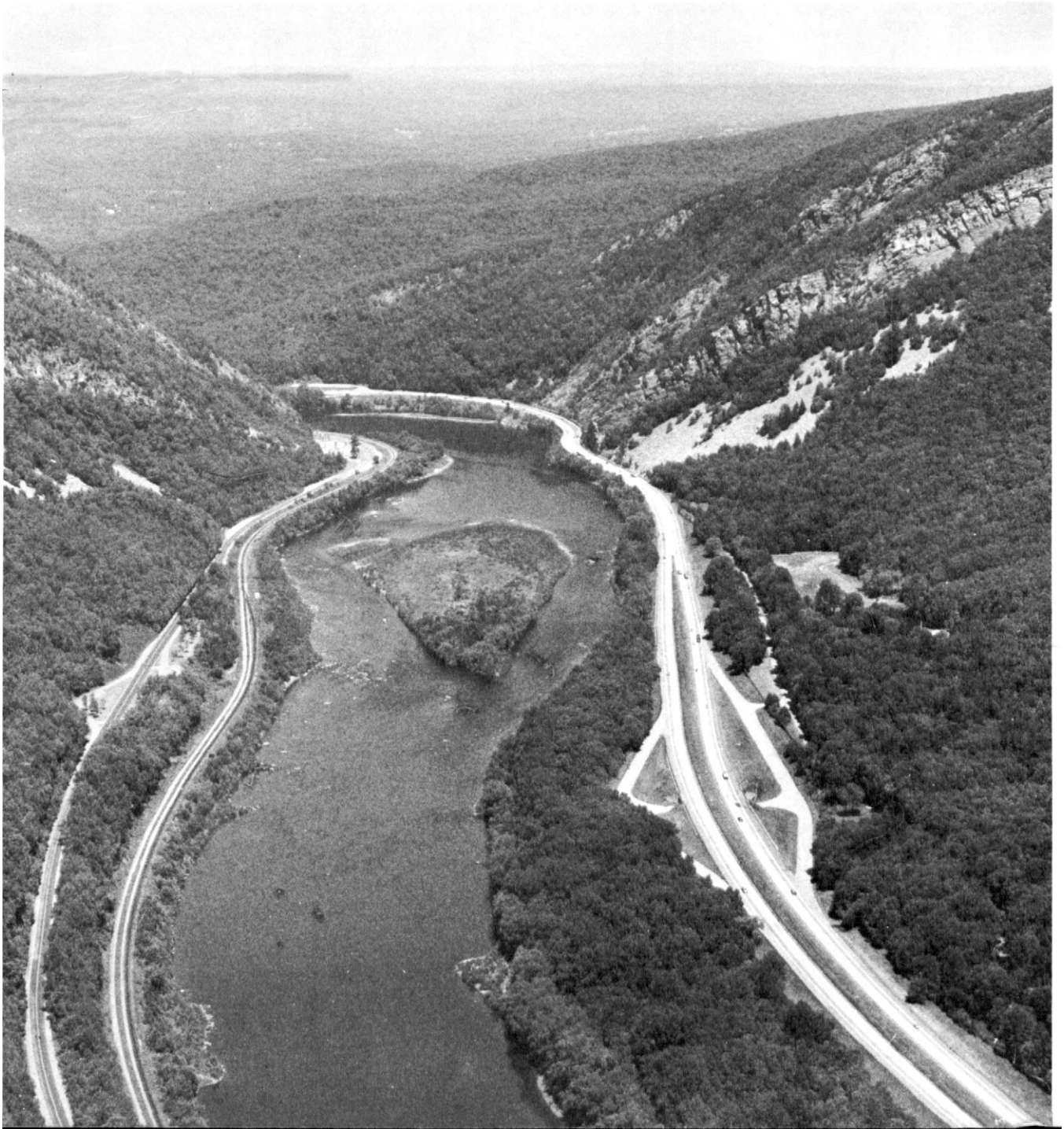
SOIL SURVEY OF
Warren County, New Jersey

United States Department of Agriculture, Soil Conservation Service

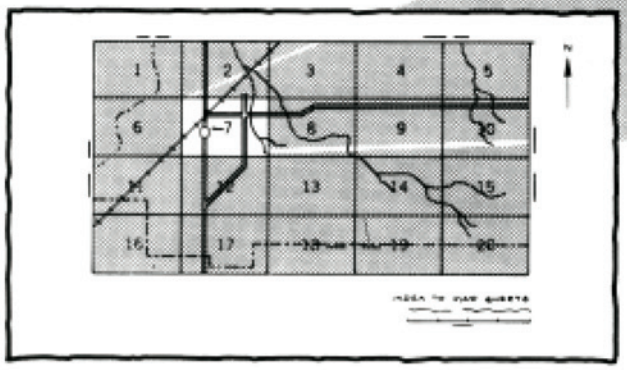
in cooperation with

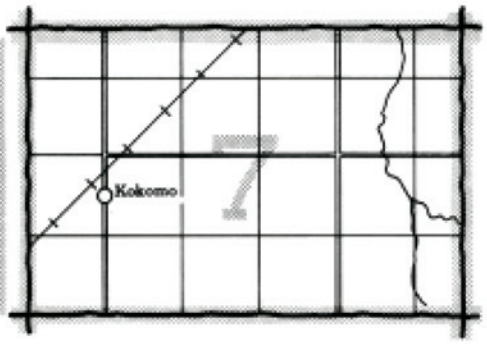
New Jersey Agricultural Experiment Station, Cook College, Rutgers, The State University; the New Jersey Soil Conservation Committee, New Jersey Department of Agriculture; and the Warren County Board of Chosen Freeholders



HOW TO USE

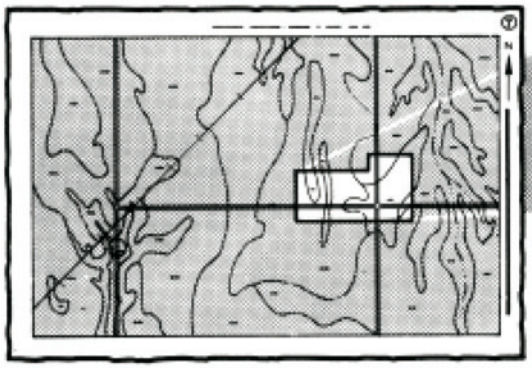
1. Locate your area of interest on the "Index to Map Sheets"

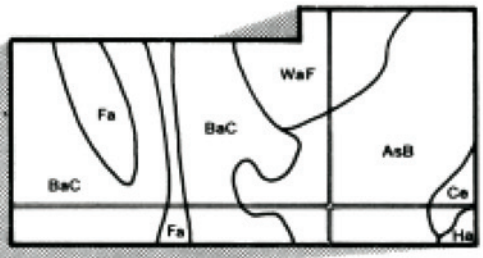




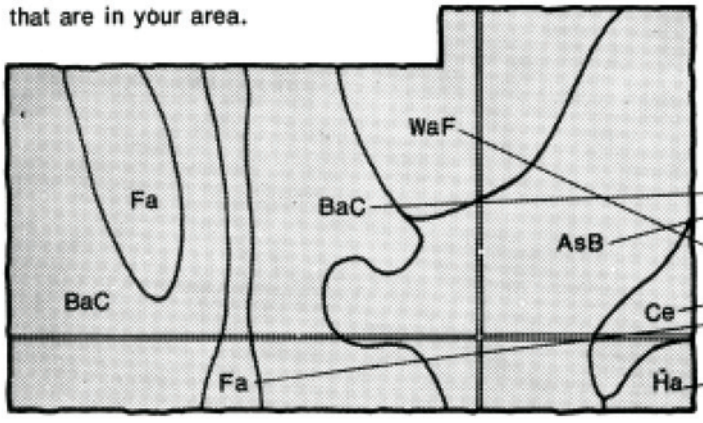
2. Note the number of the map sheet and turn to that sheet.

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





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

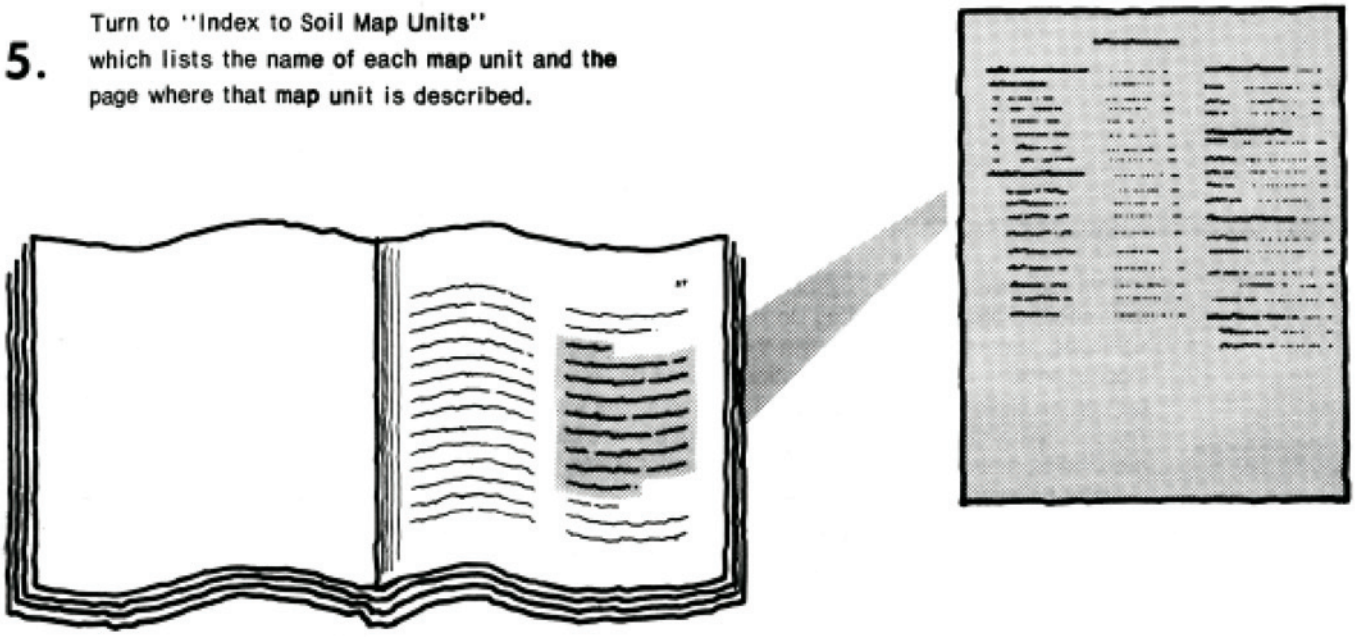


Symbols

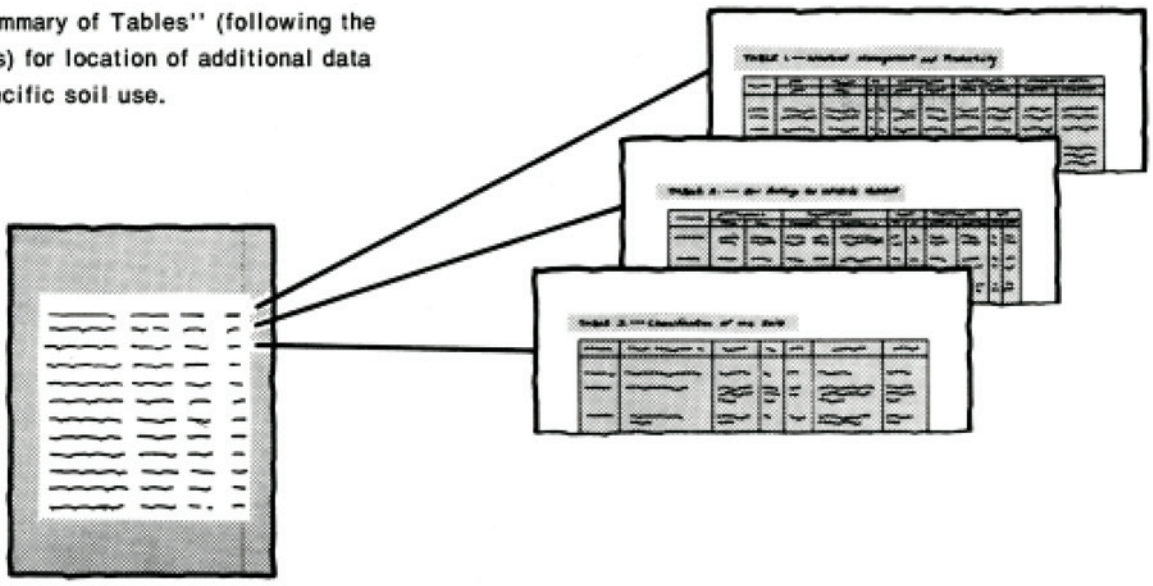
AsB
BaC
Ce
Fa
Ha
WaF

THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1973-75. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service; the New Jersey Agricultural Experiment Station, Cook College, Rutgers, The State University; the New Jersey Soil Conservation Committee, New Jersey Department of Agriculture; and the Board of Chosen Freeholders of Warren County. It is part of the technical assistance furnished to the Warren County Soil Conservation District.

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

Cover: The Delaware Water Gap was formed by the Delaware River cutting deeply into the High Falls sandstone and Shawangunk conglomerate. New Jersey is to the right of the river, and Pennsylvania is on the left.

