly sandy loam or gravelly loam. In these areas the profile is shallower than the typical profile, and it contains more gravel.

Most common farm crops grown in this area grow well on Sassafras loam, 3 to 8 percent slopes, moderately eroded. Stripcropping and diversion terraces are needed to help control erosion. A hay crop of grasses and legumes should be grown at least 50 percent of the time. The grasses and legumes will help to maintain the content of organic matter and improve the structure of the soil. White oak, red oak, black oak, hickory, and beech grow fairly well on this soil.

The soil is in capability unit IIe–2; woodland group 1; and group 1 for building sites.

Tidal Marsh

Tidal marsh (Tm).—This miscellaneous land type is made up mainly of a mixture of mineral soil materials. Most of the areas are at the mouth of Darby Creek and along the Delaware River. The areas are subject to tidal overflow and are frequently under water.

The soil material in this miscellaneous land type consists mostly of dark-gray, gray, or black, smooth silty clay or clay. At a distance of about 1 or 2 miles from the mouth of Darby Creek, the silty deposits that make up Tidal marsh have been capped by coarse-textured material washed from coastal plain sediments. The area covered by the coarse-textured material occupies less than 1,000 acres.

Tidal marsh is not used for agriculture. The vegetation consists mostly of cattails, sedges, and reeds.

This mapping unit is in capability unit VIIIw–1; woodland group 18; and group 13 for building sites.

Watchung Series

The Watchung series consists of deep, poorly drained soils of uplands. The soils are underlain by partially weathered diabase rock. The surface layer is grayish-brown silt loam. The subsoil is yellowish brown or strong brown and is mottled with various shades of gray. The native vegetation was a forest made up mainly of white oak, red oak, red maple, ash, and hickory, but it included an occasional cedar.

These soils are mainly in the northern or northwestern parts of Chester County. A few scattered areas are in

other parts of the county where diabase dikes occur on the surface.

The Watchung soils are near the Montalto, Mount Lucas, and Brecknock soils, all of which formed from similar parent material. They are not so well drained as the Montalto and Brecknock soils, which are well drained, nor are they so well drained as the Mount Lucas soils, which are moderately well drained. The Watchung soils also differ from the Brecknock soils in that they lack the fairly uniform, dark subsoil that is typical of the Brecknock soils.

Typical profile of Watchung silt loam, 3 to 8 percent slopes, moderately eroded:

A_1 0 to 1 inch, very dark brown (10YR 2/2) silt loam; weak, fine, granular structure; friable when moist; very strongly acid (pH 5.0); clear, smooth lower boundary; about 1 inch thick.

A_{21g} 1 to 6 inches, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; friable when moist; strongly acid (pH 5.2); clear, wavy lower boundary; 4 to 6 inches thick.

A_{22g} 6 to 9 inches, grayish-brown (2.5Y 5/2) silty clay loam mottled with a few, fine, faint mottles of yellowish brown (10YR 5/4); weak, medium, platy structure that breaks to moderate, medium, subangular blocky structure; continuous clay films on peds; friable when moist, slightly sticky when wet; medium acid (pH 6.0); gradual, wavy lower boundary; 2 to 5 inches thick.

B_{1g} 9 to 12 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, distinct mottles of grayish brown (2.5Y 5/2); moderate, medium, blocky structure; continuous clay films on peds; sticky and slightly plastic when wet; slightly acid (pH 6.2); gradual, wavy lower boundary; 2 to 4 inches thick.

B_{2g} 12 to 26 inches, brown (10YR 5/3) clay loam; many, medium, distinct mottles of grayish brown (2.5YR 5/2); moderate, medium, blocky structure; clay films and coatings of manganese on peds; sticky and plastic when wet; slightly acid (pH 6.4); irregular, wavy lower boundary; 12 to 15 inches thick.

B_{22g} 26 to 38 inches, strong-brown (7.5YR 5/6) silty clay; common, medium, prominent mottles of light brownish gray (10YR 6/2); moderate, medium, blocky structure; sticky and plastic when wet; slightly acid (pH 6.6); clear, wavy lower boundary; 10 to 14 inches thick.

C 38 to 50 inches, dark-brown (10YR 3/3), gritty silty clay loam; a few, medium, distinct mottles of light olive gray (5Y 6/2); moderate, medium, blocky structure; sticky and slightly plastic when wet; slightly acid (pH 6.6); 10 to 15 inches thick.

D 50 inches +, diabase rock.

The texture of the surface layer ranges from silt loam to silty clay loam, and that of the subsoil, from silty clay loam to clay. In places there are distinct mottles in the surface layer and the subsoil is very sticky and plastic. Depth to bedrock ranges from 4 to 8 feet.

These soils have slow permeability. During wet periods the available moisture capacity is high, but in dry periods it is low. The soils have moderately high natural fertility, but they are not well aerated. In many places there is diabase rock on the surface and in the solum.

Watchung silt loam, 0 to 3 percent slopes (WaA).—Except that the surface layer is thicker and in a few areas there are deposits of silt on the surface, the profile of this soil is similar to the one described as typical for the series.

This soil is suited to pasture and hay crops. Several areas have not been cleared and have been kept in forests. Because the water table is high for long periods, grasses and legumes that tolerate wetness are the best plants to grow. Using open ditches to remove excess water will improve yields of pasture and hay crops.

White oak, red oak, black oak, beech, cedar, and ash will grow on this soil, but the trees do not grow to full height.

This soil is in capability unit Vw–1; woodland group 12; and group 12 for building sites.

Watchung silt loam, 3 to 8 percent slopes, moderately eroded (WaB2).—The profile of this soil is the one described as typical for the series. The soil is fertile, but internal drainage and permeability are slow.

Areas of this soil that have been cleared are better suited to pasture than to tilled crops. The water table is high for prolonged periods. Consequently, grasses and legumes that tolerate wetness are well suited. Open ditches are needed to remove excess water. If the soil is drained, it will be better aerated and plant nutrients will be more readily available. Because of the heavy texture of the subsoil, tile drains are not satisfactory. Red oak, white oak, red maple, hickory, and beech grow well on this soil.

The soil is in capability unit VIw–2; woodland group 12; and group 12 for building sites.

Watchung very stony silt loam, 0 to 8 percent slopes (WcB).—Except for stones, the profile of this soil is similar to the one described as typical for the series. The many large stones on the surface and throughout the profile make the soil unsuitable for cultivation or for pasture. The soil is probably best used as woodland. Red maple, elm, hickory, and beech will grow on it.

This soil is in capability unit VIIs–2; woodland group 12; and group 12 for building sites.

Wehadkee Series

The Wehadkee series consists of deep, poorly drained soils on flood plains. The soils formed in general alluvium washed by streams from upland soils underlain by schist, gneiss, quartzite, anorthosite, quartz, monzonite, and granite. The surface layer is dark grayish-brown silt loam. The subsoil is yellowish-brown silty clay loam that is mottled with various shades of gray. In most places stratified layers of sand and silt occur in these soils. The soils are mostly along Brandywine Creek and its tributaries.

The native vegetation consisted of various kinds of hardwoods, chiefly red maple, alder, ash, elm, and sycamore, but it included some white oak and red oak.

The Wehadkee soils are near the Congaree and Chewacla soils. In contrast to the Congaree soils, which are also deep but are well drained and free of mottling, the Wehadkee soils have mottling throughout the profile. The Chewacla soils, on the other hand, are moderately well drained and have mottling only in the subsoil. Only one soil of this series—Wehadkee silt loam—is mapped in Chester and Delaware Counties.

Typical profile of Wehadkee silt loam:

A_p 0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; a few, fine, faint, mottles of grayish brown (2.5Y 5/2); weak, medium, crumb structure; friable when moist; very strongly acid (pH 4.5); clear, wavy lower boundary; 8 to 10 inches thick.

C_{1g} 9 to 26 inches, olive-gray (5Y 5/2), heavy silt loam, common, medium, distinct mottles of dark red (2.5YR 3/6); weak, medium, subangular blocky structure; friable when moist; very strongly acid (pH 4.5); 15 to 20 inches thick.

D_1 26 to 28 inches, yellow (10YR 7/6) sand that is mottled with different shades of yellow ranging down to yellowish brown (10YR 5/4); structureless; loose when moist; very strongly acid (pH 4.5); abrupt lower boundary; 2 to 4 inches thick.

D_2 28 to 39 inches, olive-gray (5Y 5/2) silty clay loam; common, coarse, prominent mottles of yellowish red (5YR 5/6); weak, medium, subangular blocky structure; friable when moist; slightly sticky when wet; extremely acid (pH 4.0); abrupt, wavy lower boundary; 10 to 13 inches thick.

D_3 39 to 46 inches +, dark grayish-brown (2.5YR 4/2) silty clay loam; many, medium, distinct mottles of dark red (2.5YR 3/6); weak, medium, blocky structure; friable to firm when moist, slightly sticky when wet; very strongly acid (pH 5.0); clear, wavy lower boundary; 6 to 8 inches thick.

The texture of the different horizons ranges from sandy loam to silty clay loam. The thickness and arrangement of the layers vary with the frequency of overflow from the streams and the kind of sediments deposited. Mottling is at or near the surface.

The Wehadkee soils are permeable to water, and they have a high water table during most of the year. Consequently, development of plant roots is restricted. The high water table also prevents the movement of air through the soil and restricts the availability of plant nutrients.

Wehadkee silt loam (We).—The profile of this soil is the one described as typical for the series.

The permeability of this soil is moderate. The water table is high, however, and restricts the development of plant roots and prevents aeration. This soil is subject to frequent flooding. Deposits of silt and sand added to this soil by overflow are greater than the amount removed by erosion.

If this soil is drained by open ditches and bedding, crops can be grown. The soil is better used for pasture than for crops that require tillage. Grasses and legumes that tolerate wetness grow well. Red maple, beech, elm, and sycamore grow on this soil.

The soil is in capability unit VIw–1; woodland group 11; and group 13 for building sites.

Woodstown Series

The Woodstown series consists of deep, moderately well drained soils of uplands. The soils have a surface layer of dark-brown silt loam. Their subsoil is yellowish brown to reddish brown and is mottled. The substratum consists of coastal plain deposits of sand, silt, and gravel and also of Bryn Mawr gravel. The native vegetation was white oak, red oak, black oak, tulip-poplar, hickory, and ash. These soils are not extensive. They occupy small areas near the Delaware State line, east of U.S. Highway No. 202, and some areas are south and east of Upper Darby. Many of the areas are gently sloping and are on seepy spots around the heads of small streams.

The Woodstown soils occur near areas of Sassafras soils, but they are not so well drained as those soils, which are well drained. Only one soil of this series—Woodstown loam, 0 to 3 percent slopes—is mapped in Chester and Delaware Counties.

Typical profile of Woodstown loam, 0 to 3 percent slopes:

A_p 0 to 10 inches, dark-brown (10YR 4/3) loam; occasional quartz pebbles; weak, fine, crumb structure; friable; slightly acid (pH 6.2); abrupt, smooth lower boundary; about 10 inches thick.

B_1 10 to 16 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, fine, subangular blocky structure; thin clay films on peds; friable; medium acid (pH 6.0); clear, wavy lower boundary; 5 to 7 inches thick.

B_{21} 16 to 24 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; thin, continuous clay coats; friable to firm; medium acid (pH 5.8); clear, wavy lower boundary; 7 to 10 inches thick.

B_{22} 24 to 31 inches, strong-brown (7.5YR 5/6) light silty clay loam; a few, fine, distinct mottles of light reddish brown (2.5YR 6/4); moderate, medium, blocky structure; continuous clay films on peds; firm; strongly acid (pH 5.5); gradual, wavy lower boundary; 6 to 8 inches thick.

B_{23g} 31 to 45 inches, dark reddish-brown (2.5YR 3/4) loam; common, medium, distinct mottles of gray (5Y 6/1) and yellowish red (5YR 5/8); moderate, medium, subangular blocky structure; firm; strongly acid (pH 5.5); abrupt, wavy lower boundary; 12 to 15 inches thick.

The texture of the surface layer ranges from fine sandy loam to loam. The texture of the subsoil ranges from loam to light silty clay loam. Depth to mottling ranges from 18 to 28 inches, and depth to sand and gravel, from 3 to 4 feet. The height of the water table varies with the season.

The Woodstown soils are moderately permeable and have moderate available moisture capacity. They are moderately fertile and are easy to work, but they are not well aerated. Runoff is medium.

Woodstown loam, 0 to 3 percent slopes (WnA).—The profile of this soil is the one described as typical for the series. In places it is more silty than the typical profile.

This soil is well suited to the general farm crops grown in the area. The water table is high for prolonged periods, however, and deep-rooted plants that do not tolerate wetness are not suited. Contour cultivation is needed to help control runoff. Growing a sod of grasses and legumes every few years helps add organic matter to the soil and improves the structure. White oak, red oak, tulip-poplar, ash, hickory, and walnut grow well on this soil.

The soil is in capability unit IIw–1; woodland group 7; and group 10 for building sites.

Worsham Series

The Worsham series consists of deep, poorly drained soils of uplands. Their surface layer is dark grayish-brown or black silt loam. The subsoil is brownish-yellow or strong-brown clay loam that is mottled with light grayish brown to pale yellow. The substratum consists mainly of partially weathered granite, quartz, schist, and gneiss, but part of it is made up of gabbro and other acid rocks, except those of the Triassic region. The native vegetation was a hardwood forest, mainly red maple and elm, but it included ash, white oak, black oak, and beech.

These soils occur around seepy areas fed by springs at the heads of streams, along small streams, in slight depressions, and along areas at the bases of slopes. The drainageways through areas of these soils are small and generally do not overflow.

The Worsham soils are near the Chester, Glenelg, and Glenville soils. The Worsham soils are waterlogged most of the year. They are not so well drained as the Chester

and Glenelg soils, which are well drained, nor are they so well drained as the Glenville soils, which are moderately well drained. Also, unlike those soils, the Worsham soils are mottled from the surface downward throughout the profile.

Typical profile of Worsham silt loam, 0 to 3 percent slopes:

A_p 0 to 9 inches, dark grayish-brown, (2.5Y 4/2) or black (10YR 2/1) silt loam; a few, fine, distinct mottles of dark reddish brown (5YR 3/2); weak, coarse to moderate, fine, crumb structure; friable when moist, slightly sticky when wet; medium acid (pH 5.8); clear, wavy lower boundary; 8 to 10 inches thick.

B_{2g} 9 to 19 inches, light brownish-gray (2.5Y 6/2) clay loam; many, fine, distinct mottles of brownish yellow (10YR 6/8), pale yellow (2.5Y 7/4), and other colors; moderate, fine to medium, subangular blocky structure; continuous clay films on peds; friable to firm when moist; slightly sticky and plastic when wet; strongly acid (pH 5.2); gradual, wavy lower boundary; 9 to 11 inches thick.

B_{22g} 19 to 56 inches, grayish-brown (2.5Y 5/2) clay loam; many, coarse, distinct mottles of strong brown (7.5YR 5/6); strong, coarse, blocky structure; thin clay films; sticky and slightly plastic when wet; strongly acid (pH 5.2); gradual, irregular lower boundary; 35 to 40 inches thick.

C 56 inches +, partially weathered fragments of gneiss.

In these soils the surface layer is generally silt loam, but in a few areas it is silty clay loam. The subsoil ranges from silty clay loam to clay loam in texture. Depth to bedrock ranges from 5 to 10 feet. In Delaware County several areas of these soils are underlain by igneous rock. In these places the subsoil is somewhat more clayey than that of the typical soil, but it is well within the range of the series. The surface layer in some places is thicker than normal because colluvial materials have been washed onto the areas from adjacent higher areas.

The water table is high most of the year. As a result, these soils are poorly aerated and slowly permeable. Also, they are not readily penetrated by roots. The soils are strongly acid, and they are low in plant nutrients. Tilth is moderately favorable. During wet periods, however, the soils are poorly accessible to farm machinery. Furthermore, cultivation would compact the soils.

Worsham silt loam, 0 to 3 percent slopes (WoA).—The profile of this soil is the one described as typical for the series.

Nearly all of this soil is wooded, but a few areas are in pasture. This soil is nearly level and has a high water table most of the year. It is fairly difficult to drain. If the soil is used for pasture, grasses and legumes that tolerate wetness will grow best. Red maple, beech, and elm will grow on this soil.

The soil is in capability unit Vw–1; woodland group 11; and group 12 for building sites.

Worsham silt loam, 3 to 8 percent slopes (WoB).—The profile of this soil is similar to the one described as typical for the series, but the color of the surface layer is not quite so dark and the soil is somewhat shallower to bedrock. The surface layer is grayish-brown (2.5Y 5/2) silt loam. Depth to bedrock ranges from 40 to 50 inches.

This soil is better used for permanent pasture than for crops that require tillage. The water table is high for prolonged periods, and plants that tolerate wetness are well suited. Open ditches and closed drains can be used to drain the areas. If the soil is drained, the water table will be lowered, the soil will be better aerated, and plant nutrients will be more readily available. Crops on this soil should respond to lime and fertilizer if drainage is established. Red maple, ash, hickory, elm, and beech grow fairly well.

This soil is in capability unit VIw–2; woodland group 11; and group 12 for building sites.