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Issued April 1979

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Foreword

This soil survey contains much information useful in land-planning programs in Warren County. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

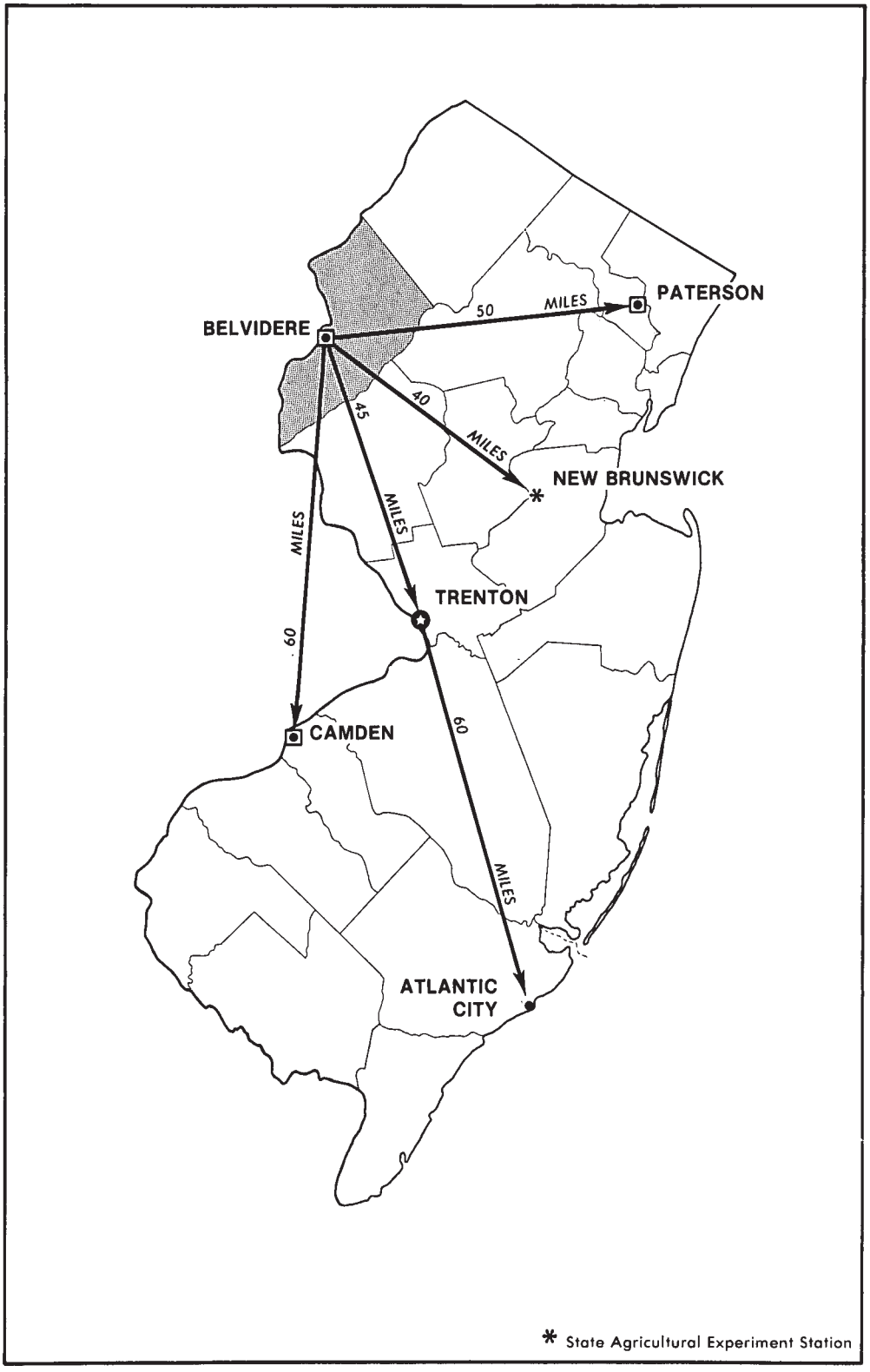
This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Warren J. Fitzgerald

Warren J. Fitzgerald
State Conservationist
Soil Conservation Service



Location of Warren County in New Jersey.

SOIL SURVEY OF WARREN COUNTY, NEW JERSEY

By Sylvester J. Fletcher, Soil Conservation Service

Soils surveyed by Sylvester J. Fletcher, George P. Gibbs, Charles W. Turner,
Frank Z. Hutton, Jr., Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the New Jersey Agricultural Experiment Station,
Cook College, Rutgers, The State University; the
New Jersey Soil Conservation Committee,
New Jersey Department of Agriculture;
and the Warren County Board of Chosen Freeholders

General nature of the county

WARREN COUNTY is in the northwestern part of New Jersey. It borders Pennsylvania and the Delaware River on the west and south, Sussex County on the north, and Morris and Hunterdon Counties on the east. The county encompasses 230,961 acres. Of this, about 1,320 acres consists of lakes that are 40 acres or more in size. Population of Warren County in 1975 was about 83,000 and that of the county seat, Belvidere, was 2,800.

The county consists of valleys and ridges that are roughly oriented northeast and southwest. The northwestern part is dominated by sandstone and quartzite ridges of Kittatinny Mountain, which has peaks of about 1,500 feet. To the southeast are alternating ridges that are underlain by sandstone and shale and valleys tha are underlain by limestone. In the southeastern half of the county, the Highlands are underlain by granitic gneiss and the intervening valleys are underlain by limestone. Extending from east to west across the middle of the county is a belt of terminal moraine left by the Wisconsin glacier. Extending to the southwest from the moraine are broad-topped ridges, which are underlain by granitic gneiss, and intervening limestone valleys.

About 38 percent of the county is in farms, most of which are dairy farms. Grain farming is important in the southern part of the county. Orchards are scattered throughout the county. The Great Meadows and Alphano muck areas are highly intensified vegetable and sod producing areas.

In 1965 the National Park Service was authorized to purchase land and develop the Delaware Water Gap National Recreation Area. About 5 percent of Warren County is in this recreation area. About 5 percent of the county is in state or municipal parks, forests, hunting and fishing areas, recreation areas, or municipal reservoir watersheds.

Climate

In Warren County, winters are cold and snowy at the high elevations. In the valleys, the weather is frequently cold, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm; there are occasional very hot days. Rainfall is evenly distributed during the year. The normal annual precipitation is adequate for most crops. In nearly every year, however, there are periods when rainfall is not sufficient for high-value crops, most of which are irrigated.

Table 1 gives data on temperature and precipitation for Warren County as recorded at Belvidere, New Jersey, for the period 1951 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the growing season.

In winter the average temperature is 30 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Belvidere on January 22, 1961 is -20 degrees. In summer the average temperature is 71 degrees, and the average daily maximum is 83 degrees.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 24 inches, or 53 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 6.62 inches at Belvidere on July 28, 1951. There are about 32 thunderstorms each year, 19 of which occur in summer.

Average seasonal snowfall is 32 inches. The greatest snow depth at any one time during the period of record was 28 inches. On the average, 23 days have a least 1 inch of snow on the ground, but the number of days varies greatly from year to year. Depth to which soil freezes ranges from 1 to 2-1/2 feet.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night in all seasons, and the average at dawn is about 81 percent. The prevailing wind is from the west. Average windspeed is highest, 12 miles per hour, in March.

Heavy rains, which occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, particularly in narrow valleys.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After the soil scientists classified and named the soils they drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, including farmers, managers of rangeland and woodland, engineers, planners, developers and builders, and home buyers.

General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map and gives general ratings of the potential of each, in relation to the other map units, for major land uses. Soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the survey area are being used to overcome soil limitations. These ratings reflect the ease of overcoming the soil limitations and the probability of soil problems persisting after such practices are used.

Each map unit is rated for *cultivated farm crops, specialty crops, woodland, urban uses, intensive recreation areas, and extensive recreation areas*. Cultivated farm

crops are those grown extensively by farmers in the survey area. Specialty crops include vegetables, fruits, and nursery crops grown on limited acreage and generally requiring intensive management. Woodland refers to land that is producing either trees native to the area or introduced species. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas include campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas include those used for nature study and as wilderness.

Each year a large amount of land is developed for urban use in the boroughs of Belvidere, Hackettstown, Phillipsburg, and Washington and in the adjacent townships. About 23,000 acres, or nearly 10 percent of Warren County, is urban or built-up land. In general, the soils that have good potential for cultivated crops also have good potential for urban development.

Areas that are not suited to urban development are not extensive in the survey area. The Wayland-Middlebury map unit is on flood plains, and flooding is a severe limitation. Urban development is very costly on the soft, wet organic soils of the Carlisle-Adrian map unit and on the steep, extremely stony soils of the Oquaga-Swartswood-Rock outcrop map unit. Many parts of the Bath-Nassau map unit are steep; and hard bedrock is at a few feet below the surface, which makes urban development costly.

Parts of the Washington-Bartley, Annandale-Washington-Califon, Hazen-Hero-Fredon, and Wassaic-Washington Rock outcrop map units can be developed for urban use at reasonable cost. The Washington-Bartley map unit is excellent farmland, and this potential should not be overlooked. The Wassaic-Washington-Rock outcrop map unit has a soil that is underlain by bedrock at a depth of 20 to 40 inches, but the rolling landscape and good soil drainage are favorable for residential and other nonfarm uses.

In some areas, soils have good potential for farming but have fair or poor potential for nonfarm uses. These soils are in map units 1 and 3 on the general soil map, and the dominant soils are Pope, Carlisle, and Adrian soils. Wetness and flooding are the limitations to the nonfarm use of these soils. Proper drainage and flood protection can reduce these limitations. The soils have good potential for farming, however, and many farmers have provided sufficient drainage for crops.

Soils of the Carlisle-Adrian map unit are well suited to vegetables and other speciality crops if proper drainage and flood protection are provided. Also suited to such crops are Pope soils and less sloping soils in the Hazen-Hero-Fredon and the Washington-Bartley map units. These soils are dominantly well drained and warm up earlier in spring than heavier, wetter soils. If they are not shallow to bedrock, these soils are well suited to nursery plants.

Most of the soils in the county have good or fair potential for woodland. Notable exceptions are the soils of the Carlisle-Adrian and the Wayland-Middlebury map units that are poorly drained and subject to damaging floods. Commercially valuable trees are less common and generally grow more slowly on the shallower Nassau and Oquaga soils of the Bath-Nassau and the Oquaga-Swartswood-Rock outcrop map units.

The hilly Bath-Nassau, Wassic-Washington-Rock outcrop, and Swartswood-Nassau-Wurtsboro map units have good potential as sites for parks and extensive recreation areas. Hardwood forests enhance the beauty of many of these map units. Undrained marshes and swamps of the Carlisle-Adrian map unit are good for nature study areas. All of these provide wildlife habitat for many important species.

Map unit descriptions

Soils that formed in glacial outwash or alluvium

This group of soils is on terraces adjacent to the Delaware River and in valleys along other major streams. The soils are deep and are mainly nearly level to strongly sloping but range to very steep. They are loams, fine sandy loams, and gravelly or cobbly loams.

1. Pope

Nearly level to gently sloping, deep, well drained loamy soils; on river terraces

This map unit is mainly on broad, nearly level to gently sloping river terraces along the Delaware River. It includes some small, sloping to steep knolls. It makes up about 3 percent of the county. It consists of about 90 percent Pope soils and 10 percent minor soils.

Pope soils are deep, well drained, and nearly level to gently sloping. Because they are at a high elevation above stream levels they are rarely subject to flooding. The minor soils are moderately well drained or somewhat poorly drained Middlebury soils on the flood plain, poorly drained and very poorly drained Wayland soils on the flood plain, and Wassaic soils in a few areas on knobs.

Most areas have been cleared for farming; some are now idle. Part of this map unit is in the Delaware Water Gap National Recreation Area. This map unit is well suited to farming and community development, but it is subject to infrequent flooding.

2. Hazen-Hero-Fredon

Nearly level to very steep, deep, well drained and poorly drained loamy soils; on river terraces, outwash terraces, and kames

This map unit is in areas that are at a higher elevation than areas of organic soils in depressions and soils on the flood plains of major tributaries. This unit makes up

about 10 percent of the county. It is about 70 percent Hazen soils, 10 percent Hero soils, 10 percent Fredon soils, and 10 percent minor soils.

Hazen soils are deep, well drained, and dominantly nearly level to sloping but range to very steep. Hero soils are deep, moderately well drained, and nearly level or gently sloping. Fredon soils are deep, poorly drained, and nearly level and are in low positions on the landscape. The minor soils are well drained Palmyra soils and very poorly drained Halsey soils.

Most areas have been cleared of trees and are now used for dairy farming, orchards, and specialty crops. Many ground-water ponds have been developed in the poorly drained and very poorly drained soils. Except for areas of Hero and Fredon soils, where wetness is a problem, this map unit is well suited to farming and community development.

Soils that formed in organic deposits or alluvium

This group of soils is on flood plains or in depressions in the valleys. The soils are deep and nearly level. The surface layer ranges from muck to silt loam.

3. Carlisle-Adrian

Nearly level, deep, very poorly drained organic soils; in depressions

This map unit is in the lowest areas on the landscape. It commonly is in long, narrow, or elliptical depressions where the water table is high because of poor drainage outlets. It makes up about 2 percent of the county. It is about 65 percent Carlisle soils, 25 percent Adrian soils, and 10 percent minor soils.

Carlisle soils are nearly level or depressional. They are very poorly drained muck soils that are more than 51 inches thick. Adrian soils also are nearly level or depressional. They are very poorly drained muck soils that are 18 to 50 inches thick over sandy mineral material. In areas that are adjacent to streams, both soils are subject to flooding, and they are subject to ponding by water from adjacent more sloping areas. The minor soils include very poorly drained Halsey soils and poorly drained and very poorly drained Wayland soils on flood plains.

Many areas have been cleared of trees and are drained. They are used for vegetables and sod crops. Some areas are still wooded. If adequately drained, the soils are well suited to vegetables and other specialty crops. They are not suited to community development.

4. Wayland-Middlebury

Nearly level, deep, very poorly drained to moderately well drained loamy soils; on flood plains

This map unit is in very low positions on the flood plains adjacent to main tributaries. In most areas it is subject to frequent flooding. It makes up about 3 percent of the county. It is about 50 percent Wayland soils, 20 percent Middlebury soils, and 30 percent minor soils.

Wayland soils are deep, nearly level, poorly drained and very poorly drained. They are on flood plains and in slight depressions. Wayland soils are subject to frequent flooding. Middlebury soils are deep, nearly level, moderately well drained or somewhat poorly drained. They are on flood plains and in slight depressions. Middlebury soils are subject to occasional flooding. The minor soils include moderately well drained Hero soils, very poorly drained Halsey soils, and well drained Hazen soils.

Most areas are in pasture, hay, and woodland. Some are idle. Some areas that are artificially drained are used for row crops. If drainage outlets are available, many areas can be drained and used for crops. This map unit is well suited to development for wetland wildlife. Because of flooding and a seasonal high water table, it has poor potential for urban use, cultivated crops, specialty crops, and extensive recreation use.

Soils that formed in glacial till or in material that weathered from bedrock

This group of soils is in the Valley and Ridge Province between Kittatinny Mountain and the Highlands. The soils are shallow to deep, nearly level to very steep, and loamy. Stony soils and Rock outcrop are common in most of the areas.

5. Wassaic-Washington-Rock outcrop

Nearly level to steep, moderately deep and deep, well drained loamy soils and Rock outcrop; on uplands

This map unit is on hillsides and lower valley slopes. It makes up about 9 percent of the county. It is about 45 percent Wassaic soils, 20 percent Washington soils, 15 percent Rock outcrop, and 20 percent minor soils.

Wassaic soils are moderately deep, nearly level to steep, and well drained. Washington soils are deep, gently sloping to steep, and well drained. Rock outcrop consists of exposed limestone beds. In some areas of Rock outcrop a thin layer of soil is on the surface. The outcrops range from 1 to 20 feet in height. The minor soils include the moderately well drained Bartley soils in intermediate positions on the landscape and the poorly drained and very poorly drained Lyons soils in low positions.

Most areas are in pasture or woodland. Many areas have been cleared for farming. A few areas are used intensively for crops, and others are idle. This map unit generally is best suited to woodland and recreation use.

6. Swartswood-Nassau-Wurtsboro

Gently sloping to very steep, deep and shallow, well drained, somewhat excessively drained, and somewhat poorly drained loamy soils; on uplands

This map unit is on hilltops and hillsides directly east of Kittatinny Mountain. It makes up about 6 percent of the county. It is about 35 percent Swartswood soils, 20 percent Nassau soils, 15 percent Wurtsboro soils, and 30 percent minor soils.

Swartswood soils are deep, well drained and moderately well drained, and gently sloping to steep. Nassau soils are shallow, somewhat excessively drained, and gently sloping to very steep. Wurtsboro soils are extremely stony loams; they are deep, somewhat poorly drained, and gently sloping to sloping. The minor soils are poorly drained and very poorly drained Chippewa soils; deep, well drained Bath soils; and moderately deep, well drained or excessively drained Oquaga soils.

Most areas are woodland. Some areas have been cleared for farming, and others are idle. This map unit is best suited to woodland and recreation use; it is poorly suited to community development.

7. Bath-Nassau

Gently sloping to very steep, shallow and deep, well drained and somewhat excessively drained loamy soils; on uplands

This map unit is on hilltops and hillsides in the northern interior valleys. It makes up about 14 percent of the county. It is about 30 percent Bath soils, 30 percent Nassau soils, and 40 percent minor soils.

Bath soils are deep, well drained, and gently sloping to very steep. Nassau soils are shallow, somewhat excessively drained, and gently sloping to very steep. The minor soils are well drained, moderately deep Wassaic soils; somewhat poorly drained Venango soils; small areas of poorly drained and very poorly drained Chippewa soils; and steep or very steep areas of slate and shale rock outcrop.

Most areas have been cleared for farming. Many ground-water and impoundment ponds have been developed on the poorly drained and very poorly drained soils. This map unit is fairly suited to farming and community development.

8. Oquaga-Swartswood-Rock outcrop

Gently sloping to very steep, moderately deep and deep, well drained and moderately well drained, very stony and extremely stony loamy soils and Rock outcrop; on uplands

This map unit is on the ridges and side slopes of Kittatinny Mountain. It makes up about 6 percent of the county. It is about 30 percent Oquaga soils, 30 percent Swartswood soils, 15 percent Rock outcrop, and 25 percent minor soils.

Oquaga soils are moderately deep, well drained, steep to very steep, and extremely stony. Swartswood soils are deep, well drained and moderately well drained, gently sloping to steep, and very stony. Rock outcrop is dominantly quartzite and red sandstone bedrock. There is a thin mantle of soil in some areas of outcrops. The minor soils are somewhat poorly drained Wurtsboro soils and poorly drained and very poorly drained Chippewa soils.

Most areas are woodland. Some of these wooded areas are part of a hydroelectric property, and others are part of the Delaware Water Gap National Recreation Area. This map unit is fairly suited to use as woodland; it is poorly suited to wildlife and recreational development.

9. Edneyville-Parker-Rock outcrop

Gently sloping to very steep, deep, well drained and somewhat excessively drained loamy soils and extremely stony loamy soils and Rock outcrop; on uplands

This map unit is on hilltops and upper side slopes in the central, eastern, and southern parts of the county. It makes up about 14 percent of the county. It is about 50 percent Edneyville soils, 25 percent Parker soils, 15 percent Rock outcrop, and 10 percent minor soils.

Edneyville soils are deep, well drained, and gently sloping to steep. Parker soils are deep, excessively drained, and steep to very steep. Rock outcrop is dominantly granite gneiss bedrock. There is a thin mantle of soil in some areas of outcrops. The minor soils are well drained Annandale soils, well drained and moderately well drained Rockaway soils, poorly drained Cokesbury soils, and very poorly drained Carlisle soils.

Most areas are woodland. Some areas have been cleared for farming; some of these areas are now idle or reverting to woodland. This map unit is moderately suited to poorly suited to farming because of steep slopes, stoniness, or rockiness. It is poorly suited to community development. Steep slopes, stoniness, and rockiness also affect urban use.

10. Annandale-Washington-Califon

Nearly level to steep, deep, well drained to somewhat poorly drained loamy soils; on uplands

This map unit is on broad upland plains and valley slopes. It makes up about 13 percent of the county. It is about 30 percent Annandale soils, 20 percent Washington soils, 15 percent Califon soils, and 35 percent minor soils.

Annandale soils are deep, well drained, and gently sloping to steep. Washington soils are deep, well drained, and nearly level to steep. Califon soils are moderately well drained and somewhat poorly drained and gently sloping to sloping. The minor soils are well drained Edneyville soils, somewhat excessively drained Parker soils, poorly drained Cokesbury soils, and poorly drained and very poorly drained Lyons soils.

Most areas have been cleared for farming. Annandale and Washington soils are well suited to intensive farming. Califon soils are suited to farming, but drainage is a problem. This map unit is well suited to community de-

velopment. The Washington soils, however, are underlain by cavernous limestone.

11. Washington-Bartley

Nearly level to steep, deep, well drained and moderately well drained loamy soils; on uplands

This map unit is in the southern and southeastern parts of the county. It makes up about 20 percent of the county. It is about 60 percent Washington soils, 15 percent Bartley soils, and 25 percent minor soils.

Washington soils are deep, well drained, and nearly level to steep. Bartley soil are deep, moderately well drained, and gently sloping or sloping. The minor soils are well drained, deep Edneyville and Annandale soils; well drained, moderately deep Wassaic soils; somewhat excessively drained Parker soils; and poorly drained Cokesbury soils.

This map unit is mostly in farms (fig. 1). The Washington soils are well suited to farming, although in places sink holes are a limitation to farming. Bartley soils are well suited to farming.

The main limitation to community development on Washington soils is the underlying cavernous bedrock in some places. Sink holes can form and foundations can be damaged because of this bedrock.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

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

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Venango silt loam, 0 to 3 percent slopes, is one of several phases within the Venango series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes and soil associations.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Wassaic-Rock outcrop complex, 3 to 8 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Edneyville-Parker-Rock outcrop asssociation, steep, is an example.

Most map units include small, scattered areas of soils other than those in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits, sand and gravel, is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 5. Information on soil properties, limitations, capabilities, and potentials is given for each kind of soil in other tables. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

Ad—Adrian muck. This is a nearly level, very poorly drained soil in former glacial lake beds, in swamps, and

on some flood plains. The muck is 18 to 50 inches deep over sandy mineral material.

Typically, black, highly decomposed muck extends to a depth of 24 inches. Below that, to a depth of 60 inches, there is light gray loam fine sand.

Included in mapping are areas of similar organic soils, except that they have loamy or clayey substrata, areas of organic soils that are less than 15 inches deep over mineral material, and areas of Carlisle soils. Also included are areas of Wayland soils on flood plains, very poorly drained Halsey soils, and poorly drained or very poorly drained Chippewa soils.

Permeability is moderately rapid or rapid. In undrained areas, the water table is at or near the surface most of the time. The available water capacity is high. Runoff is slow, and the hazard of erosion is slight. Reaction is very strongly acid to neutral where lime has not been applied. If drained, this soil is subject to blowing and burning. After drainage, subsidence is critical on this soil particularly where the organic layer is thin. In their original state, most areas are frequently flooded. This soil has low bearing capacity. Bedrock is at a depth of more than 5 feet.

Most areas are wooded. After having been farmed, many areas are reverting to woodland. Dominant trees are maple, ash, elm, and other water-tolerant trees and shrubs. Extensive areas have been cleared, drained, and used for intensive cultivation of such vegetables as onions, cabbage, and lettuce. Many areas are used for growing sod. The soil in some areas has been drained and is mined as a soil supplement. This soil is well suited to excavated irrigation ponds or wildlife ponds.

This soil has severe limitations for cultivation, unless drainage is improved. Deep ditches and tile drains have been used, but maintaining ditch banks is a problem. Subsidence is diminished by careful control of drainage to those depths required by the crop. Even if drainage is improved there is a continuing hazard of crop damage during periods of unusually heavy rainfall. Because of its low bearing capacity this soil is poorly suited to pasture.

This soil is poorly suited to use as woodland. Production is poor, and adapted species have low value. Windthrow is severe. The constantly high water table and low bearing capacity are limitations to the use of equipment.

If not drained, this soil is best suited to use as habitat for wetland wildlife and for water storage.

This soil is limited to most community development because of the constantly high water table, the flooding hazard, and poor trafficability. Capability unit IVw-41; woodland subclass 4w.

AnB2—Annandale gravelly loam, 3 to 8 percent slopes, eroded. This gently sloping, well drained, deep soil generally is on smooth to slightly concave landscapes. The areas are long and are 10 to 30 acres or more in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown gravelly loam about 8 inches thick. In the upper 16 inches the subsoil is yellowish brown, friable gravelly loam and strong brown, firm gravelly clay loam. The lower part of the subsoil, extending to a depth of 52 inches, is a fragipan of dark brown, very firm and brittle gravelly clay loam. The substratum, to a depth of 60 inches, is very friable, dark brown gravelly loam.

Included in mapping are small areas where the slope is less than 3 percent; a few scattered areas of severely eroded soils; and wooded areas where the soils are not eroded. Also included are areas of Califon soils, mainly in slight depressions, and Edneyville soils.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is slow, and the hazard of erosion is slight. In most places, granitic gneiss bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied to the soil.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban use. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, and hay. Where gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system can help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Optimum production requires that lime and fertilizer be applied periodically.

This soil is well suited to tall grass or permanent bluegrass pasture. The major management need is to maintain the desirable plants by using proper stocking rates, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is good. There are only slight limitations in woodland managment. The rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the moderately slow or slow permeability in the fragipan and the frost action potential. Capability unit IIe-53; woodland subclass 2o.

AnC2—Annandale gravelly loam, 8 to 15 percent slopes, eroded. This sloping, well drained, deep soil is

on smooth or slightly concave landscapes. The areas are long and are 5 to 30 acres or more in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown gravelly loam about 8 inches thick. The subsoil in the upper 16 inches is yellowish brown, friable gravelly loam and strong brown, firm gravelly clay loam. The lower part of the subsoil, extending to a depth of 52 inches, is a fragipan of dark brown, very firm and brittle gravelly clay loam. The substratum, to a depth of 60 inches, is very friable, dark brown gravelly loam.

Included in mapping are areas of Edneyville soils and small areas of Califon soils in seep spots and along the boundaries of other soils. Also included are scattered areas of severely eroded Annandale soils.

Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is medium, and the hazard of erosion is moderate. In most places, granitic gneiss bedrock is at a depth of more than 5 feet. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

Most areas have been cleared of trees and are used as cropland and pasture. Some areas remain wooded, and some are idle. Some areas are in urban uses.

Because of the hazard of erosion, this soil is not suited to continuous use for row crops. It could be farmed to corn in a long rotation with hay.

This soil has only fair potential for corn, small grains and hay because of the hazard of erosion. Where the gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to reduce erosion. Severely eroded areas need special treatment. Optimum production requires periodic application of lime and fertilizer.

This soil is well suited to tall grass or permanent bluegrass pasture. The major management need is to maintain the desirable plants by using proper stocking rates, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are slight limitations for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the slope, the moderately slow or slow permeability, and the frost action potential. Capability unit IIIe-53; woodland subclass 2o.

AnD2—Annandale gravelly loam, 15 to 25 percent slopes, eroded. This is a steep, well drained, deep soil in long or oval areas that are 5 to 40 acres or more in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown gravelly loam about 8 inches thick. The subsoil, in the upper 16 inches, is yellowish brown, friable gravelly loam and strong brown, firm, gravelly clay loam. The lower part of the subsoil, extending to a depth of 52 inches, is a fragipan of dark brown, very firm and brittle gravelly clay loam. The substratum, to a depth of 60 inches, is very friable, dark brown gravelly loam.

Included in mapping are very steep areas, areas of Edneyville and Parker soils, and small areas of gently sloping or sloping Califon soils. Also included are scattered areas of severely eroded Annandale gravelly loam.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. The available water capacity is moderate. Runoff is rapid, and the hazard of erosion is high. In most places, granitic gneiss bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

Extensive areas have been cleared of trees for use as cropland and pasture. Other extensive areas are woodland or are idle. Virtually none of the areas are in urban use.

This soil has poor potential for corn, small grains, and hay because of the high hazard of erosion. It is not suited to continuous row cropping. Where the gravel content is highest, cultivation is difficult. This soil could be used for hay production, but the steep slopes are difficult to work. Diversion terraces and grassed waterways are needed in most areas to control runoff and erosion.

This soil is suited to tall grass or permanent bluegrass pasture. The major management needs include stocking rates that help maintain the desirable plants, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but the equipment-use limitation is moderate because of the steep slopes. Rooting depth is restricted by the very firm fragipan. Because of the forest cover, the hazard of erosion is slight, but water should be prevented from concentrating on skid trails. The most common areas are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban use because of the steep slopes, moderately slow or slow permeability, and frost action potential. If the vegetative cover is removed, this soil has a high hazard of erosion. Capability unit IVe-53; woodland subclass 2r.

AsB—Annandale very stony loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on crests and toe slopes of long ridges that generally are oriented northeast to southwest. The areas generally are 5 to 15 acres in size and are on smooth or slightly concave landscapes. Stones occupy as much as 3 percent of the surface and are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, very stony loam about 8 inches thick. The upper 16 inches of the subsoil is yellowish brown, friable, gravelly loam and strong brown, firm, gravelly clay loam. The lower part of the subsoil, extending to a depth of 52 inches, is a fragipan of dark brown, very firm and brittle, gravelly clay loam. The substratum, to a depth of 60 inches, is very friable, dark brown, gravelly loam.