Worsham silt loam, 3 to 8 percent slopes, moderately eroded (WoB2).—The profile of this soil is similar to the one described as typical for the series, but the surface layer is 4 to 6 inches thick and depth to the parent material is shallower.

This soil is used chiefly for pasture. Because the water table is high for prolonged periods, grasses and legumes that tolerate wetness are best suited. Artificial drainage can be provided by open ditches and closed drains. If the soil is drained, the water table will be lowered, excess surface and subsurface water will be removed, aeration will be improved, and plant nutrients will be more readily available. Red maple, ash, hickory, elm, and beech grow on this soil.

The soil is in capability unit VIw–2; woodland group 11; and group 12 for building sites.

Worsham silt loam, 8 to 15 percent slopes, moderately eroded (WoC2).—The profile of this soil is shallower than the one described as typical for the series. Depth to bedrock is 40 to 50 inches. The soil is inextensive and occurs mostly in seepage areas.

This soil is used mostly for hay crops and pasture. The areas are plowed occasionally to establish new seedings. Tile drains can be used to help remove the excess subsurface water from seepy areas. Grasses and legumes that tolerate wetness are suited to this soil. White oak, beech, elm, ash, and red maple are the main trees that grow on this soil.

The soil is in capability unit VIw–2; woodland group 11; and group 12 for building sites.

Worsham very stony silt loam, 0 to 8 percent slopes (WsB).—Except for stones, the profile of this soil is similar to the one described as typical for the series. The numerous large stones on the surface make the soil unsuitable for crops, and it has only limited use for pasture. Many areas have a cover of trees and brush and probably will remain wooded. Red maple and elm are the main trees that grow on this soil, but there are also some white oak and beech.

This soil is in capability unit VIIs–2; woodland group 11; and group 12 for building sites.

Formation and Classification of the Soils

In this section the factors that have affected the formation of the soils in Chester and Delaware Counties are discussed. Also discussed is the classification of the soils by higher categories.

Factors in Soil Formation

Soil is formed by weathering and other processes that act on the parent material. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material; (2) the climate under which the parent material has accumulated

and has existed since accumulation; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of development have acted on the parent material. Through their effect on plants, climate and relief modify the characteristics of the soil. Relief also affects the characteristics of the soil by its influence on drainage, aeration, runoff, erosion, and exposure to sun and wind.

Parent material

The soils of Chester and Delaware Counties formed largely in two kinds of parent material. The first consisted of material weathered from rocks in place. The second consisted of material transported by water, gravity, or both and laid down in varying proportions as unconsolidated deposits of clay, silt, sand, and gravel. In addition, a few of the soils have formed in coastal plain sediments deposited over various kinds of rocks.

The characteristics of most of the soils in these two counties were influenced by the underlying rocks, and many of the differences among the soils are related to differences in the underlying rocks. It is, therefore, helpful to know something about the geology of the area before studying the soils.

The parent material formed in place weathered from many kinds of rocks. Metamorphosed igneous rocks underlie a large part of the two counties. Igneous rocks, formed from the hardening of molten masses of rock material and but little altered, also underlie large areas. Sedimentary rocks underlie other areas.

The transported material from which some of the soils formed consists of sediments that were laid down along streams. In these areas fresh sediments are deposited each time the streams overflow. Soils formed along streams are young because the parent material has not remained in place long enough for a distinct profile to have developed.

The altered, or metamorphosed rocks, consist mostly of schist and gneiss. These rocks are very old; they range in age from Lower Cambrian to Precambrian. Among the more important soils formed in material from these rocks are the Chester, Glenelg, and Manor. In most places the weathered parent material of these soils is 5 to 10 feet thick. In some areas underlain by schist, bedrock is at a depth of more than 10 feet.

The unaltered igneous rocks consist chiefly of gabbro, quartz, monzonite, anorthosite, granodiorite, and serpentine. These rocks underlie widely scattered areas in both counties, but the largest areas are north of Chester Valley in Chester County. Among the main soils underlain by unaltered igneous rocks are the Neshaminy, Chrome, Conowingo, and some of the soils of the Glenelg series. In these soils depth to bedrock is between 2 and 5 feet in most places.

Sedimentary rocks underlie some areas in the northern part of Chester County. These rocks are of Triassic age and consist of unaltered shale and sandstone. The main soils formed in material from these rocks are those of the Bucks, Penn, and Readington series. Depth to bedrock in these soils ranges from 1 to 4 feet. Some areas, chiefly in Chester Valley, are underlain by other sedimentary rocks consisting of dolomitic limestone or of other lime-bearing rocks. The soils in these areas are in the Hagerstown, Conestoga, and Bedford series. These are productive soils, but they are not extensive. They range from 3 to as much as 10 or 15 feet in depth.

Coastal plain sediments underlie the soils in part of southeastern Delaware County. The deposits range from Jurassic to Pleistocene in age and have been imposed on Precambrian rocks or on materials weathered from Precambrian rocks. In some places they are 15 to 20 feet deep and contain many pebbles and boulders of quartzite. The boulders are as large as 2 feet in diameter. The deposits consist of sand, silt, and clay laid down in varying proportions, but they generally are underlain by sand and gravel. Depth to the sand and gravel varies. The soils formed in material from coastal plain sediments are in the Beltsville, Butlertown, Othello, Sassafras, and Woodstown series. They have properties that differ markedly from those of the adjacent soils.

The materials laid down along streams are of Recent age. The profiles of soils formed in these materials show little development. The principal soils in these areas are the Congaree, Chewacla, Wehadkee, Bowmansville, Rowland, Melvin, and Lindside. In most places these soils are deep over bedrock.

Table 9 shows the parent material of the soils in Chester and Delaware Counties and the natural drainage under which the soils of each series formed.

Climate

Chester and Delaware Counties have a humid temperate climate, but the temperature is moderated somewhat by the nearness of the Atlantic Ocean. As a result, the climate is slightly warmer in winter than in some other parts of the State. The average annual temperature in the area is about 52 degrees, and the average annual precipitation is about 48 inches. The prevailing winds are from the west.

The climate is uniform over this area. Therefore, although the climate has had an important overall influence on the characteristics of the soils, it has had little bearing on local differences among them. Because the climate is moderate and the soil is moist much of the time, physical and chemical weathering has been moderately rapid. The large amount of precipitation has caused the soluble materials to be leached from the soils and the less soluble materials to move downward in the profile.

Some variations in plant and animal life are caused by the variations in temperature or by the action of other climatic forces on the soil material. To that extent, climate influences changes in the soil that are brought about by differences in plant and animal population.

Plant and animal life

Plants, micro-organisms, earthworms, and other forms of life that live on and in the soil are active in the soil-forming processes. The changes they bring about depend mainly on the kind of life processes peculiar to each. The kinds of plants and animals are determined by the climate, parent material, relief, and age of the soil, and by other organisms.

Most of the soils in Chester and Delaware Counties formed under a forest of hardwoods. The principal trees now growing in the area consist of various kinds of oak, hickory, beech, walnut, tulip-poplar, elm, ash, maple, wild cherry, sycamore, cedar, and dogwood. Similar trees probably made up the original forests. The undergrowth

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TABLE 9.—*Soil series arranged to show the relationship of parent material, depth, and drainage*

Principal parent material	Well drained			Moderately well drained	Somewhat poorly drained	Poorly drained
	Shallow soils	Moderately deep soils	Deep soils			
Residuum from underlying rock:						
Serpentine	Chrome	Chrome	Neshaminy	Conowingo	Aldino	Calvert.
Gabbro, granodiorite		Glenelg	Neshaminy	Glenville		Worsham.
Schist and gneiss	Manor	Glenelg	Chester	Glenville		Worsham.
Anorthosite, quartz, monzonite	Brandywine	Glenelg	Chester	Glenville		Worsham.
Diabase (traprock)			Montalto	Mount Lucas		Watchung.
Limestone and dolomite	Hollinger		Hagerstown		Lawrence	Guthrie.
Micaceous limestone and Cockeysville marble.	Hollinger		Conestoga	Bedford	Lawrence	Guthrie.
Triassic red shale, sandstone, and conglomerates.	Penn	Penn	Bucks	Readington		Croton.
Triassic gray shale and sandstone	Penn	Lansdale	Lansdale	Readington		Croton.
Metamorphosed Triassic rock		Brecknock	Brecknock	Lehigh		Croton.
Quartzite		Edgemont		Glenville		Worsham.
Coastal plain deposits:						
Sand, silt, clay, and gravel			Sassafras	Woodstown		
Silt over sand, silt, clay, and gravel.				Butlertown Beltsville	Beltsville	Othello.
Soils on flood plains:						
Alluvium from schist, gneiss, and metamorphic rocks.			Congaree	Chewacla		Wehadkee.
Alluvium from limestone				Lindside		Melvin.
Alluvium from Triassic red shale and sandstone.				Rowland		Bowmansville.

varies from place to place. It consists of young shoots of mature trees, of chestnut sprouts, and of mapleleaf viburnum, huckleberry, ironwood, laurel, sumac, poison-ivy, spicebush, greenbrier, honeysuckle, and witch-hazel. The trees are chiefly deciduous.

In soils formed under forest, much organic matter is added to the soil in the form of decayed leaves, twigs, roots, and entire plants. Most of this material accumulates on the surface, where it is acted on by micro-organisms, earthworms, and other forms of life and by direct chemical reactions brought about by the effects of climate. The plant food released by this decomposition is available for the new growth of plants.

In hollows and depressions where the areas are moist, the amount of organic matter that has accumulated is greater than that on the slopes, and the soils are likely to be more fertile. The larger amount of organic matter was probably caused by a heavier forest growth or by a slower rate of decomposition of the organic material.

Relief

Relief, by its control of natural drainage, serves as a modifying factor in the formation of soils. Depth of the soil is closely related to the steepness of slope. Generally, the steeper the slope the shallower the soil. The slope of the soil, to a great extent, governs the movement of water through the profile, which, in turn, affects drainage, weathering, and leaching of soil minerals.

The elevation in Chester and Delaware Counties ranges from about 10 feet above sea level at Chester on the Delaware River to 1,056 feet in the northern part of Chester County. If the valleys and depressions were filled, the area would resemble a peneplain sloping in a southeasterly direction.

The area is characterized by shallow valleys and narrow flood plains, and relief ranges from nearly level to steep. The uplands are mostly gently to moderately sloping, but many areas are somewhat undulating. There is only a small acreage of hilly, rough country in either county, but the northern part of Chester County is rougher than other parts of the area. The two counties are drained by the Delaware and Schuylkill Rivers and their tributaries.

Time

Time accounts for some of the differences among soils. Two soils that have similar parent material, relief, vegetation, and climatic conditions may vary greatly in characteristics because of the length of time the soil-forming processes have been active.

In this area most of the soils of uplands have had sufficient time to develop marked differences in the horizons, and, therefore, are said to be old, or mature. The moderately high rainfall and favorable relief and temperature have caused these soils to mature fairly rapidly. In contrast, the soils of flood plains are said to be young because sediments are still being deposited and the soils have not had time to develop well-defined horizons. The soils formed in coastal plain sediments have a better developed profile than soils of the flood plains, but, geologically, these soils are also young.

Classification of the Soils

In this section the soil series of Chester and Delaware Counties are placed in great soil groups. The soils within each great soil group have several characteristics in common, but they may differ greatly in other charac-

teristics. Generally, the soils have the same kinds and numbers of horizons, although horizons of similar identity are not necessarily of the same thickness, nor are they expressed with the same degree of clarity.

Most of the soils of these counties have significant characteristics of more than one great soil group. Such soils are classified in one great soil group but are described as intergrades toward another group.

The great soil groups, the intergrades, and the soil series contained in each are discussed in the pages that follow.

Alluvial soils

In the Alluvial great soil group are soils of the Chewacla, Congaree, Lindside, and Rowland series. These soils are on flood plains where they receive additional sediments from time to time, or they are scoured so frequently that definite horizons have not formed. Most of these soils contain some accumulated organic matter, and their surface layer is darker than the underlying material.

The Congaree soils are typical of the Alluvial soils in this area. They have formed in recent alluvium washed from uplands underlain by schist and gneiss. A profile of a Congaree soil is given in the section "Descriptions of Soils."

Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils

Because the soils of some of the series have characteristics of both the Gray-Brown Podzolic and Red-Yellow Podzolic great soil groups, they are classified as Gray-Brown Podzolic soils intergrading to the Red-Yellow Podzolic great soil group. The soils of this group belong to the Bedford, Brecknock, Bucks, Butlertown, Chester, Conestoga, Conowingo, Edgemont, Glenelg, Glenville Hagerstown, Readington, Sassafras, and Woodstown series.

In undisturbed areas Gray-Brown Podzolic soils have a fairly thin litter of leaves and a fairly thin layer of humus on the surface. The A_1 horizon is moderately leached and is underlain by a lighter colored, leached A_2 horizon. Just beneath the A_2 horizon is the B horizon. The B horizon contains more clay than the A horizon and has blocky or subangular blocky structure. Red-Yellow Podzolic soils typically have a lighter colored and thicker A_2 horizon than the Gray-Brown Podzolic soils, and their B horizon is thicker, finer textured, and more reddish, yellowish red, or brown. They also have a somewhat lower degree of base saturation than the Gray-Brown Podzolic soils, a characteristic of most of these soils classified as Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils.

Soils of the Bedford, Glenville, and Readington series are mottled in the lower part of the B horizon. These soils are low in bases, their horizons are definitely expressed, and in most places they have firm or very firm consistence in the lower part of the B horizon. The B horizon is fine textured and shows some accumulation of aluminum oxide, iron oxide, and colloidal material. The soils of the Bedford series are typical of Gray-Brown Podzolic soils intergrading to the Red-Yellow Podzolic great soil group. A profile of a Bedford soil is given in the section "Descriptions of Soils."

Gray-Brown Podzolic soils intergrading to Lithosols

The soils of the Chrome, Hollinger, and Penn series have characteristics of both the Gray-Brown Podzolic soils and of Lithosols. They are, therefore, classified as Gray-Brown Podzolic soils intergrading to Lithosols. In undisturbed areas these soils have a very thin layer of leaf mold, a thin, dark-colored A_1 horizon, and a somewhat lighter colored A_2 horizon. The B horizon, just beneath the A_2, shows some accumulation of clay. The horizons are not strongly expressed. Depth to bedrock ranges from 12 to 30 inches.

The Penn soils are fairly typical of Gray-Brown Podzolic soils intergrading to Lithosols. A typical profile of a Penn silt loam that has been cultivated and the upper part of a Penn silt loam in an undisturbed area are described in the section "Descriptions of Soils."

Gray-Brown Podzolic soils intergrading to Planosols

The soils of the Aldino, Beltsville, and Lehigh series are classified as Gray-Brown Podzolic soils intergrading to Planosols. In undisturbed areas these soils have a layer of leaf litter and organic mull. The mull overlies a dark-colored, thin A_1 horizon and a lighter colored A_2 horizon—features that are typical of Gray-Brown Podzolic soils. They have, however, a B horizon that is much higher in clay than the A horizon, or they have firm or very firm consistence in the lower part of the B horizon. In many places these soils have a high water table. As a result, aeration is reduced and the soils are likely to be mottled.

The Aldino soils, developed on serpentine, are typical of Gray-Brown Podzolic soils intergrading to Planosols. A profile of an Aldino silt loam is described in the section "Descriptions of Soils."

Low-Humic Gley soils

In the Low-Humic Gley great soil group are the Othello and Worsham soils of uplands and the Bowmansville, Melvin, and Wehadkee soils of flood plains. All of these soils developed in areas where the water table fluctuated, and they have profile characteristics that reflect the influence of poor drainage. The soils have a thin, grayish-colored A horizon that has a high content of organic matter. They have a yellowish-brown to gray, clayey subsoil that has distinct mottles in the lower horizons of gray, yellow, or strong brown. In some of the finer textured soils of the uplands, there is a weak claypan in the lower part of the subsoil. In places the subsoil of the soils on the flood plains contains pockets of sand or silt. The Othello soils are typical of the Low-Humic Gley soils. A representative profile is described in the section "Descriptions of Soils."

Planosols

In the Planosol great soil group are soils of the Calvert, Croton, Guthrie, Lawrence, and Watchung series. Typically, Planosols have one or more horizons that are abruptly separated from and that contrast sharply to an adjacent horizon because of compactness, cementation, or high content of clay.

In the Croton soils the upper part of the B horizon is not markedly higher in content of clay than the A horizon, but it contrasts sharply in color. The lower part of the B horizon, however, is much higher in clay than the A horizon.

In the Guthrie and Watchung soils, the upper part of the B horizon is markedly higher in content of clay than the overlying A horizon. The Watchung soils are fairly typical of the Planosols of these two counties. A profile of a Watchung soil is described in the section "Descriptions of Soils."

Red-Yellow Podzolic soils intergrading to Reddish-Brown Lateritic soils

The Montalto, Mount Lucas, and Neshaminy soils are classified as Red-Yellow Podzolic soils intergrading to Reddish-Brown Lateritic soils. These soils have horizons that are similar to those of the typical Red-Yellow Podzolic soils. Their A_2 horizon, however, is thin. In contrast, typical Reddish-Brown Lateritic soils do not have an A_2 horizon, but, instead, they have a transitional A_3 horizon. The lower part of the Montalto, Mount Lucas, and Neshaminy profiles are somewhat darker than those of most Red-Yellow Podzolic soils, and, in this respect, they are similar to the Reddish-Brown Lateritic soils.