Included in mapping are areas of nonstony Annandale soils and small areas of very stony and nonstony Califon soils mainly in depressions.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is slow, and the hazard of erosion is slight. In most places, granitic gneiss bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

This soil is mainly woodland and pasture. Surface stones are a main limitation for most uses. Some areas are used for individual homesites.

If trees and stones are removed, this soil has good potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but the many stones are a limitation to equipment use. The major management need is maintaining desirable plants through proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but there are some equipment-use limitations for woodland management. Rooting depth is restricted by the fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, slow permeability, and frost action potential. Capability unit VIs-61; woodland subclass 2o.

AsC—Annandale very stony loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on crests and side slopes of long ridges that generally are oriented in a northeast to southwest direction. The areas generally are 5 to 15 acres in size and are on smooth or slightly concave landscapes. Stones occupy as much as 3 percent of the surface and generally are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, very stony loam about 8 inches thick. The subsoil in the upper 16 inches is yellowish brown, friable, gravelly loam and strong brown, firm, gravelly clay loam. The lower part of the subsoil, extending to a depth of 52 inches, is a fragipan of dark brown, very firm and brittle, gravelly clay loam. The substratum, to a depth of 60 inches, is very friable, dark brown, gravelly loam.

Included in mapping are small areas of nonstony Annandale soils, small areas of Edneyville very stony loam, and a few areas of gently sloping Califon soils.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. If the soil is farmed, runoff is medium and the hazard of erosion is moderate. In most places, granitic gneiss bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

Most areas are woodland. Some areas are pasture, and some are in urban use.

This soil is not suited to use as cropland because of the many stones. If stones and trees are removed, it has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but the many stones limit the use of equipment. The major management need is maintaining desirable plants by using proper stocking rates, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but there are some equipment-use limitations for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban use, including onsite sewage disposal, building foundations, and roads, because of the many stones, slow permeability, and frost action potential. Capability unit VIs-61; woodland subclass 2o.

AsD—Annandale very stony loam, 15 to 25 percent slopes. This is a steep, well drained, deep soil on the side slopes of long ridges that generally are oriented in a northeast to southwest direction. The areas generally are 5 to 15 acres in size and are on smooth or slightly concave landscapes. Stones and boulders occupy as much as 3 percent of the surface and are 5 to 30 feet apart. In some areas, there are more boulders than stones. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, very stony loam about 6 inches thick. The upper 16 inches of the

subsoil is yellowish brown, friable, gravelly loam and strong brown, firm, gravelly clay loam. The lower part of the subsoil, extending to a depth of 52 inches, is a fragipan of dark brown, very firm and brittle, gravelly clay loam. The substratum, to a depth of 60 inches, is very friable, dark brown, gravelly loam.

Included in mapping are small areas of nonstony Annandale soils, small areas of Edneyville or Parker soils, and Califon soils in a few seep spots.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. The available water capacity is moderate. Runoff is rapid, and the hazard of erosion is high. In most places, granitic gneiss bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

Most areas are woodland. Some areas are pasture, and some are in urban uses.

This soil is not suited to use as cropland because of the many stones and boulders. Even if stones, boulders, and trees are removed, it has poor potential for cropland because of the hazard of erosion.

This soil is suited to tall grass or permanent bluegrass pasture, but the many stones and boulders limit the use of equipment. The major management needs include using stocking rates that help maintain the desirable plants, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but there are some equipment-use limitations for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban use, including onsite sewage disposal, building foundations, and roads, because of the steep slopes, the many stones and boulders, slow permeability, and the hazard of erosion. Capability unit VIs-61; woodland subclass 2r.

BaA—Bartley loam, 0 to 3 percent slopes. This nearly level, moderately well drained, deep soil is in valleys. The areas are long and smooth or oval in shape and are 5 to 20 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown loam about 12 inches thick. The upper 8 inches of the subsoil is faintly mottled, strong brown loam. The middle part of the subsoil is faintly mottled, yellowish brown clay loam 10 inches thick. The lower part is a fragipan of distinctly mottled, light yellowish brown, firm and brittle, gravelly sandy clay loam that extends to a depth of 52 inches. The substratum, to a depth of 65 inches, is yellowish brown, friable, gravelly loam.

Included in mapping are areas of a somewhat poorly drained soil similar to Bartley soils, areas of more sloping Bartley loam, areas of Bartley gravelly loam, and a few areas of Bartley soils that are stony. Also included are areas of Washington soils in high positions and small areas of poorly drained or very poorly drained Lyons soils in low areas.

Permeability is moderate above and below the fragipan but is moderately slow or slow in the fragipan. A moderately high seasonal water table is perched over the fragipan from December to May. The available water capacity is high, and additional water is available because of the seasonal water table. Irrigation is used on some high-value vegetable crops. Runoff is slow, and the hazard of erosion is slight. In most places, limestone bedrock is at a depth of more than 6 feet. Root penetration is somewhat restricted in the fragipan. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied. Sinkholes and disappearing streams are common in areas of this soil.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban uses. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, soybeans, hay, and vegetables. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Shallow surface ditches or random interceptor tile drains where the fragipan is relatively deep can improve drainage. Early plantings will be delayed if drainage is not improved.

This soil is suited to tall grass or permanent bluegrass pasture. The major management needs are using stocking rates that help maintain desirable plants, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to woodland use. Production is good, and there are no limitations for woodland management. Rooting depth is somewhat restricted by the firm fragipan. Planting equipment can be used, though excess surface water may delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban use, including onsite sewage disposal, building foundations, and roads, because of slow permeability, the moderately high seasonal water table, and frost action potential. Capability unit IIw-71; woodland subclass 2o.

BaB—Bartley loam, 3 to 8 percent slopes. This gently sloping, moderately well drained, deep soil is in valleys. The areas are long and smooth or oval in shape and are 5 to 20 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown loam about 12 inches thick. The upper 8 inches of the subsoil is faintly mottled, strong brown loam. The middle part of the subsoil is faintly mottled, yellowish brown clay loam

10 inches thick. The lower part is a fragipan of distinctly mottled, light yellowish brown, firm and brittle, gravelly sandy clay loam that extends to a depth of 52 inches. The substratum, to a depth of 65 inches, is yellowish brown, friable, gravelly loam.

Included in mapping are areas of a somewhat poorly drained soil similar to Bartley, areas of more sloping Bartley soils, areas of Bartley gravelly loam, and a few areas of Bartley soils that are stony. Also included are areas of Washington soils in high positions and small areas of poorly drained or very poorly drained Lyons soils in low areas.

Permeability is moderate above and below the fragipan but is moderately slow or slow in the fragipan. A moderately high seasonal water table is perched over the fragipan from December to May. If the soil is saturated, water moves laterally over the fragipan. The available water capacity is high, and additional water is available because of the seasonal water table. Irrigation is used on some high-value vegetable crops. Runoff is slow, and the hazard of erosion is slight. In most places, limestone bedrock is at a depth of more than 6 feet. Root penetration is somewhat restricted in the fragipan. Natural fertility is high.

Reaction is medium acid to neutral, if lime is not applied. Sinkholes and disappearing streams are common in areas of this soil.

Most areas have been cleared of trees and are used as cropland and pasture. Some areas are in urban uses. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, soybeans, hay, and vegetables. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Shallow surface ditches or random interceptor tile drains where the fragipan is relatively deep can improve drainage. Early plantings will be delayed unless drainage is improved. Diversion terraces and grassed waterways are effective in controlling excess runoff.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants through proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. Rooting depth is somewhat restricted by the firm fragipan. Planting equipment can be used, though excess surface water may delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of slow permeability, the moderately high seasonal water table, and frost action potential. Capability unit IIe-71; woodland subclass 2o.

BbC—Bartley gravelly loam, 8 to 15 percent slopes. This is a sloping, moderately well drained, deep soil in valleys. The areas are long and smooth or oval in shape and are 5 to 20 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown gravelly loam about 12 inches thick. The upper 8 inches of the subsoil is faintly mottled, strong brown loam. The middle part of the subsoil is faintly mottled, yellowish brown clay loam 10 inches thick. The lower part is a fragipan of strongly mottled, light yellowish brown, firm and brittle, gravelly sandy clay loam that extends to a depth of 52 inches. The substratum, to a depth of 65 inches, is yellowish brown, friable gravelly loam.

Included in mapping are areas of a somewhat poorly drained soil similar to Bartley, areas of more sloping and less sloping Bartley soils, areas of Bartley loam, and a few areas of Bartley soils that are stony. Also included are areas of Washington soils in high positions and small areas of poorly drained or very poorly drained Lyons soils in low areas.

Permeability is moderate above and below the fragipan but is moderately slow or slow in the fragipan. The soil has a moderately high seasonal water table that is perched over the fragipan from December to May. When the soil is saturated, water moves laterally over the fragipan. The available water capacity is high, and additional water is available because of the seasonal water table. Irrigation is used on some high-value vegetable crops. Runoff is medium, and the hazard of erosion is moderate. In most places, limestone bedrock is at a depth of more than 6 feet. Root penetration is somewhat restricted in the fragipan. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied. Sinkholes and disappearing streams are common in areas of this soil.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle. A small acreage is in urban uses.

This soil has fair potential for corn, small grains, soybeans, hay and vegetables; the hazard of erosion is the main limitation. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Stripcropping and diversion terraces generally are needed to control erosion. Diversion ditches or random interceptor tile drains where the fragipan is relatively deep can improve drainage. Early plantings will be delayed unless drainage is improved.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is to maintain the desirable plants by using proper stocking rates, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. Rooting depth is somewhat restricted by the firm fragipan. Planting equipment can be used, though excess surface water may delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of slope, slow permeability, moderately high seasonal water table, and frost action potential. Capability unit IIIe-71; woodland subclass 2o.

BdB—Bartley stony loam, 3 to 8 percent slopes. This gently sloping, moderately well drained, deep soil is in valleys. The areas are long and smooth or oval in shape and are 5 to 20 acres in size. Stones on the surface are 30 to 100 feet apart.

Typically, the surface layer is dark brown stony loam about 12 inches thick. The upper 8 inches of the subsoil is faintly mottled, strong brown, gravelly loam. The lower part is a firm and brittle fragipan of distinctly mottled, yellowish brown gravelly sandy clay loam that extends to a depth of 52 inches. The substratum, to a depth of 65 inches, is yellowish brown, friable, gravelly loam.

Included in mapping are areas of nonstony Bartley soils. Also included are areas of Washington soils in high positions.

Permeability is moderate above the fragipan but is slow in the fragipan. The soil has a moderately high seasonal water table that is perched over the fragipan from December to May. When the soil is saturated, water moves laterally over the fragipan. The available water capacity is high. Additional water is available because of the seasonal water table. Runoff is slow, and the hazard of erosion is slight. In most places, limestone bedrock is at a depth of more than 6 feet. Root penetration is somewhat restricted in the fragipan. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas are woodland. Some areas are cropland, pasture, or are in urban use.

This soil has some limitations for use as cropland because the stones interfere with plowing, planting, cultivating, and harvesting. It has good potential for corn, small grains, and hay. Cropland management generally requires stripcropping or diversion, cover cropping, and rotations that include sod to reduce erosion.

This soil is suited to tall grass or permanent bluegrass pasture, but the stones limit the use of equipment in plowing, seeding, and mowing. The major management needs includes using stocking rates that help maintain the desirable plants, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are few equipment-use limitations for woodland management. Rooting depth is restricted by the firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban use, including onsite sewage disposal, building foundations, and roads, because of the stones, the seasonal high water table, slow permeability, and frost action potential. Capability unit IIe-71; woodland subclass 2o.

BfB—Bath gravelly loam, 3 to 8 percent slopes. This gently sloping well drained, deep soil is on the crests and slopes of long, convex ridges. The areas are oval or long and are 5 to 40 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, gravelly loam 8 inches thick. The subsoil, in the upper 26 inches, is yellowish brown, gravelly loam. The lower part, extending to a depth of 72 inches, is a very firm and brittle fragipan of dark yellowish brown gravelly loam.

Included in mapping are areas of less sloping Bath soils and areas of soils similar to Bath, except that they have no fragipan. Also included are small areas of Venango and Chippewa soils, mainly in slight depresssions and adjacent to steeper soils. The Venango and Chippewa soils are seasonally wet and may need drainage for some uses.

Permeability is moderate above the fragipan but is slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees and are used as cropland and pasture. Some areas are in urban use. A small acreage is woodland or is idle.

This soil has good potential for corn and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system can help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are necessary for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management needs include proper stocking rates to maintain the desirable plants, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and limitations for woodland management are slight. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak,

white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the slow permeability in the fragipan and the frost action potential. Capability unit IIe-3; woodland subclass 3o.

BfC—Bath gravelly loam, 8 to 15 percent slopes. This is a sloping, well drained, deep soil on side slopes of long, convex ridges that are oriented in a northeast to southwest direction. The areas are oval or elongated and are 5 to 40 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown gravelly loam about 6 inches thick. The subsoil, in the upper 26 inches, is yellowish brown gravelly loam. In the lower part, extending to a depth of 72 inches, it is a very firm and brittle fragipan of dark yellowish brown gravelly loam.

Included in mapping are areas of Bath gravelly loam, 3 to 8 percent slopes; areas of Venango soils in slight depressions and along slope breaks; areas of Nassau soils; and small areas of a soil similar to this Bath soil except that it has no fragipan.

Permeability is moderate above the fragipan and slow in the fragipan. Small amounts of excess water are perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is medium, and the hazard of erosion is moderate. In most places, bedrock is at a depth of more than 5 feet. Root penetration is somewhat restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees and are used as cropland and pasture. Some areas are woodland, and others are idle. A small acreage is in urban uses.

This soil has fair potential for corn and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and to reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed also to help reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to all grass or permanent bluegrass pasture. The major management needs are using stocking rates that help maintain the desirable plants, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and limitations for woodland management are slight. The rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, white ash, and beech.

This soil is limited for urban use, including onsite sewage disposal, building foundations, and roads, because of slope, slow permeability, and frost action potential. Capability unit IIIe-3; woodland subclass 3o.

BfD—Bath gravelly loam, 15 to 25 percent slopes. This is a steep, well drained, deep soil on side slopes of long, convex ridges that generally are oriented in a northeast to southwest direction. The areas are oval or elongated and are 5 to 35 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, gravelly loam about 6 inches thick. The subsoil, in the upper 24 inches, is yellowish brown gravelly loam. In the lower part, extending to a depth of 72 inches, it is a very firm and brittle fragipan of dark yellowish brown gravelly loam.