Representative profiles of both the Montalto and the Mount Lucas soils are given in the section "Descriptions of Soils."

Sols Bruns Acides

In the Sols Bruns Acides great soil group are soils of the Brandywine and Manor series. Typically, Sols Bruns Acides have a thin A_1 horizon and a faint to evident A_2 horizon. The B horizon contains little or no more clay than the horizons that lie above and below. It is distinguished chiefly by color, being redder in hue or of higher chroma than either the A or C horizons. Sols Bruns Acides have a very low degree of base saturation, and most of them are very strongly acid.

The Manor soils are typical of the Sols Bruns Acides in this area. A profile of a Manor soil is described in the section "Descriptions of Soils."

Laboratory Data

Soils from eight of the main soil series in Chester and Delaware Counties were sampled in the field for detailed characterization analyses.[4] Two or three samples were taken of soils in each series. Samples were obtained of soils on the most representative slopes, under the most typical erosion conditions, and in the dominant land use. In addition, for the Glenelg, Glenville, and Penn series, one sample was taken for each series in an undisturbed woodland for comparison with samples of the cultivated and eroded soils typical of those series. Four 1-quart samples were collected of each horizon at each location. The sampling and analytical methods used are discussed in the following paragraphs.

In all the chemical procedures used, air-dry samples were crushed with a rolling pin so that the soil material would pass through a 2-millimeter, round-hole sieve. Care was taken to avoid fragmenting the nonsoil material. In table 10 the percentage of material retained by the sieve is reported in the column headed "Coarse fragments (greater than 2 mm.)." All laboratory determinations, except bulk density, were made using the part of the sample consisting of soil material less than 2 millimeters in diameter, and results are reported on that basis.

Analysis of particle-size distribution was made by the pipette method—dispersion with sodium hexametaphosphate and mechanical shaking (*3*, *4*).

The pH was determined by glass electrode using soil and water in a ratio of 1:1 (*5*, *10*).

The content of organic carbon was determined by modification of the Walkley-Black method (*5*), using 1 milliequivalent of potassium dichromate equivalent to 3.9 milligrams of carbon. A semimicro adaptation of the Kjeldahl method was used to determine the total nitrogen. When this method is used, the sample is digested in a mixture of potassium sulfate and concentrated sulfuric acid using selenium metal and copper sulfate as catalysts. Ammonia is then distilled and collected in boric acid and titrated with sulfuric acid.

Exchangeable hydrogen, calcium, magnesium, and the cation exchange capacity were determined by extraction with neutral normal ammonium acetate (*5*). The cation exchange capacity was determined by summation of the exchangeable cations and the distillation of absorbed ammonia after extraction with sodium chloride. Exchangeable sodium and potassium were determined by flame spectrophotometry. Bulk density, expressed in grams per cubic centimeter, was determined on 3-inch cylindrical core samples. The samples were taken in duplicate with a Uhland core sampler, or, if the soil was not too stony, with the Salinity Laboratory modified Uhland core sampler (*8*).

Free iron oxide was determined by a modification of the Deb's method (*2*). This method consists of mixing 1 gram of sodium hydrosulfite and 4 grams of soil together. Water is added, and the container is stoppered immediately and shaken overnight at room temperature. The sample is then acidified to a pH between 3.5 and 4.0, and free iron is determined by titrating with potassium dichromate.

In the samples examined, moisture retained at tension of 15 atmospheres was determined by using a pressure plate and pressure membrane apparatus on the fragmented samples. Clay minerals were identified for the Brecknock and Neshaminy soils and for one of the Penn soils by use of the Norelco diffractometer using iron radiation. The scanning speed was 1 degree per minute, and the samples were oriented on glass slides. The samples were saturated with magnesium, and determinations were made at room temperature and also after heating to 110° C., 250° C., and 500° C.

In general, the soils analyzed were medium textured, or predominantly loams and silt loams. There was micaceous material in many of the profiles, particularly in profiles of the Chester, Chrome, Glenelg, and Glenville soils. As a result, the proportion of particles in the size

[4] Samples of the Brecknock, Glenelg, Glenville, Neshaminy, and Penn series were collected from representative sites in Chester County, and laboratory analyses were conducted by the Soil Survey Laboratory, Soil Conservation Service, USDA, Beltsville, Md. Samples of the Chester, Chrome, and Sassafras series were collected in Delaware County, and laboratory analyses were conducted by R. P. MATELSKI, C. F. ENGLE, and E. C. MASON of the Pennsylvania Agricultural Experiment Station, Pennsylvania State University.

range of sand was high in those soils. The particles, however, were so flat and thin that they had many of the properties of silt. Coarse fragments in the soils ranged from 0 to 81 percent by weight.

In only a little more than half of the profiles sampled was there a distinct textural B horizon. In a few of the profiles, the A_p horizon was finer textured than the horizons below, probably because erosion truncated the profiles in which there was a textural B horizon.

Bulk density was medium to low in the samples tested. The maximum bulk density for most of the samples was between 1.50 and 1.70, but the density of the A horizon in samples taken in a wooded area ranged from 0.80 to 0.90. In contrast, the density of the A horizon in samples taken in a cultivated or heavily grazed area was as much as 1.53. Moisture held against 15 atmospheres tension, which is about the wilting point of most plants, ranged from 6 to 14 percent by weight, based on dry soil.

Because of liming and the transportation of bases by ground water, the pH of the soils was found to vary widely within a series. All of the samples tested were found to be naturally acid, but, in samples taken from areas that had been cultivated, the A and B horizons were almost neutral.

Except for the Chrome soil, the cation exchange capacity was low in all the soils sampled. It ranged from 8 to about 15 milliequivalents per 100 grams in the B horizons of the various profiles. Some of the samples showed a low degree of base saturation. The samples of cultivated soils had a high proportion of bases in the surface layer and subsoil. Except for the C horizon of samples taken in heavily limed and fertilized areas, the C horizons showed little increase in base saturation.

Of the samples tested for clay mineralogy, the Brecknock and Neshaminy were found to contain moderate to abundant amounts of mica and vermiculite. The samples of the Penn soils were relatively low in kaolinite, but they contained moderate to abundant amounts of mica and vermiculite.

The analytical data for each layer of soil in the various profiles sampled are given in table 10. Some of the results of the characterization analyses of the various soils are described in the paragraphs that follow.

BRECKNOCK STONY SILT LOAM

In the two samples of Brecknock soils that were analyzed, the proportion of coarse fragments in all horizons was moderate to high and the proportion of fine and very fine sand was relatively high. Sample S56PA–15–11 (1–8) showed a definite decrease in sand at a depth of 19 inches, apparently because of stratification of the parent materials. The texture above that depth was loam, but it was close to the limits of silt loam. The C_1 horizon of sample S56PA–15–12(1–6) was particularly high in sand.

In both Brecknock samples the soil profile was strongly acid; air-dry samples had a pH below 5.0. The carbon-nitrogen ratio in the upper horizons of the profiles was wide. In sample S56PA–15–11(1–8), free iron oxides ranged from 1.9 to 2.5 in the upper part of the profile to 2.7 in the B_{23} and next two horizons, and to 3.1 in the C_2 horizon. In sample S56PA–15–12(1–6), however, free iron oxides were very low in the A horizon and increased to 3.4 in the B_{23}.

The cation exchange capacity was low in sample S56PA–15–11(1–8). It was also low in much of sample S56PA–15–12(1–6), but it reached 16 milliequivalents per 100 grams of soil in the B_{23} horizon. Base saturation was low to medium in the samples, which were both taken in a wooded area. In sample S56PA–15–12(1–6) base saturation reached 38 percent in the C_1 horizon and the bases were mostly calcium. The area from which this sample was taken is only a short distance from an area of intrusive diabase, and the ground water may have carried more bases than is typical for most areas where Brecknock soils occur.

CHESTER SILT LOAM

Two samples of Chester soils were analyzed. In the area where sample S59PA–23–2(1–8) was taken, there was an overlay of silt, about 32 inches thick. The silt was underlain by loamy, micaceous material that contained some coarse fragments and more sand of all sizes than the horizons above. It was determined that sample S59PA–23–2(1–8) was more clearly representative of the Chester soils as they occur in neighboring counties than of those soils in Chester and Delaware Counties. In all horizons in the sample, micaceous material the size of fine or very fine sand was mingled with the silt.

The profile in both samples showed some increase of clay in the B horizon. Bulk density was moderate for all horizons, and the cation exchange capacity was medium. The samples contained a fairly high proportion of exchangeable calcium but lower amounts of magnesium. They were found to be nearly neutral to slightly acid. Kaolinite was the principal clay mineral in all horizons in both samples, but significant amounts of illite, vermiculite, and chloritelike minerals were present.

CHROME GRAVELLY SILT LOAM

Two samples of Chrome soils were analyzed. The soils sampled had a high proportion of flaky schistose material throughout the profile. In the upper horizon most of the flaky material was the size of sand, but in the C horizon it was coarser. In sample S59PA–23–4(1–6) the C horizon showed stratification of hard and soft rocks.

The bulk density of the samples was found to be very low, showing poor packing of the schistose material. The samples were neutral to slightly alkaline. In both samples the base saturation was high and the soil material was almost saturated with calcium and magnesium. The calcium-magnesium ratio tested very low. It ranged from 0.6 to as low as 0.2. As a result, plants growing on these soils may be lacking in nutrients, even though the content of calcium is fairly high.

Clay extracted from the soils showed extreme shrinkage on drying, and attempts at analysis by X-ray diffraction were inconclusive. The clay appeared to be similar to montmorillonite.

GLENELG CHANNERY SILT LOAM

Three samples of the Glenelg soils were analyzed. Two of the samples were taken in fields that had been cultivated, and one was taken in an undisturbed wooded area.

About one-third, by volume, of the soil material in the profile taken in a wooded area—sample number S56PA–15–2(1–7)—consisted of fragments of schist and quartz coarser than 2 millimeters in diameter. The finer material was loamy but was close to silt loam and had the field properties of channery silt loam; the B horizon showed a moderate increase in clay.

Sample S56PA–15–3(1–4) was taken in a cultivated field near the place where sample S56PA–15–2(1–7) was

TABLE 10.—*Soil characterization data for 19 profiles*

[Determinations for Brecknock, Glenelg, Glenville, Neshaminy, and Penn series made by Soil Survey Laboratory, Soil Conservation Pennsylvania State University, University Park, Pa. Dashes

Soil name, sample number, and location of sampled site	Horizon	Depth	Particle size distribution								Bulk density	Moisture held at tensions of		Free iron oxide (Fe_2O_3)
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)	Coarse fragments (greater than 2 mm.)		1/3 atmosphere	15 atmospheres	
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Gm./cu. cm.*	*Percent*	*Percent*	*Percent*
Brecknock stony silt loam; S56PA-15-11(1-8); in Chester County, ¾ mile N. of Coventryville and E. of Route T470.	A_1	0-3	1.8	6.2	8.0	13.6	9.4	45.8	15.2	9	------	------	6.3	1.9
	A_2	3-10	2.4	6.1	7.8	12.8	9.0	45.9	16.0	15	------	------	7.0	2.1
	B_{21}	10-16	2.1	6.6	7.2	11.4	8.4	47.4	16.9	19	------	------	6.0	2.2
	B_{22}	16-19	2.2	5.5	6.4	10.3	7.4	46.9	21.3	18	------	------	8.1	2.5
	B_{23}	19-27	2.4	5.2	5.5	8.9	5.9	47.9	24.2	14	------	------	9.8	2.7
	B_3	27-35	1.7	4.8	5.3	8.2	5.5	52.0	22.5	5	------	------	9.3	2.7
	C_1	35-40	2.4	4.7	5.2	7.8	5.0	52.1	22.8	13	------	------	7.7	2.7
	C_2	40+	2.5	5.7	5.8	8.6	7.0	45.7	24.7	10	------	------	9.3	3.1
Brecknock stony silt loam; S56PA-15-12(1-6); in Chester County, 1 mile N. of Harmonyville.	A_1	0-2	2.9	3.0	3.0	7.4	10.2	60.1	13.4	42	------	------	6.7	1.4
	A_2	2-10	1.3	2.4	2.9	7.0	10.1	61.6	14.7	31	------	------	5.8	1.4
	B_{21}	10-15	1.8	2.7	2.9	8.7	13.2	55.1	15.6	26	------	------	7.1	1.7
	B_{22}	15-20	2.6	3.4	3.3	9.5	14.1	46.4	20.7	16	------	------	9.3	2.1
	B_{23}	20-30	3.4	5.8	5.5	10.2	11.1	49.4	14.6	22	------	------	16.0	3.4
	C_1	30-36+	4.0	10.1	12.1	21.5	11.9	18.6	21.8	31	------	------	9.8	2.1
Chester silt loam; S59PA-23-2(1-8); in Delaware County, 2,000 feet N. of Painters Crossroads, E. of U.S. Highway No. 322.	A_p	0-8	.9	1.8	5.6	11.8	11.0	47.8	21.1	2	1.06	29.0	10.9	------
	B_1	8-12	1.7	2.1	4.8	10.6	9.6	54.0	17.2	2	1.34	23.2	9.5	------
	B_{21}	12-21	1.8	2.2	4.9	10.6	10.1	47.1	23.3	18	1.42	23.3	12.4	------
	B_{22}	21-26	3.1	4.0	7.2	13.7	14.1	36.8	21.1	30	1.45	28.4	14.8	------
	B_{23}	26-33	2.6	4.2	9.1	18.4	16.1	32.3	17.3	7	1.45	28.3	14.0	------
	B_3	33-37	1.5	3.3	7.3	17.5	19.5	33.8	17.1	1	1.35	28.3	14.5	------
	C_{11}	37-49	2.9	8.0	11.6	27.8	22.1	19.9	7.7	<1	1.23	23.9	11.1	------
	C_{12}	49-64	2.6	9.4	12.8	26.9	23.9	20.6	3.8	<1	1.15	18.6	8.9	------
Chester silt loam; S59PA-23-3(1-8); in Delaware County, 1 mile W. of Brookhaven in Aston Township; on former Sheppard property, now a real estate development.	A_p	0-8	1.5	2.2	2.9	3.3	4.1	70.5	15.5	1	1.23	23.1	7.5	------
	A_3	8-12	.7	1.1	1.7	1.8	3.4	74.6	16.7	1	1.34	19.9	7.6	------
	B_1	12-18	.1	.5	.9	1.1	3.5	72.2	21.7	1	1.42	21.2	10.1	------
	B_{21}	18-23	.3	.5	.7	1.0	3.8	72.5	21.2	<1	1.50	21.7	10.8	------
	B_{22}	23-32	1.6	1.8	1.8	2.4	4.1	72.6	15.7	3	1.56	21.8	9.5	------
	B_3	32-39	6.7	7.3	10.0	9.4	6.0	46.0	14.6	21	1.60	16.2	8.4	------
	C_1	39-48	8.9	10.2	16.5	18.1	7.2	18.2	20.9	32	1.60	15.1	9.8	------
	C_2	48+	1.6	2.7	17.6	24.0	10.4	19.5	24.2	3	1.54	15.0	12.4	------
Chrome gravelly silt loam; S59PA-23-4(1-6); in Delaware County, ½ mile SE. of Lima in Middletown Township.	A_p	0-7	2.2	4.9	7.3	11.6	10.5	39.3	24.2	13	1.23	30.6	22.8	------
	B_2	7-15	.6	2.6	6.2	19.4	16.3	18.2	36.7	3	.86	72.1	52.7	------
	B_3	15-21	7.8	13.7	13.0	14.2	11.8	10.8	28.7	4	.89	61.2	42.5	------
	C_1	21-25	16.5	17.3	13.4	12.8	7.7	8.1	24.2	12	1.04	45.7	36.4	------
	C_2	25-30	6.3	15.1	22.6	22.1	10.7	12.0	11.2	35	.91	59.7	27.2	------
	C_3	30-40	5.8	17.5	20.2	24.6	11.3	12.4	8.2	3	.72	78.2	41.7	------
Chrome gravelly silt loam; S59PA-23-5(1-3); in Delaware County, along western edge of Florida Park in Newtown Township, 500 feet S. of State Highway No. 3 and 1,200 feet E. of the creek.	A_p	0-7	4.2	6.7	9.8	13.2	10.8	32.2	23.1	13	1.24	30.3	16.9	------
	B_3	7-15	5.3	8.7	10.3	14.4	11.3	22.6	27.4	10	1.22	36.2	23.6	------
	C_1	15-21	8.2	9.1	9.6	12.0	9.5	18.4	33.2	81	1.25	32.0	28.4	------
Glenelg channery silt loam; S56PA-15-2(1-7); in Chester County on H. B. Spackman Farm, in Thornbury Township, ½ mile W. of Darlington Corners on Street Road.	A_1	0-4	3.5	7.4	5.0	9.2	7.4	48.4	19.1	26	.82	------	14.2	2.8
	A_2	4-10	5.9	7.9	5.2	9.5	7.7	47.9	15.9	32	1.27	------	8.0	3.1
	B_1	10-14	6.6	8.1	4.9	9.3	7.3	45.7	18.1	24	1.44	------	8.8	3.4
	B_{21}	14-19	6.3	7.8	4.5	8.7	6.7	44.6	21.4	19	1.36	------	9.9	3.4
	B_{22}	19-24	9.1	7.5	4.1	8.1	6.0	43.8	21.4	27	1.49	------	10.1	3.4
	B_3	24-30	6.2	8.3	4.8	9.1	6.9	43.6	21.1	37	1.45	------	9.8	3.4
	C	30-40	10.9	11.5	6.5	12.9	9.7	33.0	15.5	53	------	------	8.4	3.3