Included in mapping are soils similar to this Bath soil, except that the fragipan is at a lesser depth, areas of Venango gravelly loam in seep spots at the base of slopes, and a few areas of Nassau shaly silt loam generally along the crest of slopes.

Permeability is moderate above the fragipan and slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is rapid, and the hazard of erosion is high. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Extensive areas of this soil have been cleared of trees and are used as cropland and pasture. Other extensive areas are woodland, and some are idle. Virtually no acreage is in urban uses.

This soil has poor potential for corn, small grains, and hay because of the high hazard of erosion. It is not suited to continuous row cropping. The potential for hay is good, but the steep slopes are difficult to work. Diversion terraces and grass waterways may be needed in most areas to control runoff and erosion.

This soil is suited to tall grass or permanent bluegrass pasture. The major management needs include using stocking rates that help maintain the desirable plants, rotating pastures, and periodically applying lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, but there are moderate equipment-use limitations because of the steep slopes. The rooting depth is restricted by the very firm fragipan. The hazard of erosion is slight because of the forest cover. Care is needed, however, to prevent water from concentrating on the harvesting skid trails. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban use by steep slopes, slow permeability, and frost action potential. If the vegetative

cover is removed, this soil has a high hazard of erosion. Capability unit IVe-3; woodland subclass 3r.

BfE—Bath gravelly loam, 25 to 40 percent slopes. This very steep, well drained, deep soil is on side slopes of long, convex ridges that generally are oriented in a northeast to southwest direction. The areas generally are long and are 10 to 50 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown gravelly loam about 6 inches thick. The subsoil in the upper 24 inches is friable, yellowish brown gravelly loam. In the lower part, extending to a depth of 72 inches, it is a very firm and brittle fragipan of dark yellowish brown gravelly loam.

Included in mapping are small areas of loamy soils and some areas of soils that have a gravelly clay loam subsoil. Also included are areas of Nassau shaly silt loam along the crest of slopes and Venango gravelly loam in small, concave seep spots.

Permeability is moderate above the fragipan but is slow in the fragipan. The available water capacity is moderate. Runoff is very rapid, and the hazard of erosion is very high. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas are woodland or pasture.

This soil is so steep that it is poorly suited to cropland. The hazard of erosion is high in plowed areas, and the slopes severely limit the use of equipment.

This soil is suited to all grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. The very steep slopes limit the use of equipment, and the hazard of erosion is high if this soil is prepared for reseeding.

This soil is well suited to use as woodland. Production is fair, but there are severe equipment-use limitations because of the very steep slopes. The hazard of erosion under woodland cover is moderate. Care is needed to prevent concentrating runoff in the harvesting skid trails. Hand planting will be necessary in most places because of the very steep slopes. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban use because of the very steep slopes, the hazard of erosion, slow permeability, and the frost action potential. If vegetative cover is removed, this soil has a very high hazard of erosion. Capability unit VIe-3; woodland subclass 3r.

BgB—Bath very stony loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on crests and toe slopes of long, convex ridges that generally are oriented in a northeast to southwest direction. Stones occupy as much as 3 percent of the surface and are 5 to 30 feet apart. The areas are oval or elongated in shape and are 5 to 40 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, very stony gravelly loam about 8 inches thick. The subsoil in the upper 26 inches is yellowish brown gravelly loam. The lower part, extending to a depth of 72 inches, is a very firm and brittle fragipan of dark yellowish brown, gravelly loam.

Included in mapping are areas of Bath cobbly loam, Bath loam, and Bath gravelly loams; and small areas of somewhat poorly drained Venango soils that are mainly in slight depressions.

Permeability is moderate above the fragipan but is slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

This soil is mainly woodland. Some areas are pasture, and some are used as sites for homes. Surface stones are a major limitation for most soil use.

If trees and stones are removed, this soil has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but the many stones cause equipment-use limitations. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, but there are some equipment-use limitations for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, permeability, and frost action potential. Capability unit VIs-19; woodland subclass 3o.

BgC—Bath very stony loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on the side slopes of long, convex ridges that generally are oriented in a northeast to southwest direction. The areas are oval or elongated in shape and are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, very stony gravelly loam about 8 inches thick. The upper 26 inches of the subsoil is yellowish brown, gravelly loam. The lower part, extending to a depth of 72 inches, is a very firm and brittle fragipan of dark yellowish brown, gravelly loam.

Included in mapping are areas of Bath cobbly loam, Bath loam, and Bath gravelly loam; less sloping and more sloping Bath soils; and areas of Nassau soils. Also included are small areas of somewhat poorly drained Venango soils or poorly drained Chippewa soils that are mainly in slight depressions.

Permeability is moderate above the fragipan but is slow in the fragipan. Small amounts of excess water may be perched seasonally over the fragipan but only for short periods. The available water capacity is moderate. Runoff is medium, and the hazard of erosion is moderate. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas are woodland. Some areas are in pasture; others are in urban use.

This soil is not suited to use as cropland because of many stones. If stones and trees are removed, it has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but the many stones limit the use of equipment. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, but there are some equipment-use limitations for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, slow permeability, and frost action potential. Capability unit VIs-19; woodland subclass 3o.

CbB—Califon gravelly loam, 3 to 8 percent slopes. This gently sloping, moderately well drained or somewhat poorly drained, deep soil is in long, narrow drainageways; and on broad, oval, slightly concave toe slopes. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, gravelly loam about 9 inches thick. The upper part of the subsoil is friable, strong brown clay loam about 13 inches thick. The lower part is a very firm and brittle fragipan of mottled yellowish brown, gravelly loam about 26 inches thick. The substratum, to a depth of 66 inches, is friable, yellowish brown, gravelly sandy loam.

Included in mapping are areas of Califon soils where slopes are less than 3 percent, areas of the poorly drained Cokesbury soils in low positions, and the well drained Annandale and Edneyville soils in high positions.

Permeability is moderate above the fragipan but is slow in the fragipan. Excess water is perched seasonally over the fragipan. The available water capacity is moderate, but additional water is available because of the water table. Runoff is slow, and the hazard of erosion is slight. In most places bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to medium acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban use. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, soybeans, and hay. Where gravel content is highest, cultivation is difficult. Shallow ditches or random tile drains can be used to drain wet areas. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system will maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed on long slopes to reduce erosion. For optimum production lime and fertilizer should be applied periodically.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and the limitations for woodland management are slight. Planting with mechanical equipment may be delayed in some years. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, white ash, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the seasonal high water table, slow permeability in the fragipan, and the frost action potential. Capability unit IIe-71; woodland subclass 2o.

CbC2—Califon gravelly loam, 8 to 15 percent slopes, eroded. This sloping, moderately well drained or somewhat poorly drained, deep soil is on long, narrow side slopes of older till areas that generally are oriented in a northeast to southwest direction. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown gravelly loam about 7 inches thick. The upper part of the subsoil is friable, firm, strong brown clay loam about 13 inches thick. The lower part is a very firm and brittle fragipan of mottled yellowish brown, gravelly loam about 26 inches thick. The substratum, to a depth of 66 inches, is friable, yellowish brown, gravelly sandy loam.

Included in mapping are small areas of less sloping Califon soils, areas of Annandale soils, and small areas of Cokesbury soils in low positions.

Permeability is moderate above the fragipan but is slow in the fragipan. Excess water is perched seasonally over the fragipan and moves laterally over the pan. Seep

spots are common. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is medium, and the hazard of erosion is moderate. In most places, bedrock is at a depth of more than 5 feet. Root penetration is somewhat restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to medium acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle. A small acreage is in urban use.

This soil has fair potential for corn, small grains, and hay. Wet areas can be drained by using diversion terraces. Maintaining the organic-matter content can help to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces are needed to reduce erosion. For optimum production lime and fertilizer should be applied periodically.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and the limitations for woodland management are slight. Planting with equipment may be delayed in some seasons because of the seep areas. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the slopes, slow permeability, and frost action potential. Capability unit IIIe-71; woodland subclass 2o.

CcB—Califon very stony loam, 3 to 8 percent slopes. This gently sloping, moderately well drained to somewhat poorly drained, deep soil is in drainageways and on slightly concave toe slopes. The areas are long and narrow to nearly oval in shape. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, very stony loam about 7 inches thick. The upper part of the subsoil is friable, strong brown clay loam about 13 inches thick. The lower part is a very firm and brittle fragipan of mottled yellowish brown, gravelly loam about 26 inches thick. The substratum, to a depth of 66 inches, is friable, yellowish brown, gravelly sandy loam.

Included in mapping are areas of Califon gravelly loam and a few areas of Califon extremely stony loam. Also included are scattered areas of well drained Annandale and Edneyville soils and scattered areas of poorly drained Cokesbury soils in low areas.

Permeability is moderate above the fragipan but is slow in the fragipan. Excess water is perched seasonally over the fragipan and moves laterally over the pan. The available water capacity is moderate, but additional water is available because of the seasonal water table. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to medium acid, if lime is not applied.

This soil is mainly woodland. Some areas are pasture, and some are used as sites as homes. Surface stones are a major limitation for most uses.

If trees and stones are removed, this soil has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but the many stones and seep spots limit the use of equipment. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and the limitations for woodland management are slight. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, white ash, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the seasonal high water table, many stones, slow permeability, and frost action potential. Capability unit VIs-75; woodland subclass 2o.

CcC—Califon very stony loam, 8 to 15 percent slopes. This sloping, moderately well drained to somewhat poorly drained, deep soil is on long side slopes of older glacial till areas that generally are in a northeast to southwest direction. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, very stony loam about 7 inches thick. The upper part of the subsoil is friable, strong brown clay loam about 13 inches thick. The lower part is a very firm and brittle fragipan of mottled yellowish brown, gravelly loam about 26 inches thick. The substratum, to a depth of 60 inches, is friable, yellowish brown, gravelly sandy loam.

Included in mapping are areas of less sloping, Califon gravelly loam; and areas of Annandale and Edneyville soils; and a few areas of less sloping, Califon extremely stony loam, mainly in concave areas.

Permeability is moderate above the fragipan but is slow in the fragipan. Excess water is perched seasonally over the fragipan and moves laterally over the pan when the soil is saturated. Seepage spots are common. The available water capacity is moderate. Additional water is available because of the seasonal water table. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is

medium. Reaction is strongly acid to medium acid, if lime is not applied.

Most areas are woodland. Some areas are in pasture; others are in urban use.

This soil is not suited to use as cropland because of the many stones. If stones and trees are removed, it has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but the many stones limit the use of equipment. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is fair, and the limitations for woodland management are slight. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, hickory, and beech.

This soil is limited to urban uses, including onsite sewage disposal, building foundations, and roads, because of the seasonal high water table, many stones, slow permeability, frost action potential, and slopes. Capability unit VIs-75; woodland subclass 2o.

Ck—Carlisle muck. This nearly level, very poorly drained, organic soil is in former glacial lake beds, some bogs, swamps, and other low areas. In most areas that have not been developed for crops it is subject to frequent stream overflow. The organic material is more than 51 inches thick.

Typically, the upper 12 inches of this soil is black, highly decomposed muck. The next 36 inches is black, decomposed, fibrous muck and decomposed, woody sediment. Below that is dark reddish brown, fibrous and woody muck that extends to a depth of 60 inches or more.

Included in mapping are narrow bands of organic soils less than 51 inches thick that generally are along the edges of mapped areas but also are within the areas. Also included are areas of Wayland soils on the flood plain, scattered areas of very poorly drained Halsey soils, and areas of poorly drained or very poorly drained Chippewa soils.

Permeability is moderately rapid. In undrained areas, the water table is at or near the surface most of the time. This soil is subject to frequent overflow in undrained areas where it is adjacent to perennial streams. Available water capacity is high. Natural fertility is high. Runoff is slow, and the hazard of erosion is slight. Reaction is very strongly acid to neutral. If drained, this soil is subject to blowing, burning, and subsidence. It has low bearing capacity. Bedrock is at a depth of more than 5 feet.

Most areas are woodland, predominantly red maple, elm, and other water-tolerant trees and shrubs.

Extensive areas have been cleared, drained, and used for intensive cultivation of such vegetables as onions, cabbage, lettuce, or sod crops (fig. 2). Other areas have been drained and are mined as a soil supplement. Shallow wildlife lakes and ponds are in some areas that previously were mined. This soil is well suited to excavated irrigation ponds or wildlife ponds.

This soil has severe limitations for cultivation, unless it is protected from flooding and drainage is improved. Deep ditches and subsurface drains improve drainage. Maintaining ditch banks is a problem. Subsidence is diminished by restricting drainage to depths required by the crop. When drainage is installed, the risk of crop damage or crop loss remains during periods of unusually high rainfall.

Because of the low bearing capacity this soil is not suited to pasture.

This soil is poorly suited to use as woodland. Production is poor, and the adapted plants have low commercial value. Windthrow is severe on this soil. The constantly high water table and low bearing capacity limit the use of equipment.

This soil is best suited to wetland wildlife and water storage areas, unless it is drained.

This soil is limited for most urban use because of the constantly high water table, the flooding hazard, and very poor bearing conditions. Capability unit IIIw-41; woodland subclass 4w.

CmA—Chippewa silt loam, 0 to 3 percent slopes. This nearly level, poorly drained and very poorly drained, deep soil is on slightly concave landscapes along drainageways, in the headlands of streams, and along streams. The areas are long and broad or nearly oval in shape and are 5 to 15 acres in size. This soil has a fragipan in the lower part of the subsoil and in the substratum.

Typically, the surface layer is very dark gray silt loam 12 inches thick. The upper part of the subsoil is firm, olive gray silt loam about 6 inches thick. The lower part is a very firm and brittle fragipan of mottled, light olive gray, gravelly loam about 38 inches thick. The substratum, to a depth of 65 inches or more, is a very firm and brittle fragipan of mottled, olive gray, gravelly loam.

Included in mapping are areas of somewhat poorly drained Wurtsboro and Venango soils and well drained or moderately well drained Swartswood soils that generally are on scattered, low, dome-shaped crests within the areas. Also included are more sloping areas of Chippewa soils and scattered areas of Chippewa stony and very stony soils. Where this soil is adjacent to perennial streams, it includes some areas that are subject to flooding.

Permeability is moderate above the fragipan but is slow in the fragipan. The soil has a seasonal high water table that is perched over the fragipan from November to May. The available water capacity is moderate. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 5 feet. Root penetra-

tion is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid near the surface and neutral in the substratum, if lime is not applied.

Most areas are pasture or woodland. Some areas have been cleared of trees for use as cropland. A small acreage is in urban use.