See footnote at end of table.

of 8 soil series in Chester and Delaware Counties

Service, USDA, Beltsville, Md.; determinations for Chester, Chrome, and Sassafras series made by Soil Characterization Laboratory, in columns indicate sample not taken or material not present]

Organic carbon	Nitrogen	Extractable cations (milliequivalent per 100 grams of soil)					Sum of cations	Base saturation	pH [1]	Mineral composition of the clay fraction			
		Hydrogen	Calcium	Magnesium	Potassium	Sodium				Kaolinite	Illite (mica)	Chlorite or chlorite-like	Vermiculite
Percent	*Percent*							*Percent*					
2.11	0.106	11.6	0.1	0.4	<0.2	<0.1	12.3	6	4.4				
.84	.054	7.3	.1	.5	<.2	<.1	8.1	10	4.7	Moderate	Low		Moderate.
.20		5.4	.1	.1	<.2	<.1	5.8	7	4.5				
.12		6.7	.3	.5	<.2	<.1	7.7	13	4.3	Abundant	Abundant		Low.
.06		7.3	.6	.7	<.3	<.1	9.0	19	4.4				
.02		7.5	.4	1.0	<.3	<.1	9.2	18	4.8				
.04		7.8	.3	.4	<.3	<.1	8.9	12	4.6	Abundant	Abundant		
.02		5.9	.1	1.5	<.3	<.1	7.8	24	4.4				
3.15	.138	14.5	1.0	.4	<.2	<.1	16.2	10	4.3				
.77	.054	8.8	.4	.1	<.2	<.1	9.5	8	4.3	Abundant	Low		Abundant.
.39	.038	7.3	.6	.3	<.1	<.1	8.3	12	4.4				
.27		6.9	2.5	.9	<.2	<.1	10.5	34	4.7	Abundant	Low		Abundant.
.16		11.9	2.9	1.1	<.2	<.1	16.1	26	4.5				
.08		7.1	3.2	1.1	<.1	<.1	11.5	38	4.6	Abundant	Low		Moderate.
1.94	.180	12.5	5.6	1.9	.5	.3	20.8	40	6.0	Dominant	Detected	Moderate	Low.
.75	.080	8.5	5.6	1.7	.3	.2	16.3	48	6.6	Dominant	Low	Moderate	Low.
.33	.049	8.8	5.1	1.8	.2	.4	16.3	46	6.7	Dominant	Low	Moderate	Low.
.18	.044	6.3	8.1	3.4	.3	.6	18.7	66	6.9	Dominant	Low	Low	Moderate.
.14	.042	12.3	8.9	4.6	.3	.3	26.4	53	7.0	Dominant	Low	Low	Moderate.
.13	.032	11.5	5.4	3.5	.2	.2	20.8	44	6.9	Dominant	Low	Low	Moderate.
.07	.032	11.8	4.2	2.5	.3	.4	19.2	38	7.0	Dominant	Moderate	Detected	Detected.
.06	.026	7.3	4.7	2.2	.3	.4	14.9	51	7.0	Abundant	Moderate	Detected	Detected.
1.58	.144	9.0	3.6	.9	.5	.3	14.3	37	4.9	Abundant	Low	Moderate	Low.
.53	.072	6.7	2.5	.4	.5	.2	10.3	35	5.5	Abundant	Low	Moderate	Low.
.28	.055	7.0	4.9	1.9	.3	.3	14.4	51	5.9	Abundant	Low	Low	Moderate.
.15	.037	5.6	4.3	1.6	.2	.5	12.0	53	6.2	Abundant	Moderate	Low	Moderate.
.13	.036	6.0	3.5	2.0	.2	.3	12.0	50	6.4	Abundant	Moderate	Low	Moderate.
.08	.027	4.4	3.7	1.7	.2	.2	10.2	57	6.4	Abundant	Moderate	Low	Moderate.
.08	.023	4.4	3.5	1.9	.3	.3	10.4	58	6.3	Abundant	Low	Low	Low.
.07	.028	3.9	4.6	2.8	.3	.5	12.1	68	6.4	Dominant	Low	Low	Low.
1.12	.128	7.8	5.4	20.9	.3	.2	34.6	77	6.7				
.34	.064	9.3	17.4	27.9	.3	.3	55.2	83	7.2				
.12	.040	9.3	11.9	25.0	.2	.3	46.7	80	7.3				
.10	.041	6.2	10.7	23.4	.2	.4	40.9	85	7.2				
.10	.030	4.3	16.2	27.7	.3	.5	49.0	91	7.2				
.04	.028	5.2	18.5	35.8	.3	.5	60.3	91	7.2				
1.26	.122	6.2	3.0	8.3	.2	.2	17.9	65	7.0				
.50	.059	6.2	3.1	12.9	.3	.2	22.7	73	7.1				
.39	.031	4.1	3.4	14.4	.2	.3	22.4	82	7.3				
5.9	.385	27.1	3.7	1.8	.8	.1	33.5	19	4.8				
.87	.070	13.3	.6	.3	.4	<.1	14.6	9	4.4				
.47	.052	12.5	.6	.3	.4	.1	13.9	10	4.4				
.36	.047	12.1	.7	.9	.4	.1	14.2	15	4.3				
.16		10.4	.7	.9	.4	.1	12.5	17	4.5				
.14		10.4	.5	1.1	.4	.1	12.5	17	4.5				
.12		10.0	.3	1.4	.6	.1	12.4	19	4.5				

TABLE 10.—*Soil characterization data for 19 profiles*

Soil name, sample number, and location of sampled site	Horizon	Depth	Particle size distribution								Bulk density	Moisture held at tensions of		Free iron oxide (Fe_2O_3)
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)	Coarse fragments (greater than 2 mm.)		1/3 atmosphere	15 atmospheres	
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Gm./cu. cm.*	*Percent*	*Percent*	*Percent*
Glenelg channery silt loam; S56PA-15-3(1-4); in Chester County on H. B. Spackman Farm, in Thornbury Township, ½ mile W. of Darlington Corners on Street Road.	A_p	0-7	6.1	9.4	5.8	11.7	11.2	41.7	14.1	19	1.40	------	7.3	2.6
	B_2	7-13	6.2	9.3	5.9	11.5	11.7	40.7	14.7	20	1.50	------	7.6	3.1
	B_3	13-20	8.9	11.3	6.1	12.6	13.4	35.6	12.1	27	1.57	------	6.8	3.0
	C	20-28+	15.0	18.1	9.2	14.6	11.9	25.1	6.1	56	1.66	------	4.5	2.3
Glenelg channery silt loam; S56PA-15-4(1-6); in Chester County on Thomas Harney Farm, in West Bradford Township, ½ mile W. of Marshallton.	A_p	0-8	2.8	7.6	8.0	19.2	16.9	35.7	9.8	13	1.53	------	5.9	1.7
	B_1	8-15	3.7	7.5	7.7	18.6	17.1	33.1	12.3	3	1.62	------	6.6	2.7
	B_{22}	15-21	3.0	8.7	8.1	20.9	17.8	26.6	14.9	3	1.60	------	8.0	3.1
	B_3	21-26	2.9	10.9	8.7	21.9	20.4	25.8	9.4	1	1.58	------	5.9	2.1
	C_1	26-32	2.9	9.7	7.4	20.1	24.6	29.9	5.4	0	1.42	------	4.1	2.1
	C_2	32-42+	2.5	11.6	10.2	23.4	24.3	25.0	3.0	9	1.46	------	2.2	.8
Glenville silt loam; S56PA-15-1(1-9); in Chester County on H. B. Spackman Farm, in Thornbury Township, ½ mile W. of Darlington Corners on Street Road.	A_1	0-5	2.6	5.7	4.4	9.0	9.1	50.8	18.4	2	.86	------	9.3	2.5
	A_2	5-12	3.4	5.8	4.0	8.5	8.5	49.1	20.7	2	1.30	------	8.6	3.5
	B_{21}	12-18	3.8	5.4	3.4	7.1	7.1	51.7	21.5	5	1.38	------	9.7	4.2
	B_{22}	18-22	3.3	4.4	2.8	6.2	5.8	57.6	20.8	2	1.42	------	9.8	3.7
	B_{23g}	22-28	3.6	5.5	3.1	7.1	6.8	56.1	17.8	2	1.43	------	8.7	2.8
	B_{24g}	28-35	3.1	5.3	3.5	7.2	6.1	55.9	18.9	1	1.69	------	8.3	1.0
	B_{31}	35-47	7.3	11.8	7.5	14.4	11.0	37.7	10.3	8	1.80	------	7.2	3.4
	B_{32}	47-51	6.7	11.7	7.2	13.8	10.4	39.0	11.2	6	1.79	------	7.1	3.1
	C	51-75	4.2	5.4	3.4	7.1	7.3	64.5	8.1	4	1.69	------	5.2	2.2
Glenville silt loam; S56PA-15-5(1-6); in Chester County on Thomas Harney Farm, in East Bradford Township, E. of Brandywine Creek and N. of Taylor Run.	A_{p1}	0-8	.8	2.3	2.2	5.1	6.1	61.3	22.2	1	1.15	------	7.2	3.2
	A_{p2}	8-16	1.9	3.6	3.4	6.5	6.6	63.4	14.6	3	1.28	------	11.3	2.3
	A_2	16-20	1.7	4.1	3.5	6.5	6.3	62.7	15.2	6	1.38	------	6.7	2.2
	B_{21}	20-26	2.9	4.6	3.9	7.0	6.5	56.9	18.2	2	1.51	------	8.0	2.9
	B_{22g}	26-33	4.4	6.0	4.6	8.5	7.6	48.4	20.5	6	1.58	------	9.7	3.7
	B_{31g}	33-38	3.0	6.4	5.0	9.4	7.8	50.9	17.5	4	1.58	------	9.4	3.8
Glenville silt loam; S56PA-15-13(1-6); in Chester County on Ira Hicks Farm, in West Goshen Township; in alfalfa field 200 feet N. of woods on West Chester Airport property, 150 feet W. of Route T464.	A_p	0-9	.7	1.3	1.1	3.2	4.0	69.0	20.7	9	1.35	------	------	1.8
	B_{21}	9-18	1.0	1.3	1.0	3.1	4.1	64.2	25.3	6	1.57	------	------	2.1
	B_{22g}	18-26	1.3	1.7	1.2	3.9	5.1	65.2	21.6	16	1.70	------	------	1.8
	B_{23g}	26-34	3.0	3.9	2.8	8.4	10.2	55.8	15.9	9	1.63	------	------	1.8
	B_{3g}	34-40	2.9	4.2	2.5	6.8	7.6	61.7	14.3	11	1.63	------	------	3.3
	C	40-48	6.4	9.0	6.1	17.4	17.4	33.8	9.9	24	1.73	------	------	4.2
Neshaminy gravelly silt loam; S56PA-15-9(1-7); in Chester County, 1 mile E. of Martins Corner, 140 feet S. of Route T437, and 40 feet E. of woods.	A_p	0-7	2.5	6.3	5.7	7.7	4.8	53.0	20.0	23	------	------	9.5	3.2
	A_3	7-12	4.3	7.5	6.1	8.2	5.4	47.9	20.6	12	------	------	9.1	3.9
	B_{21}	12-19	4.1	7.5	6.1	8.2	5.5	41.5	27.1	23	------	------	11.7	5.0
	B_{22}	19-28	5.0	7.6	6.0	8.1	5.6	36.9	30.8	14	------	------	13.2	5.2
	B_{23}	28-35	4.3	8.0	6.6	9.1	6.4	36.7	28.9	9	------	------	13.8	5.0
	B_3	35-41	4.1	8.1	6.4	8.4	6.0	37.8	29.2	5	------	------	14.2	5.3
	C_1	41-58	5.8	12.5	7.8	9.0	5.5	24.0	35.4	7	------	------	15.6	4.7
Neshaminy silt loam; S56PA-15-10(1-7); in Chester County, on Grant Steele Farm; 5 miles SE. of Honey Brook, 300 feet S. of Route T435.	A_p	0-8	2.9	6.3	4.6	6.4	4.2	53.2	22.4	23	1.32	------	12.6	4.0
	B_1	8-13	2.9	5.3	4.5	6.6	4.5	52.8	23.4	21	1.41	------	12.3	4.5
	B_{21}	13-18	2.7	5.5	4.3	6.2	4.4	50.1	26.8	26	1.48	------	14.3	4.9
	B_{22}	18-22	3.9	5.0	3.7	5.6	4.2	49.6	28.0	26	1.54	------	14.8	5.0
	B_{23}	22-28	3.1	5.2	3.9	5.6	4.0	51.9	26.3	34	1.44	------	14.4	4.4
	B_3	28-37	2.0	3.9	2.9	4.2	3.0	57.0	27.0	15	1.54	------	14.6	4.2
	C_1	37-48+	2.4	4.2	2.8	3.8	2.7	60.8	23.3	16	1.70	------	13.0	3.7

See footnote at end of table.

of 8 soil series in Chester and Delaware Counties—Continued

Organic carbon	Nitrogen	Extractable cations (milliequivalent per 100 grams of soil)					Sum of cations	Base saturation	pH [1]	Mineral composition of the clay fraction			
		Hydrogen	Calcium	Magnesium	Potassium	Sodium				Kaolinite	Illite (mica)	Chlorite or chlorite-like	Vermiculite
Percent	*Percent*							*Percent*					
1.25	0.123	8.3	5.0	1.2	0.3	0.1	14.9	44	5.5				
.19		5.7	4.0	.9	.3	<.1	10.9	48	5.3				
.12		4.7	4.2	1.0	.2	.1	10.2	54	5.5				
.06		3.6	3.4	1.5	.3	.2	9.0	60	5.4				
1.44	.132	6.9	5.4	1.1	.2	.1	13.7	50	5.8				
.21		4.7	4.0	1.2	.1	.1	10.1	53	6.3				
.10		4.9	5.5	1.2	.1	.1	11.8	58	6.3				
.06		4.1	4.5	1.0	.1	.1	9.8	58	6.3				
.06		4.1	5.2	.9	.1	.1	10.4	60	6.3				
.04		1.8	2.2	1.0	.1	.1	5.2	65	6.3				
3.25	.208	15.2	2.2	1.4	.5	.1	19.4	22	5.2				
.47	.045	10.6	.6	.4	.2	.1	11.9	11	5.2				
.17		10.8	.3	1.1	.2	.1	12.5	14	5.2				
.11		10.4	.5	2.1	.2	.1	13.3	22	5.2				
.08		9.8	.6	3.0	.2	.2	13.8	29	5.2				
.04		5.1	2.4	7.2	.2	.6	15.5	67	5.6				
.08		5.7	4.0	6.3	.1	.5	16.6	66	6.0				
.08		6.5	4.0	5.5	.1	.3	16.4	60	5.9				
.08		4.5	2.5	2.6	.2	.2	10.0	55	5.8				
2.18	.226	12.6	6.1	2.1	.2	.1	21.1	40	6.6				
.78	.075	8.3	2.2	.9	.2	.1	11.7	29	6.2				
.35		6.1	1.8	.8	.2	.1	9.0	32					
.18		5.5	2.4	1.5	.2	.1	9.7	43	6.6				
.18		6.1	3.5	2.1	.2	.1	12.0	49	6.8				
.08		5.1	3.2	1.1	.2	.1	9.7	47	7.0				
1.79	.145	7.1	4.0	2.0	.2	.1	13.4	47	7.2				
.27		6.3	5.2	2.3	.1	<.1	13.9	55	6.0				
.15		7.1	2.3	2.0	.2	.1	11.7	39	5.7				
.06		6.3	2.2	1.3	.1	<.1	9.9	35	5.4				
.06		6.7	1.9	1.5	.1	.1	10.3	35	5.4				
.04		4.4	.9	1.0	.1	<.1	6.4	31	5.0				
1.93	.158	6.5	7.5	1.6	.3	.1	16.0	59	6.4		Abundant		Low.
.36	.045	4.3	4.0	1.0	.2	.1	9.6	55	6.2				
.20		4.7	4.1	1.3	.2	.1	10.4	55	6.2	Moderate	Low		Moderate.
.10		5.8	4.1	1.5	.2	.1	11.7	50	6.0				
.08		6.0	3.3	2.0	.2	.1	11.6	48	5.9	Low	Low		Low.
.04		6.6	2.4	2.3	.2	.1	11.6	43	5.2				
.06		6.6	1.6	1.8	.2	.1	10.3	36	4.9	Moderate			Low.
2.00	.157	5.3	9.0	1.8	.3	.1	16.5	68	6.5	Moderate	Low		Low.
.30		3.6	4.5	1.5	.1	.1	9.8	63	6.7				
.18		3.4	4.6	2.0	.1	.1	10.2	67	6.8	Moderate	Low		Low.
.13		3.6	4.8	2.6	.2	.1	11.3	68	6.6				
.14		3.6	4.9	3.0	.2	.1	11.8	69	6.8	Moderate	Low		Low.
.06		3.8	5.2	3.1	.2	.1	12.4	69	6.7				
.08		3.8	4.7	2.8	.2	.1	11.6	67	6.6	Abundant	Low		Low.