This soil is poorly suited to crops because of the high water table. If drained, it is best suited to corn and hay. Drainage outlets are not available in some areas. The risk of crop damage remains even after drainage. Deep ditches can improve drainage. This soil is suited to excavated irrigation ponds and wildlife ponds (fig. 3).

If drained, this soil is fairly suited to tall grass or permanent bluegrass pasture. In addition to drainage, the major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is poorly suited to use as woodland. Production is poor, and the perched high water table severely limits the use of equipment in woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are red maple, elm, swamp white oak, and black birch.

This soil is poorly suited to urban uses. It is limited to use as sewage disposal, building foundations, and roads because of the high water table, slow permeability, and frost action potential. Capability unit IVw-44; woodland subclass 5w.

CmB—Chippewa silt loam, 3 to 8 percent slopes. This gently sloping, poorly drained and very poorly drained, deep soil is on smooth landscapes along drainageways, in the headlands to streams, and along streams. The areas are long and broad or nearly oval in shape and are 5 to 15 acres in size. This soil has a fragipan in the lower part of the subsoil and in the substratum.

Typically, the surface layer is very dark gray silt loam about 12 inches thick. The upper part of the subsoil is firm, olive gray silt loam about 6 inches thick. The lower part is a very firm and brittle fragipan of mottled, olive gray, gravelly loam about 38 inches thick. The substratum, to a depth of 65 inches or more, is a very firm and brittle fragipan of mottled, olive gray gravelly loam.

Included in mapping are scattered areas of somewhat poorly drained Wurtsboro and Venango soils, and well drained and moderately well drained Swartswood soils generally on scattered low, dome-shaped crests within the areas. Also included are areas of less sloping Chippewa soils and areas of stony and very stony Chippewa soils, mostly in woodland.

Permeability is moderate above the fragipan but is slow in the fragipan. The soil has a seasonal high water table that is perched over the fragipan from November to May. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid near the surface and neutral in the substratum, if lime is not applied.

Most areas are pasture or woodland. Some areas have been cleared of trees for use as cropland. A small acreage is in urban use.

This soil is poorly suited to crops because of the high water table. If drained, it is best suited to corn and hay. Drainage outlets are not available in some areas. The risk of crop damage remains after drainage. Deep ditches can improve drainage. This soil is suited to excavated irrigation ponds or wildlife ponds.

If drained, this soil is fairly suited to tall grass or permanent bluegrass pasture. In addition to drainage, the major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is poorly suited to woodland use. Production is poor, and equipment-use limitations are severe for woodland management because of the perched high water table. Rooting depth is restricted by the very firm fragipan. The most common trees are red maple, elm, swamp white oak, and black birch.

This soil is poorly suited to urban uses. It is limited to use as onsite sewage disposal, building foundations, and roads because of the high water table, slow permeability, and frost action potential. Capability unit IVw-44; woodland subclass 5w.

CnA—Chippewa very stony silt loam, 0 to 3 percent slopes. This nearly level, poorly drained and very poorly drained, deep soil is on slightly concave landscapes as headlands to streams and along drainageways and some streams. The areas are long and narrow to nearly oval in shape and are 5 to 15 acres in size. Stones occupy as much as 3 percent of the surface and are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil and in the substratum.

Typically, the surface layer is very dark gray, very stony silt loam about 12 inches thick. The upper part of the subsoil is firm, olive gray silt loam about 6 inches thick. The lower part is a very firm and brittle fragipan of mottled, light olive gray, gravelly loam about 38 inches thick. The substratum, to a depth of 65 inches or more, is a very firm and brittle fragipan of mottled, olive gray, gravelly loam.

Included in mapping are areas of extremely stony, stony, and nonstony Chippewa soils that generally are in slight depressions; and poorly drained Wurtsboro or Venango soils on low, dome-shaped crests in the areas. Also included are areas of more sloping Chippewa very stony soils.

Permeability is moderate above the fragipan but is slow in the fragipan. The soil has a seasonal high water table that is perched over the fragipan from November to

May. The available water capacity is moderate, but additional water is available because of the seasonal high water table. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid near the surface and neutral in the substratum, if lime is not applied.

Most areas are woodland or pasture.

The soil has poor potential for crops. Drainage and stone and tree removal are needed to make this soil suitable for crops. Deep ditches can improve drainage. Outlets are not available in some areas, and the risk of crop damage remains after drainage. The soil is suited to excavated irrigation ponds or wildlife ponds.

If drained, this soil is fairly suited to tall grass or permanent bluegrass pasture. Red canary grass is suited to the wettest areas. In addition to drainage, the main management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Liming and fertilizing are difficult because of many stones.

This soil is poorly suited to use as woodland. Production is poor, and there are severe limitations for use of equipment in woodland management because of the perched high water table. Rooting depth is somewhat restricted by the very firm fragipan. The most common trees are red maple, elm, swamp white oak, and black birch.

This soil is poorly suited to urban uses. It is limited to use as onsite sewage disposal, building foundations, and roads because of the high water table, slow permeability, stone content, and frost action potential. Capability unit VIIs-45; woodland subclass 5w.

CnB—Chippewa very stony silt loam, 3 to 8 percent slopes. This gently sloping, poorly drained and very poorly drained, deep soil is on slightly convex to smooth landscapes along drainageways, in the headlands of streams, and along some streams. The areas are long and narrow to nearly oval in shape and are 5 to 15 acres in size. Stones occupy as much as 3 percent of the surface and are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil and in the substratum.

Typically, the surface layer is very dark gray, very stony silt loam about 12 inches thick. In the upper part, the subsoil is firm, olive gray silt loam about 6 inches thick. In the lower part, it is a very firm and brittle fragipan of mottled, light olive gray, gravelly loam about 38 inches thick. The substratum, to a depth of 65 inches or more, is a very firm and brittle fragipan of mottled, olive gray, gravelly loam.

Included in mapping are areas of extremely stony, stony, and nonstony Chippewa soils that generally are in slight depresssions; somewhat poorly drained Wurtsboro or Venango soils on low, dome-shaped crests in the areas; and less sloping, Chippewa very stony soils.

Permeability is moderate above the fragipan but is slow in the fragipan. The soil has a seasonal high water table that is perched over the fragipan from November to May. The available water capacity is moderate, but additional water is available because of the seasonal water table. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid near the surface and neutral in the substratum, if lime is not applied.

Most areas are woodland or pasture.

This soil has poor potential for crops. Drainage and stone and tree removal are needed to make this soil suited to crops. Deep ditches can improve drainage. Outlets are not available in some areas, and the risk of crop damage remains after drainage. The soil is suited to excavated irrigation ponds or wildlife ponds.

If drained, this soil is fairly suited to tall grass or permanent bluegrass pasture. Reed canarygrass is suited to the wettest areas. In addition to drainage, the main management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Liming and fertilizing are difficult because of the many stones.

This soil is poorly suited to use as woodland. Production is poor, and equipment-use limitations are severe for woodland management because of the perched high water table. Rooting depth is somewhat restricted by the very firm fragipan. The most common trees are red maple, elm, swamp white oak, and black birch.

This soil is poorly suited to urban uses. It is limited to use as onsite sewage disposal, building foundations, and roads because of the high water table, slow permeability, stone content, and frost action potential. Capability unit VIIs-45: woodland subclass 5w.

CoA—Cokesbury loam, 0 to 3 percent slopes. This nearly level, poorly drained, deep soil is along drainageways, in the headwaters of streams, and along some streams. The areas are long and narrow to broad and nearly oval and are 5 to 15 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The upper part of the subsoil, extending to a depth of 26 inches, is distinctly mottled, light brownish gray, gravelly sandy clay loam and clay loam. The lower part, extending to a depth of 38 inches, is a very firm and dense fragipan of mottled, strong brown, gravelly clay loam. The substratum, to a depth of 60 inches or more, is very firm, dense, mottled strong brown, gravelly loam.

Included in mapping are areas of very poorly drained soils in scattered slight depressions. Also included are small areas of more sloping Cokesbury soils, stony Cokesbury soils, and Califon soils that generally are in slightly higher areas.

Permeability is moderately slow above the fragipan but is slow in the fragipan. The soil has a seasonal high water table that is perched over the fragipan from September to June. When it is highest, the water table is at the surface to 1 foot below the surface. The available water capacity is moderate, but additional water is available because of the water table. In most places, bedrock is at a depth of more than 6 feet. Root penetration is restricted in the very firm fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas are woodland. Some areas have been cleared of trees for use as cropland and pasture, and some are in urban use.

This soil has poor potential for crops; wetness is the main limitation. If drained, it is best suited to corn and hay. Drainage outlets are not available in some areas. Deep ditches can improve drainage, but underground drains generally are not effective because permeability is slow. Runoff is slow, and the hazard of erosion is slight. Diversions can be used in places to distribute some of the runoff. The risk of crop damage remains even after drainage is improved. This soil is suited to excavated irrigation ponds and wildlife ponds.

If drained, this soil is suited to tall grass or permanent bluegrass pasture. The wettest areas are suited to Reed canarygrass. Including drainage, the major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is fair, but equipment-use limitations are severe for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are red maple, swamp white oak, black birch, pin oak, white ash, hickory, white oak, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the seasonal high water table, slow permeability, and the frost action potential. Capability unit IVw-82; woodland subclass 3w.

CoB—Cokesbury loam, 3 to 8 percent slopes. This gently sloping, poorly drained, deep soil is along some streams, in drainageways, and in the headwaters of streams. The areas are long and narrow to broad and nearly oval in shape and are generally 5 to 15 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The upper part of the subsoil, extending to a depth of 26 inches, is distinctly mottled, light brownish gray, gravelly sandy clay loam and clay loam. The lower part, extending to a depth of 38 inches, is a very firm and dense fragipan of strong brown, gravelly clay loam, mottled with light gray and light brownish gray. The substratum, to a depth of 60 inches or more, is very firm, dense, mottled, strong brown gravelly loam.

Included in mapping are scattered areas of moderately well drained and somewhat poorly drained Califon soils and areas of stony and very stony Cokesbury soils. Also included are a few areas of more sloping Cokesbury soils. These latter inclusions generally are areas where seeps occur adjacent to changes in slope within the areas or adjacent to boundaries with areas of more sloping soils.

Permeability is moderately slow above the fragipan but is slow in the fragipan. The soil has a seasonal high water table that is perched over the fragipan from September to June. When it is highest, the water table is at the surface to 1 foot below the surface. The available water capacity is moderate, but additional water is available because of the water table. In most places, bedrock is at a depth of more than 6 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is stongly acid to slightly acid, if lime is not applied.

Most areas are woodland. Some areas have been cleared of trees for use as cropland and pasture, and some are in urban use.

This soil has poor potential for crops; wetness is the main limitation. If drained, it is best suited to corn and hay. Drainage outlets are not available in some areas. Deep ditches can improve drainage, but underground drains generally are not effective because permeability is slow. Runoff is slow, and the hazard of erosion is slight. Diversions can be used in places to distribute some of the runoff. This risk of crop damage remains even after drainage is improved. This soil is suited to excavated irrigation ponds and wildlife ponds.

If drained, this soil is suited to tall grass or permanent bluegrass pasture. The wettest areas are suited to Reed canarygrass. Including drainage, the main management need is maintaining desirable plants by proper stocking rates, and periodic applications of lime and fertilizer.

This soil is suited to woodland use. Production is fair, but equipment-use limitations are severe for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are red maple, swamp white oak, black birch, pin oak, white ash, hickory, white oak, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the seasonal high water table, slow permeability, and frost action potential. Capability unit IVw-82; woodland subclass 3w.

CsB—Cokesbury very stony loam, 3 to 8 percent slopes. This gently sloping, poorly drained, deep soil is at the base of steeper slopes, along some streams, in drainageways, and in the headwaters of streams. The areas are long and narrow to broad and oval in shape and are generally 5 to 15 acres in size. Stones occupy

as much as 3 percent of the surface and are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is very dark grayish brown, very stony loam about 7 inches thick. The upper part of the subsoil, extending to a depth of 26 inches, is distinctly mottled, light brownish gray, gravelly sandy clay loam and clay loam. The lower part, extending to a depth of 38 inches, is a very firm and dense fragipan of mottled, strong brown, gravelly clay loam. The substratum, to a depth of 60 inches or more, is very firm, dense, mottled, strong brown, gravelly loam.

Included in mapping are scattered areas of Cokesbury stony loam and some nonstony Cokesbury soils that generally are in slight depressions. Also included are areas of moderately well drained or somewhat poorly drained Califon soils. The Califon soils generally are on slightly dome-shaped areas within the larger areas of this soil.

Permeability is moderately slow above and below the fragipan but is slow in the fragipan. The soil has a seasonal high water table that is perched over the fragipan from October to June. The available water capacity is moderate, but additional water is available because of the water table. In most places, bedrock is at a depth of more than 6 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas are woodland or pasture. A small acreage is idle or in urban use.

This soil is suitable for corn and hay if stones are removed and the soil is drained. Deep ditches can be used to drain the soils if outlets are available. If farmed, runoff is slow, and the hazard of erosion is slight. Plantings may be delayed; and the risk of crop damage remains even after drainage. Periodic applications of lime and fertilizer are needed for optimum production. The soil is suited to ground-water ponds.

If drained, this soil is suited to tall grass or permanent bluegrass pasture. Because of the stones there are equipment-use limitations. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, but equipment use is limited for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are swamp white oak, red maple, white oak, hickory, white ash, black birch, beech, and sugar maple.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the high water table, stones, slow permeability, and frost action potential. Capability unit VIIs-83; woodland subclass 3w.

EdB—Edneyville gravelly loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on wide, smooth to undulating landscapes in plateau-like positions and at the base of steeper slopes. The areas are 5 to 20 acres or more in size.

Typically, the surface layer is dark brown, gravelly loam about 7 inches thick. The upper part of the subsoil, extending to a depth of 15 inches, is yellowish brown, friable, gravelly loam. The lower part, extending to a depth of 36 inches, is dark brown, gravelly heavy loam. The substratum, to a depth of 72 inches, is yellowish brown, gravelly sandy loam.

Included in mapping are scattered areas of Annandale soils in positions very similar to Edneyville soils and scattered areas of Califon soils that generally are in slight depressions and are adjacent to the boundary with steeper soils. Also included are a few areas of more sloping Edneyville soils.

Permeability is moderate. The available water capacity is high. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied. Runoff is slow, and the hazard of ersoion is slight.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban use. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, soybeans, and hay. Where the gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system can help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion on the long slopes. For optimum production, lime and fertilizer should be applied periodically.