TABLE 10.—*Soil characterization data for 19 profiles*

Soil name, sample number, and location of sampled site	Horizon	Depth	Particle size distribution								Bulk density	Moisture held at tensions of		Free iron oxide (Fe_2O_3)
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)	Coarse fragments (greater than 2 mm.)		1/3 atmosphere	15 atmospheres	
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Gm./cu. cm.*	*Percent*	*Percent*	*Percent*
Penn silt loam; S56PA-15-6(1-4); in Chester County, on Jonathan Thorne Farm in East Coventry Township; 110 feet SW. of Route 15125.	A_p	0-8	2.5	7.0	9.7	13.5	5.9	47.1	14.3	15	------	------	6.0	2.1
	B_{21}	8-14	2.8	6.3	7.3	9.0	4.0	50.7	19.9	4	------	------	8.3	3.1
	B_{22}	14-23	.9	3.3	4.5	6.5	4.4	57.2	23.2	3	------	------	9.7	4.0
	C_1	23-27	3.8	11.2	12.3	14.0	4.9	36.2	17.6	8	------	------	6.5	3.0
Penn silt loam; S56PA-15-7(1-6); in Chester County on Wm. F. Tyson Farm in East Coventry Township; ½ mile S. of cemetery on Schuylkill Road E. of Kenilworth.	A_1	0-3	.9	3.0	4.9	11.9	8.1	55.9	15.3	<1	.89	------	7.7	2.1
	A_2	3-8	.8	2.9	4.8	11.9	7.8	56.0	15.8	<1	1.08	------	5.2	2.1
	B_1	8-11	.8	2.8	4.7	11.1	7.6	56.8	16.2	<1	1.29	------	5.4	2.2
	B_{21}	11-16	.6	3.0	4.9	12.1	8.6	53.5	17.3	4	1.41	------	5.9	2.4
	B_{22}	16-24	.4	2.9	5.5	13.0	10.6	48.1	19.5	2	1.50	------	7.3	2.8
	C_1	24-30+	.5	3.5	5.6	12.9	8.9	47.7	20.9	<1	1.58	------	9.8	3.2
Penn silt loam; S56PA-15-8(1-5); Sunny Slope Dairy Farm No. 2 in East Vincent Township; ½ mile N. of Hiestand.	A_p	0-9	1.9	2.5	4.0	18.0	16.6	41.3	15.7	10	1.46	------	7.0	2.3
	B_{21}	9-13	.7	2.0	1.9	11.0	18.7	45.5	20.2	32	1.58	------	9.1	3.1
	B_{22}	13-21	.6	1.7	1.6	13.9	23.6	39.9	18.7	2	1.63	------	8.4	3.1
	B_3	21-24	.2	1.2	1.8	7.6	16.5	50.3	22.4	15	1.51	------	9.4	3.1
	C_1	24-33+	.7	9.7	11.0	23.2	13.6	24.7	17.1	6	1.27	------	8.7	2.8
Sassafras loam; S59PA-23-12(1-8); in Delaware County, 125 feet N. of Delaware State line, and 1,500 feet E. of U.S. Highway No. 202.	A_{1p}	0-4	6.1	12.6	14.8	12.1	3.5	42.8	8.1	11	1.00	21.4	5.8	------
	A_{12}	4-10	4.5	10.1	10.8	7.3	2.6	47.6	17.1	13	1.46	16.7	7.5	------
	B_1	10-19	5.4	8.6	8.7	8.1	2.9	46.1	20.2	14	1.56	19.3	9.2	------
	B_2	19-27	5.4	9.3	16.6	25.6	5.7	18.3	19.1	27	1.73	10.0	4.9	------
	B_{31}	27-40	2.7	31.8	30.2	10.3	.8	1.0	23.2	9	1.63	12.1	9.7	------
	B_{32}	40-52	8.0	18.2	29.9	16.1	1.4	3.6	22.8	20	1.65	12.0	9.5	------
	B_{33}	52-57	4.6	19.8	37.5	14.2	1.1	3.1	19.7	7	1.60	10.0	8.1	------
	C_1	57-68	8.7	28.6	35.3	7.7	.4	.3	19.0	10	------	------	7.0	------
Sassafras loam; S59PA-23-1(1-7); in Delaware County, 1 mile SE. of Johnsons Corner in Concord Township, 3/4 mile N. of Delaware State line, 300 feet N. of Pyle Road.	A_p	0-9	3.5	9.7	11.3	25.4	5.0	34.3	10.8	10	1.35	15.7	5.3	------
	B_1	9-16	2.6	7.6	8.2	22.1	4.7	40.1	14.7	12	1.57	15.5	6.6	------
	B_{21}	16-25	2.0	4.1	4.7	15.7	4.1	46.2	23.2	13	1.55	18.8	10.6	------
	B_{22}	25-36	.8	3.2	3.6	10.4	3.3	52.5	26.2	12	1.56	23.5	11.6	------
	B_{31}	36-43	5.7	15.7	14.9	13.5	3.5	31.4	15.3	15	1.54	22.1	6.3	------
	B_{32}	43-55	8.5	33.3	34.8	7.9	2.5	4.8	8.2	10	1.66	8.2	3.2	------
	C_1	55-60+	12.6	28.2	39.0	9.5	2.4	2.6	5.7	30	1.64	7.6	2.7	------

[1]For Brecknock, Glenelg, Neshaminy, and Penn soils and for Sassafras loam (Sample No. S59 PA 23-12(1-8) pH was determined in the laboratory with glass electrode on dried samples; for Chester, Chrome, and Glenville soils and for Sassafras loam (Sample No. S59 PA 23-1(1-7) pH was determined in the field on fresh soil at time of sampling.

removed. It was found to be coarser textured throughout than the sample taken in a wooded area, but it had about the same amount of silt and clay in the plow layer and in the subsoil. Sample S56PA-15-4(1-6), also taken in a cultivated field, contained fewer coarse fragments than the other two samples. The soil material in this sample was rated as a fine sandy loam. It contained a high proportion of mica flakes, and, therefore, behaved as a silt loam. The sample of this soil showed a distinct increase of clay in the B horizon.

Sample number S56PA-15-2(1-7), was strongly acid in all horizons, but the cultivated area from which the other two samples were taken had been limed and the soils were less acid. Free iron oxides were higher in sample number S56PA-15-2(1-7) than in the other two samples. The carbon-nitrogen ratio was low in the samples taken from a cultivated area, and the total organic carbon was moderately low.

Bulk density was low in sample number S56PA-15-2(1-7) and only moderate in the other two samples, reflecting the porous nature of the micaceous soil material. The cation exchange capacity was a little higher in the subsoil of that sample than in the samples taken in a cultivated area. However, the proportion occupied by bases was much higher in the samples taken from a cultivated area. The degree of saturation in the B horizon and in the upper C horizon was low in the sample taken from a wooded area, but was more than 50 percent in the other two samples. The increase was mostly in exchangeable calcium, but there was some increase in magnesium. The increase extended into the C horizon.

of 8 soil series in Chester and Delaware Counties—Continued

Organic carbon	Nitrogen	Extractable cations (milliequivalent per 100 grams of soil)					Sum of cations	Base saturation	pH [1]	Mineral composition of the clay fraction			
		Hydrogen	Calcium	Magnesium	Potassium	Sodium				Kaolinite	Illite (mica)	Chlorite or chlorite-like	Vermiculite
Percent	*Percent*							*Percent*					
0.88	0.69	1.0	8.7	1.0	0.2	0.1	10.9	91	7.1				
.23		2.2	4.1	1.4	.2	.1	8.0	72	6.7				
.08		2.0	4.4	1.4	.2	.1	8.1	75	6.6				
.06		1.4	3.5	1.2	.2	.1	6.4	78	6.6				
3.98	.213	16.0	1.8	.6	.4	.1	18.9	15	4.4				
.97	.076	9.7	.3	.2	.2	.1	10.5	8	4.5	Low	Moderate		Abundant.
.50	.041	8.3	.4	.3	.2	<.1	9.2	10	4.3	Low	Moderate		Moderate.
.26		8.1	.3	.3	.2	.1	9.0	10	4.4	Low	Moderate		Moderate.
.15		9.1	.2	.5	.2	<.1	10.0	9	4.2	Low	Abundant		Moderate.
.04		9.4	.6	1.6	.3	.1	12.0	22	4.4	Low	Abundant		Low.
1.11	.102	3.0	7.2	1.9	.3	.1	12.4	76	6.5				
.14		3.4	4.9	2.2	.2	.1	10.8	68	5.6				
.04		3.0	4.6	2.7	.2	.1	10.6	72	5.5				
.06		9.6	3.7	3.1	.3	.1	16.8	43	4.4				
.02		10.4	1.7	2.2	.2	.1	14.6	29	4.6				
.68	.090	8.7	1.3	.5	.3	.3	11.1	22	5.5	Abundant	Low	Moderate	
.08	.051	6.5	1.5	.4	.3	.2	8.9	27	5.1	Abundant	Detected	Moderate	Low.
.06	.042	7.1	2.1	.5	.2	.2	10.1	30	4.8	Dominant	Low	Low	Moderate.
.03	.033	3.8	1.9	.3	.2	.2	6.4	41	4.6	Dominant	Low	Low	Moderate.
.03	.030	3.7	1.8	.3	.2	.2	6.2	40	4.8	Dominant	Low	Moderate	Low.
.02	.018	3.2	.8	.4	.2	.2	4.8	33	4.8	Dominant	Low	Low	Low.
.01	.013	2.7	.3	.3	.2	.2	3.7	27	4.9	Dominant	Low	Low	Low.
.01	.013	2.1	.3	.3	.2	.2	3.1	32	4.9	Dominant	Low	Low	Low.
1.07	.093	7.9	1.3	.8	.3	.2	10.5	25	5.2	Dominant	Low	Moderate	
.21	.046	7.2	1.4	.4	.3	.2	9.5	24	5.4	Dominant	Low	Moderate	Low.
.13	.040	9.0	2.7	.5	.3	.3	12.8	30	5.9	Dominant	Low	Low	Moderate.
.13	.035	9.4	2.1	.8	.3	.2	12.8	27	5.5	Dominant	Low	Low	Moderate.
.04	.032	7.7	1.0	.4	.2	.3	9.6	20	5.7	Dominant	Moderate	Low	Low.
.12	.015	2.7	.5	.1	.2	.3	3.8	29	5.8	Dominant	Moderate	Low	Low.
.05	.013	4.4	.3	.3	.1	.2	5.3	17	5.9	Abundant	Moderate	Low	Moderate.

GLENVILLE SILT LOAM

Three samples of Glenville soils were analyzed. One of the samples was taken in a wooded area. The other two were taken in open fields that had once been cultivated, although one was currently being used as pasture. All three samples were low in fragments larger than 2 millimeters in diameter. The texture in all the samples was found to be silt loam that contained a fairly high proportion of silt. Sample S56PA–15–13(1–6), taken from the area under cultivation, showed a moderate increase of clay in the upper B horizon and a decrease below that depth. The other two samples showed only a slight increase of clay in the B horizon. The small amount of clay in the B horizon was probably the result of the stratification of the soil material inasmuch as the movement of clay was indicated by distinct clay films on the peds in the B horizon.

All of the Glenville samples tested were found to be strongly acid, but the samples taken in areas that had been cultivated or pastured were from soils that had been limed. As a result, they were less strongly acid than the sample taken in a wooded area.

The surface layer of the sample taken in a wooded area contained a large amount of organic matter, but the content of organic matter in the plow layer of the other two samples was moderate. The carbon-nitrogen ratio ranged from 16 in the sample taken in a wooded area to 10 in the sample taken where the soil had been pastured. Free iron oxides varied in all of the profiles and ranged from 1.0 to 4.2 percent.

In the lower B horizon, bulk density was high in the sample taken in a wooded area, but it was moderate in the other two samples. Moisture retained against 15 atmospheres tension was fairly high.

The cation exchange capacity in the B horizon in the three samples ranged from 9 to 16 milliequivalents per 100 grams of soil, but the content of bases was variable. The degree of saturation was moderate in the sample taken from cultivated or pastured areas, where the upper horizons of the soils had been enriched by calcium. In the sample taken in a wooded area, the upper horizons were low in bases, but the horizons below the pan were fairly high in bases, probably because the ground water contained calcium.

NESHAMINY GRAVELLY SILT LOAM

Two samples of Neshaminy soils were analyzed. Both samples contained enough coarse fragments in the surface layer so that they could be classed as channery. Sample S56PA–15–10(1–7) had fewer coarse fragements in the subsoil than sample S56PA–15–9(1–7). In sample S56PA–15–9(1–7), coarse fragments were uniformly distributed throughout. The fine material in the surface layer of both samples was silt loam, and in both samples there was a well-expressed B horizon. The bulk density of the B horizon in sample S56PA–15–10(1–7) was moderately high, and in the C_1 horizon it was very high. Moisture held against 15 atmospheres tension was about 14 percent.

In both of the samples, the soil material was slightly acid to moderately acid. The content of calcium and magnesium was fairly high. The cation exchange capacity for the clay loam in the B horizon was fairly low, and the degree of saturation was high. Free iron oxide was fairly high in both profiles.

PENN SILT LOAM

Three samples of Penn soils were analyzed. One of the samples was taken in a wooded area. The other two were taken from strips seeded to hay on dairy farms where the soil profile had been truncated by erosion. The soil material in sample S56PA–15–7(1–6), taken from the wooded area, was found to be a true silt loam. Analysis of the other two samples showed the soil material to be loam in which the sandy material was mostly small particles of shale. None of the three samples contained much hard, coarse material, although fragments of shale and sandstone appeared common during analysis.

The increase in clay was slight in the B horizon in the sample taken in a wooded area, but it was moderate in the B horizon of the other two samples. Bulk density was moderate in the sample taken from a wooded area and in sample S56PA–15–8(1–5), taken from a cultivated area, but it was not determined for the other sample.

The soil material taken in a wooded area was found to be strongly acid, but the soils from which the other two samples were taken had been limed and the samples were found to be only slightly acid. Organic carbon was high in the surface layer of the sample taken from a wooded area, but it was low in the other samples. The carbon-nitrogen ratio was much lower in the samples taken from soils that had been cultivated than in the samples taken from the A_1 horizon of a soil in a wooded area.

The content of free iron oxides in all of the samples was moderate, although the red color suggested that the soil material contained a large amount of iron oxide. The cation exchange capacity of the soils was moderately low. The degree of base saturation in the sample taken from a wooded area was very low, but the other two samples had been taken from cultivated areas where the soils had been limed to a high degree of saturation. The increase was mostly in calcium, but there was some increase in magnesium.

SASSAFRAS LOAM

Two samples of Sassafras soils were analyzed. Both samples contained a large amount of fine and medium sand and slight to moderate amounts of gravel in the lower horizons. In both samples there was a textural B horizon. The bulk density was moderate.

In both of the samples, the cation exchange capacity was low, and there was only a moderate degree of base saturation. The degree of saturation decreased in the lower horizons as compared with the middle horizons, suggesting that some of the bases had been added by liming. Kaolinite was found to be dominant among the clay minerals.

General Information About the Counties

In this section general information is given about the physiography, relief, and drainage of Chester and Delaware Counties. Information is also provided about the water supply, climate, transportation, industries, and agriculture of the area.

Physiography, Relief, and Drainage

Except for a small part of the area that is in the Atlantic Coastal Plain, Chester and Delaware Counties are almost entirely in the Piedmont Province of the Appalachian Highlands. In general, the Piedmont Province is characterized by gently rolling uplands with occasional low hills and ridges underlain by diabase, quartzite, and others of the more resistant rocks.

The Piedmont Province has two parts—the Piedmont Upland and the Triassic Lowland. The Piedmont Upland is underlain mostly by schist, gneiss, gabbro, quartzite, and limestone. The Triassic Lowland, which is in the northern part of Chester County, is underlain by fairly soft shale and sandstone. A small, narrow belt in the southeastern corner of Delaware County along the Delaware River comprises the area in the Atlantic Coastal Plain.

Chester Valley, which extends northeast and southwest across the middle of Chester County, is the outstanding topographic feature of the area. The valley ranges in width from less than 1 mile at the Lancaster County line to about 2 miles at the Schuylkill River. The floor of the valley is nearly level to moderately sloping, and it does not serve as a main drainageway for any stream.

The altitude in the area ranges from 10 feet at the Delaware River to 1,056 feet in the northern part of Chester County. If the slight depressions and streams were filled in, a nearly level plain that has a gradual slope in a southeasterly direction toward the Delaware River and the Atlantic Ocean would result.

The principal streams draining the two counties are Brandywine Creek, Chester Creek, Ridley Creek, Crum Creek, French Creek, Octoraro Creek, and the Schuylkill River.

Water Supply

The supply of water has been adequate in Chester and Delaware Counties for most farms and for the small towns. During the past 10 years, however, the increase in population has caused concern about the adequacy of the water supply in a number of communities. Coatesville and West Chester have enough water at present, but additional water will be required to take care of future needs. The thickly populated area in Tredyffrin Township, Chester County, and in many towns in southeastern Delaware County are supplied with water by the Springfield Consolidated Water Company. Most of the water for all of these areas is obtained from surface supplies. The supply of water for Kennett Square is augmented by a well, drilled in Cockeysville marble, that yields 500 gallons of water a minute. Most drilled wells, however, yield 2 to 50 gallons of water a minute, but an occasional well produces up to 100 gallons of water a minute. Several rural developments near West Chester are supplied with water by the borough water system.

The water for most towns and communities in Delaware County is obtained from private water companies. These companies draw water from surface streams. Springs and wells are the main source of water on farms and at housing developments that are not near enough to connect with a water main of a private company.

The mushroom industry, which requires large quantities of pure water, uses water supplied by deep wells or by city waterlines. Pond or other surface water is not used, because it would require treatment before it could be used for the growing of mushrooms. The steel and paper industries also require large quantities of water.

In the summer of 1954, there was a severe drought in the area. It was followed by a flood that caused nearly $1 million in direct damages. The two disasters pinpointed the need for a survey to determine the requirements for water and ways of preventing damage from floods. The Soil Conservation Service agreed to make a survey of flood damage, and the Pennsylvania Department of Forest and Waters, to make a survey to determine the water needs of the Brandywine watershed.

The results of the surveys indicated a need for 12 multipurpose dams to provide water, control floods, and provide recreational areas. A project of this scope would be expected to supply all the water needed for agriculture, industry, home and community use, and for recreation in the Brandywine Valley up to the year 2010.

Climate

Chester and Delaware Counties have a humid, temperate climate, and extreme changes in temperature within short periods are rare. Winters are usually mild. Table 11, compiled from records of the United States Weather Bureau at West Chester, in Chester County, Pa., gives normal, monthly, seasonal, and annual temperatures and precipitation considered typical for this area.

This area has an average frost-free period of 190 days. The average date of the last killing frost in spring is April 16, and the average date of the first frost in autumn is October 23.

Rainfall is well distributed throughout the year. In most years enough rain falls to provide ample moisture for crops to grow well. Occasionally, however, local periods of drought occur. The resulting long, dry spells are likely to cause considerable damage to crops, particularly on shallow, well-drained soils. Generally, the largest amount of precipitation falls during the growing season; the least occurs in fall.

TABLE 11.—*Temperature and precipitation at West Chester, Chester County, Pennsylvania*

[Elevation, 440 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1941)	Wettest year (1889)	Average snowfall
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December	33. 4	71	−1	3. 76	3. 78	1. 95	5. 1
January	30. 8	73	−5	3. 76	3. 07	4. 78	6. 0
February	31. 4	74	−15	3. 63	2. 25	2. 46	8. 6
Winter	31. 9	74	−15	11. 15	9. 10	9. 19	19. 7
March	39. 4	87	5	3. 92	2. 24	5. 44	5. 4
April	50. 0	90	21	3. 69	2. 36	5. 46	. 4
May	61. 0	94	29	4. 34	1. 60	5. 78	0
Spring	50. 1	94	5	11. 95	6. 20	16. 68	5. 8
June	69. 7	98	40	4. 26	3. 71	5. 38	0
July	74. 4	105	48	4. 76	3. 88	12. 49	(3)
August	72. 2	99	46	4. 74	2. 83	4. 43	0
Summer	72. 1	105	40	13. 76	10. 42	22. 30	(3)
September	65. 8	96	33	3. 86	. 78	9. 95	0
October	54. 9	97	21	3. 55	1. 57	4. 97	. 1
November	43. 4	84	13	3. 60	2. 79	9. 91	1. 2
Fall	54. 7	97	13	11. 01	5. 14	24. 83	1. 3
Year	52. 2	105	−15	47. 87	30. 86	73. 00	26. 8

[1] Average temperature based on a 100-year record, through 1955; highest and lowest temperatures on a 21-year record, through 1952.

[2] Average precipitation based on a 105-year record, through 1955; wettest and driest years based on a 104-year record, in the period 1849–1955; snowfall based on a 20-year record, through 1952.

[3] Trace.

Transportation

This area has good transportation facilities. The main line of the Pennsylvania Railroad, which runs from Philadelphia to Pittsburgh, crosses Chester County near the center and passes through the towns of Paoli, Downingtown, and Coatesville. Another branch runs from Philadelphia through Media, the county seat of Delaware County, and on to West Chester. Still another branch runs through Kennett Square, West Grove, and Oxford to Washington, D.C. The Baltimore and Ohio Railroad has a line that passes through Delaware County to Wilmington, Del.

The Lincoln Highway, or U.S. Route 30, crosses Chester County and runs parallel with the Pennsylvania Railroad through Chester Valley. Baltimore Pike, or U.S. Route 1, crosses Delaware County and the southern part of Chester County through Kennett Square, West Grove, and Oxford.

The Pennsylvania Turnpike crosses the northern part of Chester County. It enters the county near Elverson in the northwestern part of the county and extends eastward to Valley Forge State Park. The Downingtown interchange is located about 7 miles north of West Chester on State Route No. 100.

All communities have hard-surface roads or gravel roads that are well maintained. In winter the roads are kept open by snowplows. If the roads are icy, fine gravel and sodium chloride are sprinkled on them.

Industries

The steel and paper industries located at Coatesville and Dowingtown provide employment for large numbers of workers. Numerous other industries in both counties employ numbers of workers of diversified skills.

The mushroom industry also provides employment for many persons. During the winter of 1959–60, nearly 2,000 workers were employed in the mushroom industry, and about half that number were employed in summer. The mushroom industry in this area, originating in Chester County about 1890, is now one of the largest industries of its kind in the United States. The business continues to expand from year to year as new houses are built and air-conditioning units are installed in the mushroom houses.

Agriculture

Agriculture played a prominent role in the development of Chester and Delaware Counties. The settlement and agricultural development in these two counties are discussed in the pages that follow.[5] Also discussed are agricultural improvements in the area, types and sizes of farms, farm tenure, crops, pasture, and livestock and livestock products. The statistics used are from the U.S. Census of Agriculture.

Settlement and agricultural development

Among the first settlers in this area were the Dutch. Although the Dutch did some planting, their chief interest was not in tilling the soil. It was the Swedes, who came to the area later, who laid the foundation of agriculture in the area. The Swedes made their first permanent settlement in 1643 at the present site of Chester and on Tinicum Island. After William Penn took over the territory, other settlers soon arrived in large numbers from various countries.

The Swedes had a definite agricultural objective—to grow grain, vegetables, grapes, and tobacco, and also to produce silk. They made butter, cheese, beer, and cider, and planted orchards and gardens. The Swedish settlers prospered and soon produced grain, tobacco, and cattle in quantities beyond their needs. They sold their surplus products to other settlers.

Many different crops have been grown in the area since the time of the first settlement. From the Indians, the settlers learned how to grow corn, and they added that crop to the other kinds of crops planted. The early settlers brought wheat, barley, oats, and rye with them. Barley, grown for use in the brewing of malt, was an important crop until about 1840, when the brewers refused to pay the price demanded for it by the farmers. Mediterranean wheat was introduced about 1838, and buckwheat and flax were grown in the 19th century. Clover was introduced at a fairly early date, but it was not planted widely until 1825.

The early settlers planted extensive orchards of apple and peach trees. An abundance of fruit was harvested from the orchards, and distilleries were built in many places to convert the fruit into brandy. About 1835, many farmers began to use a cropping system consisting of corn, oats, wheat, and grass, and they have continued to use approximately the same kind of cropping system to the present time.

In the early years, the agricultural implements used in planting and harvesting crops were crude. The first plow with an iron moldboard was used near Honey Brook in 1826. Threshing machines were introduced about 1840.

Material for fences was scarce in the early years, and only the cultivated fields were enclosed. Stock was allowed to run at large, and each farmer identified his own stock by branding. When forage became scarce, the animals became stunted, and, as the result of promiscuous interbreeding, the quality of the stock degenerated. Early in the 1800's, efforts were made to improve the livestock. Durham cattle were brought in from Kentucky, and a small herd was imported from England. Spanish Merino sheep were introduced about 1810. By careful crossing of selected bloodlines and good management, a new breed of hog, the Chester White, was developed. This breed is now widely raised throughout the eastern part of the United States.

Because Chester and Delaware Counties have been farmed longer than any other part of the State, erosion is a serious problem in many places. The soils are easily eroded, and erosion likely began before the area was settled, when the Indians burned the undergrowth periodically to keep the forest open for better hunting. In this way ground cover that protected the soils from erosion was destroyed. Other factors contributing to erosion of the soils are the long period of agricultural use, the intensive type of agriculture, heavy summer storms, and open winters.

Philadelphia has always been the principal market for the dairy products of Chester County. In the early days women on horseback often took butter, eggs, and poultry to the city in butter pails suspended at the horses' sides. As the demand increased, farmers loaded their wagons with produce for the weekly markets and drove to the city.

Agricultural improvement programs

Little was done by the early settlers of Chester and Delaware Counties to maintain the fertility of the soil. The first system of farming was to plow the same field year after year until the supply of plant nutrients was exhausted, and then clear a new field. The settlers planted corn, sowed barley, oats, flax, and buckwheat until, as one early settler stated, "We could hardly raise our bread and seed."

The first improvement came in the early 1700's when the rotation of crops was first practiced. At that time, neither lime nor fertilizer was used, but manure was scattered on the fields planted to corn. There were a few limekilns in these counties, where suitable limestone was

[5] The historical facts included in this chapter were taken principally from HISTORY OF CHESTER COUNTY, by FUTHEY and COPE.

available. Lime and fertilizer came into general use during the last half of the 1800's. By 1900, acid phosphate was being applied at rates ranging from 150 to 800 pounds per acre, or a complete commercial fertilizer was used at a cost of $18 to $28 per ton. If no manure was applied, from 500 to 1,000 pounds of commercial fertilizer was used.

As farming became more complex and scientific, private and governmental programs began to help its advance in the area. Among the earliest groups of farmers, organized to discuss agricultural problems and more efficient ways of increasing the productive capacity of their farms, were the Farm Clubs. These clubs were most active between 1860 and 1900. Each club was made up of about 20 families who met once a month. The clubs were mostly in the southwestern part of Chester County near Doe Run, Oxford, and West Grove. Five or six of these clubs are still in existence.

Shortly after 1900, Farmers' Institutes were held in the area to bring the farmers the results of research done at State College. In 1912, the Agricultural Extension Association established an office and appointed a county agent in Chester County. About 4 years later, a county agent was appointed in Delaware County. The program of the Extension Association includes teaching and demonstrating various kinds of practices to improve the soil.

The first organized classes in agriculture in this area were held at rural community vocational schools in Avondale, West Fallowfield, and Honey Brook in 1919. The courses given covered at least 2 years' study of agriculture or homemaking. The rural community vocational schools preceded high school classes in vocational agriculture that are now taught in eight high schools in Chester County. There are no vocational agricultural schools in Delaware County.

The Brandywine Valley Association was organized in 1945 to help restore, conserve, and improve all of the natural resources in the Brandywine Valley. This association is private and nonpolitical and is a locally financed, educational organization.

In the fall of 1946, the Veterans Farm Training program was set up. Persons who participated in that program, as well as the members of the Brandywine Valley Association, assisted in organizing a Soil Conservation District in Chester County. In 1947, the commissioners of that county established the Chester County Soil Conservation District, and the directors of the district were chosen in April 1948. More than 1,585 farmers are now cooperating with the district. Their farms occupy more than 142,021 acres in Chester County.

To coordinate the work and advance the conservation of the soil and water resources of Chester County, the Chester County Soil Conservation District has made cooperative agreements with the Pennsylvania State University; the Soil Conservation Service of the U.S. Department of Agriculture; the Pennsylvania Game Commission; the Pennsylvania Department of Forests and Waters; the Pennsylvania Fish Commission; and the Pennsylvania Department of Agriculture. The Agricultural Extension Association, the Farm Credit Administration, the Farmers Home Administration, vocational agricultural departments, and other State or Federal agencies also serve the farmers of the two counties.

Types and sizes of farms

In 1959, 292,776 acres, or 60.2 percent of the total acreage in Chester County, was in farms, and 20,413 acres, or 17.2 percent of the total acreage in Delaware County was used for the same purpose. The number of farms in each county in 1959 classified by type, follows:

	Chester	*Delaware*
Dairy farms	1,039	21
Poultry farms	92	10
Livestock farms other than dairy or poultry	218	20
General farms	96	10
Field-crop farms other than vegetable and fruit-and-nut	55	5
Fruit-and-nut farms	35	0
Vegetable farms	5	0

The number of dairy farms in the counties has decreased during the past few years. During the same period the number of poultry farms decreased and farms on which fruits and nuts are grown has increased in Chester County but has decreased in Delaware County.

The farms in Chester and Delaware Counties are generally not large. In 1959, the average size of farms in Chester County was 106.6 acres, and in Delaware County, 72.4 acres. In the same year, 429 of the 2,746 farms in Chester County were larger than 180 acres. Of the 282 farms in Delaware County, only 31 farms were larger than 180 acres. The largest farm in the area is in Chester County; it occupies about 10,000 acres, but the owners rent an additional 2,000 acres for pasture.

Tenure

Most of the farmers in Chester and Delaware Counties own the land they work. In 1959 full owners operated 1,804 farms, or 69.6 percent of the farms in Chester County, and 184 farms, or 76.9 percent of the farms in Delaware County. In Chester County part owners operated 534 farms in 1959 and tenants operated 369. The tenants in Chester County were either cash or share tenants. In Delaware County part owners operated 46 of the farms, and tenants operated 33 of the farms; the tenants were predominantly cash tenants.

Crops

Forage crops, corn, and small grains occupied a large acreage in Chester and Delaware Counties in 1959. The acreage of the principal crops grown in these two counties in that year is as follows:

	Chester	*Delaware*
Corn, for all purposes	38,247	1,642
Harvested for grain	30,765	1,250
Cut for silage	7,189	372
Hogged, grazed, or cut for green or dry fodder	293	20
Wheat, threshed or combined	13,644	496
Oats, threshed or combined	9,496	355
Barley, threshed or combined	7,651	417
Rye, threshed or combined	503	7
Soybeans for all purposes	1,932	144
Cut for hay	523	8
Harvested for beans	412	25
Hogged, grazed, or cut for silage	930	71
Plowed under for green manure	67	40
Alfalfa and alfalfa mixtures cut for hay	30,354	1,225
Clover, timothy, and mixtures of clover and grasses cut for hay	22,282	1,569
Tobacco, harvested	439	0
Tomatoes, harvested for sale	870	38
Sweet corn, harvested for sale	351	309

In 1959 fruit orchards, groves, vineyards, or nut trees were reported on 195 farms in Chester County and on 61 farms in Delaware County. The number of fruit trees of all ages in each county follows:

	Chester	*Delaware*
Apple trees	23, 605	11, 338
Peach trees	15, 104	7, 469
Pear trees	1, 000	1, 108
Cherry trees	1, 286	505
Plum and prune trees	377	421

In addition to tree fruits, grapes, strawberries, and raspberries were grown on some of the farms and provided considerable cash income. In 1959, forest products and horticultural specialties, including mushrooms, accounted for 42.5 percent of all the income derived from the sale of farm products in Chester County, and for 72.6 percent of that in Delaware County. Mushrooms were the main specialty crop grown. About 70 acres of topsoil, 8 inches thick, is required each year to provide casing soil for use in growing mushrooms. If a suitable procedure is used, the topsoil can be stripped from some areas more than once. Generally, 8 to 10 years are required between strippings to prepare the soil for use again.

Irish potatoes, sweetpotatoes, and other field crops were grown on some of the farms in both counties. Truck crops were grown for home use on most of the farms and were harvested for sale on many of the farms.

Pasture

More than 29.2 percent of the land in farms in Chester County, or 85,595 acres, was used for pasture in 1959. A total of 4,893 acres, or about 24 percent, was used for pasture in Delaware County. The pastures are mostly of good quality. Lime and fertilizer are applied to pastures on nearly all farms, and rotational grazing is practiced. The largest farm in the area, the Buck and Doe Run Valley Farms, in Chester County, receives a large number of cattle from Texas each year about the first of May. The cattle are pastured during the summer and are shipped to market in fall.

Livestock and livestock products

In 1959, the kinds of livestock and the number of livestock in Chester and Delaware Counties, were as follows:

	Chester	*Delaware*
Cattle and calves	71, 033	3, 110
Horses and mules	2, 567	377
Hogs and pigs	19, 382	5, 294
Sheep and lambs	5, 498	612
Chickens, 4 months old and over	334, 346	21, 873
Turkeys raised	99, 762	1, 045

Of the total number of cattle and calves in Chester County in 1959, 34,078 were milk cows, and in Delaware County the milk cows numbered 1,348. More than 255 million pounds of whole milk was sold in that year from the farms in Chester County, and nearly 10 million pounds, from farms in Delaware County. A total of 42,025 cattle and calves was sold alive from 1,660 farms in Chester County in 1959, and a total of 1,340 cattle and calves was sold from 86 farms in Delaware County.