This soil is well suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants through proper stocking rates, rotation pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including building foundations and roads, mainly because of the frost action potential. Capability unit IIe-58; woodland subclass 2o.

EdC—Edneyville gravelly loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on long, slightly angular side slopes. The areas are 5 to 20 acres or more in size.

Typically, the surface layer is dark brown, gravelly loam about 6 inches thick. The upper part of the subsoil, extending to a depth of 15 inches, is yellowish brown, friable, gravelly loam. The lower part, extending to a depth of 36 inches, is dark brown, gravelly heavy loam. The substratum, to a depth of 72 inches, is yellowish brown, gravelly sandy loam.

Included in mapping are scattered areas of Annandale soils on similar slopes and scattered areas of Califon soils in low positions. Also included are areas of less sloping Edneyville soils.

Permeability is moderate. The available water capacity is high. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied. Runoff is medium, and the hazard of erosion is moderate.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland, are idle, or are in urban use.

This soil has fair potential for corn, soybeans, small grains, and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces are needed to reduce erosion. Severely eroded areas need special treatment. For optimum production, lime and fertilizer should be applied periodically.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including building foundations and roads, because of the slope and frost action potential. Capability unit IIIe-58; woodland subclass 2o.

EeB—Edneyville extremely stony loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on wide, smooth landscapes in plateau-like positions and at the base of steeper slopes. The areas are 5 to 20 acres or more in size. Stones occupy more than 3 percent of the surface and are mostly 2-1/2 to 5 feet apart.

Typically, the surface layer in a wooded area is dark brown, extremely stony loam about 3 inches thick. The upper part of the subsoil, extending to a depth of 15 inches, is yellowish brown, friable, gravelly loam. The lower part, extending to a depth of 36 inches, is dark brown, gravelly heavy loam. The substratum, to a depth of 72 inches, is yellowish brown, gravelly sandy loam.

Included in mapping are less stony areas of Edneyville soils; scattered areas of Annandale soils on similar slopes; and scattered areas of Califon soils in slight depressions and adjacent to the boundary with other soils that have different slopes. Also included are areas of other Edneyville soils that have similar slopes and more sloping Edneyville gravelly loam.

Permeability is moderate. The available water capacity is high. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

This area is woodland. Because of the many stones, this soil is not suited to cropland and has limited use as pasture. It has limited potential for many urban uses mostly because of the high stone content.

If the stones are not removed, this soil is not suited to cultivated crops. The use of farm machinery is impractical because of the many stones on the surface.

Mainly because of the many stones on the surface, this soil is poorly suited to pasture, the use of equipment is limited, liming and fertilizing should be applied by hand in most places, and reseeding is very difficult.

This soil is suited to use as woodland. Production is good, but the use of planting equipment is impractical, and the use of harvesting equipment is very difficult. The most common trees are northern red oak, white oak, black oak, white ash, yellow-poplar, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones and the frost action potential. Capability unit VIIs-61; woodland subclass 3x.

EeC—Edneyville extremely stony loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on long, slightly angular side slopes. The areas are 5 to 20 acres or more in size. Stones occupy more than 3 percent of the surface and are mostly 2-1/2 to 5 feet long.

Typically, the surface layer of this soil in a wooded area is dark brown, extremely stony loam about 3 inches thick. The upper part of the subsoil, extending to a depth of 15 inches, is yellowish brown, friable, gravelly loam. The lower part of the subsoil, extending to a depth of 36 inches, is dark brown, friable to firm, gravelly, heavy loam. The substratum, to a depth of 72 inches, is yellowish brown, gravelly sandy loam.

Included in mapping are less stony Edneyville soils; areas of Annandale soils; and scattered, small areas of Califon soils in low positions and along the edges of the mapped areas. Also included are a few areas of Parker soils and a few knobs of highly weathered, gneissic Rock outcrop.

Permeability is moderate. The available water capacity is high. In most places, bedrock is at a depth of more

than 6 feet. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime has not been applied.

This soil is in woodland. Because of the many stones, this soil is not suited to cropland and has limited use as pasture. It is best suited to use as woodland.

Unless this soil is cleared of stones, it is not suited to cultivated crops. The many stones on the surface make the use of farm machinery impractical.

Mainly because of the many stones on the surface this soil is poorly suited to pasture, the use of farm equipment is severely limited, liming and fertilizing must be applied by hand in most places, and reseeding is very difficult.

This soil is suited to trees. Production is good, but the use of planting equipment is impractical, and the use of harvesting equipment is very difficult. The most common trees are northern red oak, white oak, black oak, white ash, yellow-poplar, hickories, black birch, beech, and sugar maple.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, the slope, and the frost action potential. Capability unit VIIs-61; woodland subclass 3x.

EPD—Edneyville-Parker-Rock outcrop association, steep. This well drained, steep association of soils and Rock outcrop is on crests and side slopes of older glaciated landscapes that generally are oriented in a northwest to southwest direction. Slopes range from 15 to 25 percent.

The association consists of about 50 percent extremely stony Edneyville soils about 36 percent extremely stony Parker soils, and as much as 15 percent Rock outcrop. The areas are 20 to 40 acres or more in size. Some are dominantly Parker soils and a few are dominantly Rock outcrop.

Typically, the surface layer of the Edneyville soils is dark brown, extremely stony loam about 3 inches thick. The upper part of the subsoil, extending to a depth of 15 inches, is yellowish brown, friable, gravelly sandy loam. The lower part, extending to a depth of 36 inches, is dark brown, friable to firm, sandy clay loam. The substratum, to a depth of 72 inches, is yellowish brown, gravelly sandy loam.

Typically, the surface layer of the Parker soil is dark brown, extremely stony sandy loam about 6 inches thick. The subsoil is dark brown, very gravelly loam about 24 inches thick. The substratum, extending to a depth of 60 inches, is brown, very gravelly loam and has about 70 percent slightly weathered pieces of gneissic stones and pebbles.

Rock outcrop consists of weathered granitic gneiss. In some areas, the upper part of the outcrop is rippable, and in other areas it is not.

Included in mapping are areas of Annandale soils; small areas of Califon soils in depressions; and scattered, small areas of Cokesbury soils in wet depressions.

Edneyville and Parker soils are extremely stony. Edneyville soils are moderately permeable and have high available water capacity. Bedrock is at a depth of more than 6 feet in the Edneyville soils and at a depth of 4 feet or more in the Parker soils. Parker soils have moderately rapid permeability. Reaction is very strongly acid or strongly acid in both soils.

The soils in this association are not suited to cropland and have limitations to use as pasture and for urban use because of the many stones, steep slopes, and rock outcrops. Because of the many stones, the use of equipment is severely limited.

The soils in this association are best suited to woodland, recreation, and watershed protection uses. Woodland production is fair. It is good on the Edneyville soils and fair on the Parker soils. There is no woodland production on Rock outcrop. There are equipment-use limitations because of the many stones in the Edneyville and Parker soils. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, hickory, and beech.

The soils in this association are limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the rock outcrops, the many stones, and steep slopes. Capability unit VIIs-22; woodland subclass 3x.

FrA—Fredon loam, 0 to 3 percent slopes. This nearly level, poorly drained, deep soil is on stream terraces and in depressions. The areas are 5 to 15 acres in size.

Typically, the surface layer is mottled, dark grayish brown loam 10 inches thick. In the upper 8 inches the subsoil is olive gray loam, and in the lower 12 inches it is gray loam. The subsoil has olive yellow mottles. The substratum, to a depth of 60 inches or more, is gray, stratified loamy sand and gravelly loamy sand and has olive yellow mottles.

Included in mapping are areas of Halsey or Adrian soils in depressions and scattered areas of Hero soils on slightly convex slopes.

Permeability is moderate in the surface layer and subsoil and moderately rapid in the substratum. The soil has a seasonal high water table from September to June. When it is highest, the water table is at the surface to 1 foot below the surface. The available water capacity is high, and additional water is available because of the water table. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to neutral, if lime is not applied. In some areas adjacent to perennial streams, this soil is subject to flooding.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland, and others are in urban use.

If it is not drained, this soil has poor potential for crops; wetness and flooding are the main limitations. If drained, it is best suited to corn and hay. Drainage outlets are not available in some areas. Deep ditches or tile drains can improve drainage. Diversions can be used in places to distribute some of the runoff. The risk of crop damage remains even after drainage is improved. This soil is suited to excavated ponds (fig. 4).

If drained, this soil is suited to tall grass or permanent bluegrass pasture. The wettest areas are suited to Reed canarygrass. In addition to drainage, the major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is poor, and the equipment-use limitations are severe for woodland management because of the high water table. The most common trees are red maple, swamp white oak, black birch, pin oak, white ash, hickory, white oak, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the seasonal high water table, frost action potential, and flooding. Capability unit IIIw-36; woodland subclass 4w.

Ha—Halsey loam. This nearly level, very poorly drained, deep soil is in depressions of broad areas near streams, the headwaters of streams, and depressions within the large areas of soils on glacial outwash terraces. The areas are 5 to 15 acres in size. The soils that are adjacent to streams are occasionally to frequently flooded.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsurface layer is mottled olive gray fine sandy loam about 8 inches thick. The subsoil extending to a depth of 34 inches, is mottled dark gray fine sandy loam. The substratum is stratified gray loamy sand silt loam to a depth of 60 inches or more.

Included in mapping are areas of poorly drained Fredon soils and very poorly drained Carlisle muck and Adrian muck.

Permeability is moderate in the surface layer and subsoil and rapid in the substratum. The soil has a seasonal high water table from September to June. When it is highest, the water table is at the surface or within 6 inches of the surface. The available water capacity is high and additional water is available because of the water table. Runoff is very slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to neutral, if lime is not applied.

Most areas are woodland. Some areas have been cleared for use as cropland and pasture. A few are in urban use.

If it is not drained, this soil has poor potential for crops; wetness and flooding are the main limitations. If drained, it is best suited to corn and hay. Drainage outlets are not available in some areas. Deep ditches or underground drains can improve drainage. The risk of crop damage remains even after drainage is improved. This soil is suited to excavated ponds.

If drained, this soil is suited to tall grass or permanent bluegrass pasture. The wettest areas are suited to Reed canarygrass. In addition to drainage, the major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is poor, and the equipment-use limitations are severe for woodland management. The most common trees are red maple, swamp white oak, black birch, white ash, hickory, white oak, beech, and pin oak.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the seasonal high water table, flooding, and frost action potential. Capability unit IIIw-36; woodland subclass 5w.

HbA—Hazen loam, 0 to 3 percent slopes. This nearly level, well drained, deep soil is on broad, nearly oval outwash terraces and on long, narrow to broad stream terraces. The areas are 5 to 40 acres or more in size. In some areas along streams, this soil is subject to infrequent flooding.

Typically, the surface layer is very dark grayish brown gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly loamy sand to a depth of 70 inches or more.

Included in mapping are areas of Hazen gravelly loam, 0 to 3 percent slopes, and Hazen soils that have slopes of 3 to 8 percent. Also included are areas of Hero soils and Palmyra soils; the Hero soils are in slight depressions, in seep spots along boundaries with more sloping soils, and in areas of transition from Hazen soils to Fredon or Halsey soils.

Permeability and the available water capacity are moderate. Runoff is very slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban uses. A small acreage is woodland.

This soil has good potential for corn, small grains, and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can help to maintain soil structure. Diversion terraces may be needed in places to

divert runoff from higher-lying soils. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the hazard of infrequent flooding and frost action potential. Capability unit I-6; woodland subclass 3o.

HbB—Hazen loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on broad, nearly oval outwash terraces and on long, narrow to broad stream terraces. The areas are 5 to 40 acres or more in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is yellowish brown and dark brown gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly loamy sand to a depth of 70 inches or more.

Included in mapping are areas of Hazen soils that have slopes of 0 to 3 percent and Hazen gravelly loam, 3 to 8 percent slopes. Also included are areas of Hero soils and Palmyra soils; the Hero soils are in slight depressions, in seep spots along boundaries with more sloping soils, and in areas of transition from Hazen soils to Fredon or Halsey soils.

Permeability and the available water capacity are moderate. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban use. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system can help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are necessary for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses, including building foundations and roads, because of the frost action potential. Capability unit IIe-6; woodland subclass 3o.

HbC—Hazen loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on a long, low, kame-like landscape that generally is oriented in a northeast to southwest direction, but in places it is oriented in another direction. The areas are 5 to 30 acres or more in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsoil is yellowish brown and dark brown, gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly loamy sand to a depth of 70 inches or more.

Included in mapping are areas of Hazen gravelly loam, 8 to 15 percent slopes, and Hazen soils that have 3 to 8 percent slopes. Also included are some eroded areas and a few areas of Hero soils that generally are in seep spots along the boundary with soils, in some closed depressions, that have 3 to 8 percent slopes.

Permeability and the available water capacity are moderate. Runoff is medium, and the hazard of erosion is moderate. Bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle. A small acreage is in urban use.

This soil has fair potential for corn, small grains, and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is fair, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the slope and frost action potential. Capability unit IIIe-6; woodland subclass 3o.

HcB—Hazen cobbly loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on terraces, generally along or near streams. The areas are long and narrow and are 5 to 30 acres or more in size.

Typically, the surface layer is very dark grayish brown, cobbly loam about 6 inches thick. The subsoil is yellowish brown and dark brown, gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly sand and very gravelly sand to a depth of 70 inches or more.

Included in mapping are areas of less sloping Hazen cobbly loam and noncobbly Hazen soils. Also included are areas of Hero soils in slight depressions.

Permeability and the available water capacity are moderate. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to slightly acid, if lime is not applied.

Many areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle, and some are in urban use.

This soil has only fair potential for corn, small grains, and hay. Where cobblestone content is highest, cultivation is very difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, minimum tillage, and the use of grass and legume sod in the cropping system can help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Lime and fertilizer should be applied periodically for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Cobblestones can limit the use of some seeding equipment.

This soil is well suited to woodland use. Production is fair, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

The soil is limited for urban use, including playgrounds and campsites, because of the cobblestones and frost action potential. Capability unit IIIs-19; woodland subclass 3o.

HfA—Hazen gravelly loam, 0 to 3 percent slopes. This nearly level, well drained, deep soil is on long, broad to nearly oval outwash terraces and on stream terraces. The areas are 5 to 40 acres or more in size. Along some streams, some areas are subject to infrequent flooding.