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Glossary

Accelerated erosion. Erosion more rapid than natural, normal, of geological erosion. It usually results from the activities or man or animals.

Aeration, soil. The process by which air and other gases in the soil are renewed. The rate of soil aeration depends largely on the size and number of pores in the soil and on the amount of water clogging the pores.

Aggregate, soil. A single mass or cluster consisting of many primary soil particles held together, such as a prism, crumb, or granule.

Alluvial soil. Soil formed from material, such as gravel, sand, silt, or clay, deposited by a stream of water and showing little or no modification of the original material by soil-forming processes.

Anorthosite. A medium- to coarse-grained igneous rock, generally having a bluish-gray color. It is high in feldspar and is dominantly a plagioclase.

Available moisture capacity. The ability of a soil to hold water that will not drain away but that can be taken up by plant roots.

Base saturation. The relative degree to which a soil has absorbed metallic cations (calcium, potassium, magnesium, and so on). The proportion of the cation-exchange capacity that is saturated with metallic cations.

Bedding, land. Plowing, grading, or otherwise elevating the surface of fields into a series of parallel beds, or lands, that have shallow surface drains separating them.

Bedrock. The solid rock that underlies the soils and other earthy surface formations.

Calcareous. Containing calcium carbonate or lime.

Channery. Containing thin, flat fragments of sandstone, limestone, or schist as much as 6 inches along the longer axis. A single piece is called a fragment.

Claypan. A compact horizon or layer rich in clay and separated more or less abruptly from the overlying horizon.

Clean tillage. Cultivation to prevent the growth of all vegetation except the particular crop desired.

Coarse-textured soils. Sand, loamy sand, sandy loam, and fine sandy loam.

Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

Colluvial soil. Soil formed from material that has been moved downhill by gravity, soil creep, frost action, or local wash. It accumulates on the lower slopes and at the bases of slopes.

Conglomerate. Rock composed of gravel and rounded stones cemented together by hardened clay, lime, iron oxide, or silica.

Consistence. 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; will not hold together in a mass.

Friable. When moist, crushes easily under moderate 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.

Hard. When dry, moderately resistant to pressure; can barely be broken between thumb and forefinger.

Cemented. Hard and brittle; little affected by moistening.

Contour farming. Conducting field operations, such as plowing, planting, cultivating, and harvesting, in rows that are at right angles to the natural direction of the slope and as nearly level as practical.

Cover crop. A close-growing crop grown primarily to improve the soil and protect it between periods of regular crop production; or crops grown between trees in orchards.

Deciduous trees. Trees that drop their leaves annually; generally refers to broadleaf trees.

Diabase. A basic, igneous rock, locally called ironstone. It is composed essentially of plagioclase feldspar and augite with small quantities of magnetite and apatite.

Dike (rock). Igneous rock that was forced into a vertical crack or fissure while molten, then hardened in that shape.

Diversion terrace. A channel that has a supporting ridge on the lower side. It is constructed across the slope to intercept runoff and to carry runoff to a planned outlet. These terraces are maintained in permanent sod.

Drainage terrace. A relatively deep channel and low ridge constructed across the slope primarily for drainage. It may be either a diversion terrace or a field terrace.

Dolomite. A rock consisting chiefly of calcium carbonate and magnesium carbonate in approximately equal proportions.

Erodible. Susceptible to erosion; easily lost through the action of water or wind.

Erosion. The wearing away of the surface of the soil by the action of running water, wind, or other geological agents.

Field terrace. A ridge 10 to 20 inches high and 15 to 30 feet wide with gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. The ridge is constructed across the direction of the slope to control erosion by diverting runoff along the contour at a safe speed. It may grade toward one or both ends. Cultivated crops may be grown over this terrace.

Fine-textured soil. Clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, and clay.

Flood plain. The nearly level areas, subject to overflow, that occur along streams.

Gabbro. A more or less dark-colored, granular, igneous rock comprised mainly of basic plagioclase, generally labradorite, with a ferromagnesian mineral (augite, hypersthene, or hornblende) and accessory iron ore.

Geological erosion. Normal erosion that takes place when the soil is under native vegetation and undisturbed by human activity.

Gneiss. A crystalline rock in which the component minerals are arranged in parallel bands or layers. This rock tends to cleave into slabs.

Graded stripcropping. Growing crops in strips that are graded toward a protected waterway.

Granodiorite. A granular, intrusive, igneous rock, intermediate between quartz-monzonite and quartz-diorite.

Graphitic. Containing graphite, or native carbon.

Grassed waterways. A waterway planted to grass to protect it against erosion; sometimes graded or shaped to control runoff.

Green-manure crop. Any crop grown for the purpose of being turned under while green or soon after maturity for the purpose of improving the soil.

Gully. A steep-sided channel resulting from accelerated erosion; large enough to be an obstacle to farm machinery.

Hardpan. A horizon or soil layer that is strongly compacted or cemented.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by soil-forming processes. Horizons are identified by letters of the alphabet.

A horizon. The horizon at the surface. It contains organic matter, has been leached of soluble minerals and clay, or shows the effects of both. The major A horizon may be subdivided into A_1, the part that is darkest in color because it contains organic matter, and A_2, the part that is the most leached and light-colored layer in the profile. In woodlands a layer of organic matter accumulates on top of the mineral soil; this layer is called the A_0 horizon. The depth of the soil, however, is measured from the top of the mineral soil, because the A_0 horizon is rapidly destroyed if fire occurs or if the soil is cultivated. Where the upper layers of the soil are thoroughly mixed by cultivation, this plow layer is called the A_p horizon.

B horizon. The horizon in which clay, minerals, or other material has accumulated, that has developed a characteristic blocky or prismatic structure, or that shows the characteristics of both processes. It may be subdivided into B_1, B_2, or B_3 horizons. The B_2 horizon may be subdivided further by adding a number to the symbol, such as B_{21}, B_{22}, or B_{23}.

C horizon. The unconsolidated material immediately under the true soil. It is presumed to be similar in chemical, physical, and mineral composition to the material from which at least part of the overlying solum has developed.

D horizon. The stratum beneath the parent material. It may be unlike the parent material of the soil. If it consists of solid rock like that from which the parent material has developed, it is designated as the D_r horizon.

Gleyed horizon. A strongly mottled or gray horizon that occurs in wet soils. It is designated by the letters BG, CG, or sometimes merely by G. A horizon only slightly gleyed may have the small letter *g* added to the symbol in subscript.

Igneous rock. A rock produced through the cooling of melted mineral materials.

Leached layer. A layer in which the soluble constituents have been dissolved and washed away by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for carrying loads.

Medium-textured soil. Very fine sandy loam, loam, silt loam, and silt.

Metamorphic rock. A rock that has been considerably altered by the combined action of pressure, heat, and water. Generally, the resulting rock is more compact and more highly crystalline than the original. Gneiss, schist, and marble are common examples.

Micaceous. Containing mica.

Mottling, soil. Contrasting color patches that vary in number and size. Descriptive terms are as follows: Contrast—*faint*, *distinct*, and *prominent*; abundance—*few*, *common*, and *many*; and size—*fine*, *medium*, and *coarse*. The size measurements are the following: Fine, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, ranging from 5 to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and coarse, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. The unconsolidated material, such as sand, silt, or clay, from which the soil develops.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a *clod*, which is a mass of soil brought about by digging or other disturbance.

Pegmatite. Coarse-grained granitic rock that consists mostly of dikes composed chiefly of quartz and feldspar.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

Phyllite. A micaceous schist, intermediate between mica-schist and slate.

Physiographic province. One of the major geographic divisions of the continent.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content over which the soil remains plastic.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Quartz-monzonite. A granite rich in plagioclase.

Quartzite. A compact, granular metamorphosed sandstone.

Reaction, soil. The degree of acidity or alkalinity of the soil, expressed in pH values or in words, as follows:

	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
Slighty 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.

Residual soil. Soil formed from material weathered from the underlying consolidated rock.

Rill. A steep-sided channel resulting from accelerated erosion, but in most places only a few inches in depth and width; not large enough to be an obstacle to farm machinery.

Runoff. Water that flows off the surface of the soil without sinking in.

Schist. A rock that has a parallel or foliated structure secondarily developed in it by shearing, a process generally accompanied by more or less recrystallization of the constituent minerals in layers parallel to the cleavage; splits or cleaves readily.

Sedimentary rock. A rock formed from an accumulation of sediment in water. Although there are many intermediate types, the principal groups of sedimentary rocks are (1) conglomerates (from gravel), (2) sandstones (from sand), (3) shales (from clay), and (4) limestones (from deposit of calcium carbonate).

Serpentine. A rock consisting essentially of hydrous magnesium silicate.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Sheet erosion. The removal of a fairly uniform layer of soil material from the surface of the land by the action of rainfall and runoff water without the formation of rills and gullies.

Sill. Igneous rock that was forced into a horizontal crack or fissure while molten, then hardened in that shape.

Solum. The upper part of the soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils consists of the A and B horizons.

Stripcropping. Growing alternate strips of close-growing crops and clean-tilled crops or fallow on the contour or parallel to terraces.

Structure, soil. The arrangement of the primary soil particles into lumps, granules, or other aggregates. Structure is described by grade—*weak, moderate,* or *strong;* that is, the distinctness and durability of the aggregates. It is also described by the size of the aggregates—*very fine, fine, medium, coarse,* or *very coarse;* and by their shape—*platy, prismatic, columnar, blocky, granular,* or *crumb.* A soil is described as structureless if there are no observable aggregates. Structureless soils may be massive (coherent) or single grain (noncoherent).

Blocky, angular. Aggregates are shaped like blocks; they may have flat or rounded surfaces that join at sharp angles.

Blocky, subangular. Aggregates have some rounded and some flat surfaces; the upper sides are rounded.

Columnar. Aggregates are prismatic and are rounded at the top.

Crumb. Aggregates are generally soft, small, porous, and irregular, but tend toward a spherical shape.

Granular. Roughly spherical, firm, small aggregates that may be either hard or soft but that are generally more firm and less porous than crumb and without the distinct faces of blocky structure.

Platy. Aggregates are flaky or platelike.

Prismatic. Aggregates have flat, vertical surfaces, and their height is greater than their width.

Subsoil. The soil layers below the plow layer; the B horizon.

Substratum. The soil material below the surface soil and the subsoil; the C or D horizon.

Surface soil. The plow layer; the A horizon.

Texture, soil. The relative amounts of particles of different size classes, called sand, silt, and clay, determine texture. The common soil textures in Chester and Delaware Counties are sandy loam, loam, and silt loam. Sandy loam is ½ to more than ⅘ sand and less than ⅕ clay—the remainder is silt. Loam is ¼ or less clay, ¼ to ½ sand, and ¼ to ½ silt. Silt loam is ½ or more silt and as much as ½ sand—it contains very little clay.

Clay. Small mineral soil grains, less than 0.002 millimeter (0.000079 inch) in diameter.

Silt. Small mineral soil grains ranging from 0.05 millimeter (0.002 inch) to 0.002 millimeter (0.000079 inch) in diameter.

Sand. Small rock or mineral fragments ranging from 0.05 millimeter (0.002 inch) to 2.0 millimeter (0.079 inch) in diameter.

Tilth. The physical properties of the soil that affect the ease of cultivating it or its suitability for crops; it implies the presence or absence of favorable soil structure.

Topsoil (engineering). Soil material containing organic matter and suitable as a surfacing for shoulders and slopes.

Water table. The upper surface of the ground water.

GUIDE TO MAPPING UNITS

[See table 1, p. 13, for productivity ratings of the soils, and table 8, p. 58, for the acreage and proportionate extent of the soils. To find the engineering properties of the soils, including soils in rural development, see the section beginning on p. 28. Dashes indicate the soil materials are variable and, therefore, the soil was not given the particular classification]

Map symbol	*Soils*	*Page*	*Capability unit*	*Page*	*Woodland group*	*Page*	*Building group*	*Page*
AgA	Aldino silt loam, 0 to 3 percent slopes	61	IIw-1	9	9	25	12	57
AgB2	Aldino silt loam, 3 to 8 percent slopes, moderately eroded	61	IIIw-1	9	9	25	12	57
AsB2	Aldino very stony silt loam, 0 to 8 percent slopes, moderately eroded	61	VIIs-2	12	9	25	12	57
BdA	Bedford silt loam, 0 to 3 percent slopes	62	IIw-1	7	8	25	10	57
BdB	Bedford silt loam, 3 to 8 percent slopes	62	IIe-6	7	8	25	10	57
BdB2	Bedford silt loam, 3 to 8 percent slopes, moderately eroded	62	IIe-6	7	8	25	10	57
BeA	Beltsville silt loam, 0 to 3 percent slopes	62	IIw-1	7	7	24	10	57
BeB2	Beltsville silt loam, 3 to 8 percent slopes, moderately eroded	62	IIe-6	7	7	24	10	57
Bo	Bowmansville silt loam	63	Iw-1	11	11	25	13	57
BrB2	Brandywine loam, 3 to 8 percent slopes, moderately eroded	64	IIe-5	7	13	25	7	56
BrC	Brandywine loam, 8 to 15 percent slopes	64	IIIe-4	8	15	26	8	56
BrC2	Brandywine loam, 8 to 15 percent slopes, moderately eroded	64	IIIe-4	8	15	26	8	56
BrC3	Brandywine loam, 8 to 15 percent slopes, severely eroded	64	IVe-4	10	15	26	8	56
BrD	Brandywine loam, 15 to 25 percent slopes	64	IVe-4	10	15	26	8	56
BrD2	Brandywine loam, 15 to 25 percent slopes, moderately eroded	64	IVe-4	10	15	26	8	56
BrD3	Brandywine loam, 15 to 25 percent slopes, severely eroded	64	VIe-2	11	15	26	8	56
BrE	Brandywine loam, 25 to 40 percent slopes	65	VIe-	11	1	26	9	56
BsB	Brandywine very stony loam, 0 to 8 percent slopes	5	Is-1	11	1	25	7	56
BsD	Brandywine very stony loam, 8 to 25 percent slopes	65	VIs-1	11	15	26	8	56
BsF	Brandywine very stony loam, 25 to 50 percent slopes	65	VIIs-1	12	17	26	9	56
BtB2	Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded	66	IIe-5	7	1	20	5	55
BtC2	Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded	66	IIIe-4	8	3	21	6	55
BtC3	Brecknock channery silt loam, 8 to 15 percent slopes, severely eroded	66	IVe-4	10	3	21	6	55
BtD2	Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded	66	IVe-4	10	3	21	6	55
BtD3	Brecknock channery silt loam, 15 to 25 percent slopes, severely eroded	66	VIe-2	11	3	21	6	55
BtE3	Brecknock channery silt loam, 25 to 35 percent slopes, severely eroded	66	VIIe-1	12	5	24	9	56
BvB	Brecknock very stony silt loam, 0 to 8 percent slopes	66	VIs-1	11	1	20	5	55
BvD	Brecknock very stony silt loam, 8 to 25 percent slopes	66	VIs-1	11	3	21	6	55
BvF	Brecknock very stony silt loam, 25 to 50 percent slopes	66	VIIs-1	12	5	24	9	56
BxB2	Bucks silt loam, 3 to 8 percent slopes, moderately eroded	67	IIe-2	6	1	20	3	54
ByA	Butlertown silt loam, 0 to 3 percent slopes	68	IIw-1	7	1	20	3	54
ByB2	Butlertown silt loam, 3 to 8 percent slopes, moderately eroded	68	IIe-6	7	1	20	3	54
CaA	Calvert silt loam, 0 to 3 percent slopes	68	Vw-1	11	11	25	12	5
CaB	Calvert silt loam, 3 to 8 percent slopes	68	VIw-2	11	11	25	12	57
CaB2	Calvert silt loam, 3 to 8 percent slopes, moderately eroded	68	VIw-2	11	11	25	12	57
CdA	Chester silt loam, 0 to 3 percent slopes	69	I-1	6	1	20	1	54
CdA2	Chester silt loam, 0 to 3 percent slopes, moderately eroded	69	IIe-2	6	1	20	1	54
CdB	Chester silt loam, 3 to 8 percent slopes	70	IIe-2	6	1	20	1	54
CdB2	Chester silt loam, 3 to 8 percent slopes, moderately eroded	70	IIe-2	6	1	20	1	54
CdB3	Chester silt loam, 3 to 8 percent slopes, severely eroded	70	IIIe-2	8	1	20	1	54
CdC	Chester silt loam, 8 to 15 percent slopes	70	IIIe-2	8	3	21	2	54
CdC2	Chester silt loam, 8 to 15 percent slopes, moderately eroded	70	IIIe-2	8	3	21	2	54
CdC3	Chester silt loam, 8 to 15 percent slopes, severely eroded	70	IVe-2	9	3	21	2	54
CgB	Chester very stony silt loam, 0 to 8 percent slopes	70	VIs-1	11	1	20	5	55
CgC	Chester very stony silt loam, 8 to 15 percent slopes	71	VIs-1	11	3	21	6	55
Ch	Chewacla silt loam	71	IIw-2	7	7	24	13	57
CkB2	Chrome gravelly silty clay loam, 3 to 8 percent slopes, moderately eroded	72	IIe-5	7	13	25	7	56
CkC2	Chrome gravelly silty clay loam, 8 to 15 percent slopes, moderately eroded	72	IIIe-4	8	15	26	8	56
CkC3	Chrome gravelly silty clay loam, 8 to 15 percent slopes, severely eroded	72	IVe-4	10	15	26	8	56
CkD2	Chrome gravelly silty clay loam, 15 to 25 percent slopes, moderately eroded	72	IVe-4	10	15	26	8	56
CkD3	Chrome gravelly silty clay loam, 15 to 25 percent slopes, severely eroded	72	VIe-2	11	15	26	8	56
CkE2	Chrome gravelly silty clay loam, 25 to 40 percent slopes, moderately eroded	72	VIIe-1	12	17	26	9	56
CmA	Conestoga silt loam, 0 to 3 percent slopes	73	I-1	6	2	21	1	54
CmA2	Conestoga silt loam, 0 to 3 percent slopes, moderately eroded	73	IIe-1	6	2	21	1	54
CmB2	Conestoga silt loam, 3 to 8 percent slopes, moderately eroded	73	IIe-1	6	2	21	1	54

GUIDE TO MAPPING UNITS—Continued

Map symbol	Soils	Page	Capability unit	Page	Woodland group	Page	Building group	Page
CmC2	Conestoga silt loam, 8 to 15 percent slopes, moderately eroded.	73	IIIe-1	8	4	24	2	54
CmC3	Conestoga silt loam, 8 to 15 percent slopes, severely eroded	73	IVe-1	9	4	24	2	4
Cn	Congaree silt loam	74	I-2	6	1	20	13	57
CoA	Conowingo silt loam, 0 to 3 percent slopes	74	IIIw-2	9	7	24	10	57
CoB2	Conowingo silt loam, 3 to 8 percent slopes, moderately eroded.	75	IIIw-2	9	7	24	10	57
CrA	Croton silt loam, 0 to 3 percent slopes	75	IV -1	10	11	5	12	57
CrB	Croton silt loam, 3 to 8 percent slopes	75	IVw-2	10	11	5	12	57
EcB	Edgemont channery loam, 3 to 8 percent slopes	76	IIe-4	6	1	20	1	54
EcB2	Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.	76	IIe-4	6	1	0	1	54
EcC	Edgemont channery loam, 8 to 15 percent slopes	76	IIIe-3	8	3	21	2	54
EcC2	Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.	76	IIIe-3	8	3	21	2	54
EcC3	Edgemont channery loam, 8 to 15 percent slopes, severely eroded.	77	IVe-2	9	3	1	2	54
EcD	Edgemont channery loam, 15 to 25 percent slopes	77	I e-2	9		21	2	54
EcD2	Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.	77	IVe-2	9	3	21	2	54
EcD3	Edgemont channery loam, 15 to 25 percent slopes, severely eroded.	77	VIe-1	11	3	1	2	54
EcE	Edgemont channery loam, 25 to 35 percent slopes	77	VIe-1	11	5	24	9	56
EcE2	Edgemont channery loam, 25 to 35 percent slopes, moderately eroded.	77	VIe-1	11		24	9	56
EdB	Edgemont very stony loam, 0 to 8 percent slopes	77	VIs-1	11	1	20	5	55
EdD	Edgemont very stony loam, 8 to 25 percent slopes	77	VIs-1	11	3	21	6	55
EdF	Edgemont very stony loam, 25 to 60 percent slopes	78	VIIs-1	12	5	24	9	56
GeA	Glenelg channery silt loam, 0 to 3 percent slopes	78	I-1	6	1	20	5	55
GeA2	Glenelg channery silt loam, 0 to 3 percent slopes, moderately eroded.	78	IIe-2	6	1	20	5	55
GeB	Glenelg channery silt loam, 3 to 8 percent slopes	78	IIe-2	6	1	20	5	55
GeB2	Glenelg channery silt loam, 3 to 8 percent slopes, moderately eroded.	79	IIe-2	6	1	0	5	55
GeB3	Glenelg channery silt loam, 3 to 8 percent slopes, severely eroded.	79	IIIe-2	8	1	20	5	55
GeC	Glenelg channery silt loam, 8 to 15 percent slopes	79	IIIe-2	8	3	21	6	
GeC2	Glenelg channery silt loam, 8 to 15 percent slopes, moderately eroded.	79	IIIe-2	8	3	21	6	55
GeC3	Glenelg channery silt loam, 8 to 15 percent slopes, severely eroded.	79	IVe-2	9	3	21	6	55
GeD	Glenelg channery silt loam, 15 to 25 percent slopes	80	IVe-2	9	3	21	6	5
GeD2	Glenelg channery silt loam, 15 to 25 percent slopes, moderately eroded.	80	IVe-2	9	3	21		55
GeD3	Glenelg channery silt loam, 15 to 25 percent slopes, severely eroded.	80	VIe-1	11	3	21	6	55
GeE	Glenelg channery silt loam, 25 to 35 percent slopes	80	VIe-1	11	5	24	9	56
GeE3	Glenelg channery silt loam, 25 to 35 percent slopes, severely eroded.	80	VIIe-1	12	5	24	9	56
GgA3	Glenelg silt loam, 0 to 3 percent slopes, severely eroded	80	IVe-5	10	13	25	5	55
GgB3	Glenelg silt loam, 3 to 8 percent slopes, severely eroded	80	IVe-5	10	13	25	5	55
GmD	Glenelg very stony silt loam, 15 to 25 percent slopes	81	VIs-1	11	3	21	6	56
GmE	Glenelg very stony silt loam, 25 to 35 percent slopes	81	VIIs-1	12	5	24	9	56
GnA	Glenville silt loam, 0 to 3 percent slopes	81	IIw-1	7	7	24	10	57
GnB	Glenville silt loam, 3 to 8 percent slopes	81	IIe-6	7	7	24	10	57
GnB2	Glenville silt loam, 3 to 8 percent slopes, moderately eroded	82	IIe-6	7	7	24	10	57
GnC2	Glenville silt loam, 8 to 15 percent slopes, moderately eroded	82	IIIe-5	9	7	24	11	57
GsB	Glenville very stony silt loam, 0 to 8 percent slopes	81	VIs-2	12	7	24	10	57
Gu	Guthrie silt loam	83	IIe-w-1	10	12	25	12	57
HaA2	Hagerstown silt loam, 0 to 3 percent slopes, moderately eroded.	82	IV1S	6	2	21	1	54
HaB2	Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded.	83	IIe-1	6	2	1	1	54
HaC2	Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded.	83	IIIe-1	8	4	24	2	54
HaC3	Hagerstown silt loam, 8 to 15 percent slopes, severely eroded.	83	IVe-1	9	4	4		54
HoB2	Hollinger silt loam, 3 to 8 percent slopes, moderately eroded	84	IIe-5	7	14	26	7	56
HoC2	Hollinger silt loam, 8 to 15 percent slopes, moderately eroded	84	IIIe-4	8	16	26	8	56
HoC3	Hollinger silt loam, 8 to 15 percent slopes, severely eroded	84	IVe-4	10	16	26	8	56
HoD3	Hollinger silt loam, 15 to 25 percent slopes, severely eroded	84	VIe-2	11	16	26	8	56
HoE3	Hollinger silt loam, 25 to 35 percent slopes, severely eroded	84	VIIe-1	12	17	26	9	56
LaA	Lawrence silt loam, 0 to 3 percent slopes	85	IIIw-1	9	10	25	12	57
LaB	Lawrence silt loam, 3 to 8 percent slopes	85	IIIw-1	9	10	25	12	7
LeB	Lehigh silt loam, 3 to 8 percent slopes	86	IIIw-2	9	7	24	10	57
LeB2	Lehigh silt loam, 3 to 8 percent slopes, moderately eroded	86	IIIw-2	9	7	24	10	57
LeC3	Lehigh silt loam, 8 to 15 percent slopes, severely eroded	86	IIIe-5	9	7	24	11	57

GUIDE TO MAPPING UNITS—Continued

Map symbol	Soils	Page	Capability unit	Page	Woodland group	Page	Building group	Page
LhB	Lehigh very stony silt loam, 0 to 8 percent slopes	86	VIs–2	12	7	24	10	57
LhD	Lehigh very stony silt loam, 8 to 25 percent slopes	86	VIs–2	12	7	24	11	57
Ls	Lindside silt loam	87	IIw–2	7	8	25	13	57
Ma	Made land, gravelly materials	87					1	54
Mc	Made land, silt and clay materials	87					3	54
Md	Made land, gabbro and diabase materials	87					3	54
Me	Made land, schist and gneiss materials	87					1	54
Mf	Made land, sanitary land fill	87					5	55
MgA2	Manor loam, 0 to 3 percent slopes, moderately eroded	88	IIs–1	8	13	25	5	55
MgB2	Manor loam, 3 to 8 percent slopes, moderately eroded	88	IIe–5	7	13	25	5	55
MgB3	Manor loam, 3 to 8 percent slopes, severely eroded	88	IIIe–4	8	13	25	5	55
MgC	Manor loam, 8 to 15 percent slopes	88	IIIe–4	8	15	26	6	55
MgC2	Manor loam, 8 to 15 percent slopes, moderately eroded	88	IIIe–4	8	15	26	6	55
MgC3	Manor loam, 8 to 15 percent slopes, severely eroded	88	IVe–4	10	15	26	6	55
MgD	Manor loam, 15 to 25 percent slopes	88	IVe–4	10	15	6	6	55
MgD2	Manor loam, 15 to 25 percent slopes, moderately eroded	89	IVe–4	10	15	26	6	55
MgD3	Manor loam, 15 to 25 percent slopes, severely eroded	89	Ie–2	11	15	26	6	55
MhE	Manor loam and channery loam, 25 to 35 percent slopes	89	VIe–2	11	17	26	9	56
MhE3	Manor loam and channery loam, 25 to 35 percent slopes, severely eroded.	89	VIIe–1	12	17	26	9	56
MkF	Manor soils, 35 to 60 percent slopes	89	VIIe–1	12	17	26	9	56
MmB	Manor very stony loam, 0 to 8 percent slopes	89	VIIs–1	12	13	25	5	55
MmD	Manor very stony loam, 8 to 25 percent slopes	89	VIIs–1	12	15	26	6	55
MmF	Manor very stony loam, 25 to 60 percent slopes	89	VIIs–1	12	17	26	9	56
Mn	Melvin silt loam	90	VIw–1	11	12	25	13	57
MoB2	Montalto channery silt loam, 3 to 8 percent slopes, moderately eroded.	91	IIe–	6	2	21	3	54
MoC2	Montalto channery silt loam, 8 to 15 percent slopes, moderately eroded.	91	IIIe–2	8	4	24	4	55
MoC3	Montalto channery silt loam, 8 to 15 percent slopes, severely eroded.	91	IVe–3	10	4	24	4	55
MoD3	Montalto channery silt loam, 15 to 25 percent slopes, severely eroded.	91	VIe–1	11	4	24	4	55
MrB	Montalto very stony silt loam, 0 to 8 percent slopes	91	VIs–1	11	2	21	3	54
MrD	Montalto very stony silt loam, 8 to 25 percent slopes	91	VIs–1	11	4	24	4	55
MrF	Montalto very stony silt loam, 25 to 45 percent slopes	91	VIIs–1	12	6	24	9	56
MsB	Mount Lucas very stony silt loam, 0 to 8 percent slopes	92	VIs–2	12	8	25	10	57
NaA	Neshaminy gravelly silt loam, 0 to 3 percent slopes	93	I–1	6	1	20	3	54
NaB2	Neshaminy gravelly silt loam, 3 to 8 percent slopes, moderately eroded.	93	IIe–2	6	1	20	3	54
NaC2	Neshaminy gravelly silt loam, 8 to 15 percent slopes, moderately eroded.	93	IIIe–2	8	3	21	4	55
NaC3	Neshaminy gravelly silt loam, 8 to 15 percent slopes, severely eroded.	93	IVe–2	9	3	21	4	55
NaD	Neshaminy gravelly silt loam, 15 to 25 percent slopes	93	IVe–2	9	3	21	4	55
NaD3	Neshaminy gravelly silt loam, 15 to 25 percent slopes, severely eroded.	93	VIe–1	11	3	21	4	55
NsB	Neshaminy very stony silt loam, 0 to 8 percent slopes	93	VIs–1	11	1	20	3	54
NsD	Neshaminy very stony silt loam, 8 to 25 percent slopes	93	VIs–1	11	3	21	4	55
NsF	Neshaminy very stony silt loam, 25 to 45 percent slopes	94	VIIs–1	12	5	24	9	56
OtA	Othello silt loam	94	IIIw–1	9	11	25	12	57
PeB3	Penn shaly silt loam, very shallow, 3 to 8 percent slopes, severely eroded.	95	IVe–4	10	13	25	7	56
PeC3	Penn shaly silt loam, very shallow, 8 to 15 percent slopes, severely eroded.	95	VIe–2	11	15	26	8	56
PeD3	Penn shaly silt loam, very shallow, 15 to 25 percent slopes, severely eroded.	95	VIIe–1	12	15	26	8	56
PmB2	Penn silt loam, 3 to 8 percent slopes, moderately eroded	95	IIe–5	7	13	25	7	56
PmC2	Penn silt loam, 8 to 15 percent slopes, moderately eroded	95	IIIe–4	8	15	26	8	56
PmC3	Penn silt loam, 8 to 15 percent slopes, severely eroded	95	IVe–4	10	15	26	8	56
PmD	Penn silt loam, 15 to 25 percent slopes	96	IVe–4	10	15	26	8	56
PmD2	Penn silt loam, 15 to 25 percent slopes, moderately eroded	96	IVe–4	10	15	26	8	56
PnB	Penn very stony silt loam, 0 to 8 percent slopes	96	VIIs–1	12	13	25	7	56
PnD	Penn very stony silt loam, 8 to 25 percent slopes	96	VIIs–1	12	15	26	8	56
PnF	Penn very stony silt loam, 25 to 50 percent slopes	96	VIIs–1	12	17	26	9	56
PsE2	Penn soils, 25 to 35 percent slopes, moderately eroded	96	VIe–2	11	17	26	9	56
PsE3	Penn soils, 25 to 35 percent slopes, severely eroded	96	VIIe–1	12	17	26	9	56
PsF	Penn soils, 35 to 50 percent slopes	96	VIIe–1	12	17	26	9	56
PtB2	Penn and Lansdale sandy loams, 3 to 8 percent slopes, moderately eroded.	96	IIe–5	7	1	20	7	56
PtC2	Penn and Lansdale sandy loams, 8 to 15 percent slopes, moderately eroded.	97	IIIe–4	8	3	21	8	56
PtC3	Penn and Lansdale sandy loams, 8 to 15 percent slopes, severely eroded.	97	IVe–4	10	3	21	8	56
PtD2	Penn and Lansdale sandy loams, 15 to 25 percent slopes, moderately eroded.	97	IVe–4	10	3	21	8	56
RdA	Readington silt loam, 0 to 3 percent slopes	97	IIw–1	7	7	24	10	57

GUIDE TO MAPPING UNITS—Continued

Map symbol	*Soils*	*Page*	*Capability unit*	*Page*	*Woodland group*	*Page*	*Building group*	*Page*
RdB	Readington silt loam, 3 to 8 percent slopes	98	IIe–6	7	7	24	10	57
RdB2	Readington silt loam, 3 to 8 percent slopes, moderately eroded.	98	IIe–6	7	7	24	10	57
Ro	Rowland silt loam	98	IIw–2	7	7	24	13	7
Rp	Rowland silt loam, dark surface	98	IIw–2	7	11	25	13	57
SaA	Sassafras loam, 0 to 3 percent slopes	99	I–1	6	1	20	1	54
SaB2	Sassafras loam, 3 to 8 percent slopes, moderately eroded	99	IIe–2	6	1	20	1	54
Tm	Tidal marsh	99	VIIIw–1	12	18	26	13	57
WaA	Watchung silt loam, 0 to 3 percent slopes	100	Vw–1	11	12	25	12	57
WaB2	Watchung silt loam, 3 to 8 percent slopes, moderately eroded.	100	VIw–2	11	12	25	12	57
WcB	Watchung very stony silt loam, 0 to 8 percent slopes	100	VIIs–2	12	12	25	12	57
We	Wehadkee silt loam	101	VIw–1	11	11	25	13	57
WnA	Woodstown loam, 0 to 3 percent slopes	101	IIw–1	7	7	24	10	57
WoA	Worsham silt loam, 0 to 3 percent slopes	102	Vw–1	11	11	25	12	57
WoB	Worsham silt loam, 3 to 8 percent slopes	102	Iw2	11	11	25	12	57
WoB2	Worsham silt loam, 3 to 8 percent slopes, moderately eroded.	102	VIw–2	11	11	25	12	57
WoC2	Worsham silt loam, 8 to 15 percent slopes, moderately eroded.	102	VIw–2	11	11	25	12	57
WsB	Worsham very stony silt loam, 0 to 8 percent slopes	102	VIIs–2	12	11	25	12	57

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