Typically, the surface layer is very dark grayish brown, gravelly loam about 8 inches thick. The subsoil is yellowish brown and dark brown, gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown, gravelly sand and very gravelly sand to a depth of 70 inches or more.

Included in mapping are areas of Hazen loam, 0 to 3 percent slopes and more sloping Hazen gravelly loam. Also included are areas of Hero soils in slight depressions, in seep spots along the boundary with more sloping soils, and in areas of transition to Fredon or Halsey soils.

Permeability and the available water capacity are moderate. Runoff is very slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban use or are used as a source of sand or gravel. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, vegetables, hay, and nursery stock. Where gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and use of grass and legume sod in the cropping system can help to maintain soil structure. Periodic applications of lime and fertilizer are needed for optimum production. Irrigation can benefit most crops.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is fair, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban use because of the frost action potential. Capability unit I-6; woodland subclass 3o.

HfB—Hazen gravelly loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on long, broad, to nearly oval, undulating outwash and stream terraces. The areas are 5 to 40 acres or more in size.

Typically, the surface layer is very dark grayish brown, gravelly loam about 8 inches thick. The subsoil is yellowish brown and dark brown, gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly sand, to very gravelly sand to a depth of 70 inches or more.

Included in mapping are less sloping and more sloping areas of Hazen soils. Also included are small areas of Hero soils in slight depressions, along the boundary with more sloping soils, and in areas of transition to Fredon or Halsey soils.

Permeability and the available water capactiy are moderate. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural

fertility is medium. Reaction is medium acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban use. A small acreage is woodland or is idle.

This soil has good potential for corn, small grains, vegetables, hay, and nursery stock. Where gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system helps to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production. Irrigation is beneficial to high-value crops.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and there are no limitations for woodland managment. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban use, including playgrounds, building foundations, and roads, because of the slope, gravel content, and frost action potential. Capability unit IIe-6; woodland subclass 3o.

HfC—Hazen gravelly loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on low kames. The areas are irregular in shape and in length and are 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, gravelly loam about 6 inches thick. The subsoil is yellowish brown and dark brown, gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly sand to a depth of 70 inches or more.

Included in mapping are areas of Hazen loam and areas of the less sloping Hazen gravelly loam. Also included are areas of seepy Hero soils along the contact with wetter soils and in some closed depressions. Some eroded cropland is also included.

Permeability and the available water capacity are moderate. Runoff is medium, and the hazard of erosion is moderate. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to slightly acid, if lime is not applied.

Many areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle. A small acreage is in urban uses.

This soil has fair potential for corn, small grains, and hay. Where gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production. Irrigation is beneficial to high-value crops.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses, including playgrounds, building foundations, and roads, because of the slope, gravel content, and frost action potential. Capability unit IIIe-6; woodland subclass 3o.

HfD—Hazen gravelly loam, 15 to 25 percent slopes. This steep, well drained, deep soil is on kames and hillsides. It generally is oriented in a northeast to southwest direction. The areas are irregular in shape and in length and are 10 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, gravelly loam about 6 inches thick. The subsoil is yellowish brown and dark brown, gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly sand to a depth of 70 inches or more.

Included in mapping are the less sloping Hazen soils and soils similar to this Hazen soil except that the solum is 20 inches or less thick. Also included are isolated areas of limestone ledge, generally along the top of the landscape.

Permeability and the available water capacity are moderate. Runoff is rapid, and the hazard of erosion is high. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to slightly acid, if lime is not applied.

Many areas have been cleared of trees for use as cropland and pasture. Extensive areas are woodland, or they are idle. Very little acreage is in urban use.

This soil has poor potential for corn, small grains, and hay because of the high hazard of erosion. It is not suited to continuous row cropping. It could be used for hay production, but the steep slopes are difficult to work. Diversion terraces and grassed waterways are needed in most areas to control runoff and erosion. Because the slopes are steep there are some equipment-use limitations.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is fair, but the equipment-use limitations are moderate because of the steep slopes. The hazard of erosion is slight because of the forest cover. Care is needed, however, to prevent water from collecting on the harvesting skid trails. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban use because of the steep slopes, the hazard of erosion, and frost action potential. If the vegetative cover is removed, the hazard of erosion is high. Capability unit IVe-6; woodland subclass 3r.

HfE—Hazen gravelly loam, 25 to 40 percent slopes. This very steep, well drained, deep soil is on kames and ground moraines. It generally is oriented in a northeast to southwest direction. The areas are irregular in shape and in length and are 10 to 40 acres or more in size.

Typically, the surface layer is very dark grayish brown, gravelly loam about 5 inches thick. The subsoil is yellowish brown and dark brown, gravelly loam about 22 inches thick. The substratum is stratified layers of dark brown gravelly sand to a depth of 70 inches or more.

Included in mapping are areas of soils similar to Hazen soils, except that they are 20 inches or less deep to stratified sand and gravel. In some areas, gravel is dominant in the substratum instead of sand. Also included are isolated areas of limestone ledge, generally along the top of the landscape.

Permeability and the available water capacity are moderate. Runoff is very rapid, and the hazard of erosion is very high if the vegetative cover is removed. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to slightly acid, if lime is not applied.

Most areas are woodland or pasture.

This soil is so steep that it is poorly suited to cropland. The hazard of erosion is very high. Because the slopes are very steep, equipment-use limitations are severe.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Because of the very steep slopes there are equipment-use limitations, and the hazard of erosion is very high if this soil is prepared for reseeding.

This soil is suited to use as woodland. Production is fair, but the equipment-use limitations are severe because of the very steep slopes. The hazard of erosion is moderate under woodland cover. Care is needed to prevent water from collecting on the harvesting skid trails. Hand planting is necessary in most places because the slopes are very steep. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban use because of the very steep slopes, the hazard of erosion, and the frost action potential. If vegetative cover is removed, the hazard of erosion is very high. Capability unit VIe-6; woodland subclass 3r.

HkA—Hero loam, 0 to 3 percent slopes. This nearly level, moderately well drained, deep soil is on broad, nearly oval or long, narrow outwash terraces and stream terraces. The areas are 5 to 15 acres or more in size. Areas adjacent to major streams are subject to occasional flooding.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is dark yellowish brown, fine sandy loam and gravelly fine sandy loam 20 inches thick and has mottles in the lower part. The substratum is mottled, dark grayish brown, stratified gravelly loamy sand to a depth of 65 inches or more.

Included in mapping are Hero soils that have a surface layer of gravelly loam or gravelly fine sandy loam. Also included are areas of Hazen and Palmyra soils in the highest positions and areas of Fredon and Halsey soils in low positions.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The soil has a moderately high seasonal water table from November to April. The available water capacity is moderate, but additional water is available because of the seasonal water table. Irrigation generally benefits the high-value vegetable crops. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to neutral in the solum and medium acid to mildly alkaline in the substratum, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle, and some are in urban uses.

This soil has fair potential for corn, small grains, soybeans, hay, and vegetables. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Subsurface drains can improve drainage. Early plantings can be delayed unless drainage is improved. Diversion terraces and grassed waterways can be effective in controlling excess runoff. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and there are no limitations for woodland management. Planting equipment can be used, although excess surface water may delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the moderately high seasonal water table, the flooding hazard, and the high frost action potential. Capability unit IIw-25; woodland subclass 3o.

HkB—Hero loam, 3 to 8 percent slopes. This gently sloping, moderately well drained, deep soil is on broad, nearly oval or long, narrow outwash terraces of stream terraces. The areas are 5 to 10 acres or more in size.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is dark yellowish brown, fine sandy loam and gravelly fine sandy loam 20 inches thick and has mottles in the lower part. The substratum is mottled, dark grayish brown, stratified gravelly loamy sand to a depth of 65 inches or more.

Included in mapping are areas of Hero gravelly loam and gravelly fine sandy loam. Also included are areas of Hazen and Palmyra soils in high positions, and areas of Fredon and Halsey soils in low positions.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The soil has a moderately high seasonal water table from November to April. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to neutral in the surface layer and subsoil and medium acid to mildly alkaline in the substratum, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle, and some are in urban use.

This soil has fair potential for corn, small grains, soybeans, hay, and vegetables. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Underground drains and surface smoothing can improve drainage. Early plantings can be delayed unless drainage is improved. Contour farming, stripcropping, grassed waterways, and cropland terraces and diversion terraces can be effective in controlling excess runoff and in reducing erosion. Periodic applications of lime and fertilizers are needed for optimum production. Irrigation is generally profitable if high-value vegetable crops are grown.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and there are no limitations for woodland management. Planting equipment can be used, though excess surface water may delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This soil has limitations for urban uses, including onsite sewage disposal, building foundations, and roads, because of the moderately high seasonal water table and high frost action potential. Capability unit IIw-25; woodland subclass 3o.

HrA—Hero gravelly loam, 0 to 3 percent slopes. This nearly level, moderately well drained, deep soil is on broad, nearly oval outwash terraces and long, narrow stream terraces. The areas are 5 to 15 acres or more in size. Areas adjacent to major streams are subject to occasional flooding.

Typically, the surface layer is dark brown, gravelly loam about 10 inches thick. The subsoil is dark yellowish brown, fine sandy loam and gravelly fine sandy loam 20 inches thick and has mottles in the lower part. The substratum is mottled, dark grayish brown, stratified gravelly loamy sand to a depth of 65 inches or more.

Included in mapping are areas of Hero loam, fine sandy loam, and cobbly loam. Also included is a gravelly loam soil that has a moderately expressed firm layer, areas of well drained Hazen and Palmyra soils in high positions, and areas of Fredon and Halsey soils in low positions.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The soil has a moderately high seasonal water table from November to April. The available water capacity is moderate, but additional water is available because of the seasonal water table. Irrigation is generally profitable if high-value crops are grown. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to neutral in the solum and medium acid to mildly alkaline in the substratum, if lime is not applied.

Most areas have been cleared of trees for use as cropland or pasture. Some areas are in urban use. A small acreage is woodland or is idle.

This soil has fair potential for corn, small grains, soybeans, hay, and vegetables. Where the gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Underground drains and surface smoothing can improve drainage. Early plantings can be delayed unless drainage is improved. Diversion terraces and grassed waterways can be effective in controlling excess runoff. Periodic applications of lime and fertilizer are need for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is fair, and there are no limitations for woodland management. Planting equipment can be used, though excess surface water can delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the moderately high seasonal water table, flooding hazard, and high frost action potential. Capability unit IIw-25; woodland subclass 3o.

HrB—Hero gravelly loam, 3 to 8 percent slopes. This gently sloping, moderately well drained, deep soil is on broad, glacial outwash terraces and long, narrow stream terraces. The areas are 5 to 15 acres or more in size.

Typically, the surface layer is dark brown, gravelly loam about 10 inches thick. The subsoil is dark yellowish brown, fine sandy loam and gravelly fine sandy loam 20 inches thick and has mottles in the lower part. The substratum is mottled, dark grayish brown, stratified gravelly loamy sand to a depth of 65 inches or more.

Included in mapping are areas of Hero soils that have a loam, fine sandy loam, and cobbly loam surface layer. Also included are a gravelly loam soil that has a moderately expressed firm layer, areas of Hazen soils in high positions, and areas of Fredon and Halsey soils in low positions.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. The soil has a moderately high seasonal water table. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is medium acid to neutral in the surface layer and subsoil and medium acid to slightly alkaline in the substratum, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle, and some are in urban use.

This soil has fair potential for corn, small grains, and hay. Where gravel content is highest, cultivation is difficult. The main problem is the moderately high seasonal water table, which can be lowered by underground drains and surface smoothing. Early plantings can be delayed if drainage is not improved. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is fair, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the moderately high seasonal water table and high frost action potential. Capability unit IIw-25; woodland subclass 3o.

LyA—Lyons silt loam, 0 to 4 percent slopes. This nearly level, poorly drained and very poorly drained, deep soil is in depressions and waterways on the uplands. The areas are broad and long or long and narrow and are 5 to 15 acres or more in size. Along the major tributaries, this soil is subject to frequent flooding.

Typically, the surface layer is very dark brown silt loam about 12 inches thick. The subsoil is mottled, light olive gray clay loam and silt loam about 14 inches thick. The substratum is very firm, gray, gravelly silt loam to a depth of 60 inches or more.

Included in mapping are areas of Adrian muck in some depressions, isolated areas of soils that formed in slackwater sediment, and some low dome-shaped areas of Bartley soils.

Permeability is slow. This soil has a seasonal high water table that is at or near the surface from November to June. The available water capacity is moderate, but additional water is available because of the high water table. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of 4 to 6 feet or more. Natural fertility is high. Reaction is medium acid to neutral in the surface layer and subsoil and medium acid to midly alkaline in the substratum, if lime is not applied.

Most areas are woodland. Some areas have been cleared for use as cropland and pasture, and some areas are in urban uses.

This soil has poor potential for crops, wetness is the main limitation. If drained, it is suited to corn and hay. Drainage outlets are not available everywhere. Deep ditches can improve drainage, but tile drains generally are not effective because permeability is slow. Diversions can be used in places to distribute some of the runoff. The risk of crop damage remains even if drainage is improved. This soil is suited to excavated irrigation and wildlife ponds.

If drained, this soil is suited to tall grass or permanent bluegrass pasture. In the wettest areas, it is suited to Reed canarygrass. The major management needs are improving drainage, maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to trees. Production is poor, and equipment-use limitations and the windthrow hazard are severe. The most common trees are red maple, swamp white oak, black birch, white ash, pin oak, hickory, white oak, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the flooding hazard, seasonal high water table, and frost action potential. Capability unit IVw-44, woodland sublcass 5w.

LzB—Lyons very stony silt loam, 3 to 8 percent slopes. This gently sloping, poorly drained and very poorly drained deep soil is in depressions and waterways on the uplands. The areas are 5 to 15 acres or more in size.

Typically, the surface layer is very dark brown very stony silt loam about 12 inches thick. The subsoil is light olive gray clay loam and silt loam about 14 inches thick; it has strong brown mottles. The substratum is very firm, gray, gravelly silt loam to a depth of 60 inches or more.

Included with this soil in mapping are poorly drained and very poorly drained soils on the flood plains of major streams, pockets of Adrian muck and shallow muck in small isolated areas, and a few areas of Lyons soils, 8 to 15 percent slopes.

Permeability is slow. A seasonal high water table is at or near the surface from November to June. The available water capacity is moderate, but additional water is available because of the high water table. In most places, bedrock is at a depth of 4 to 6 feet or more. Natural fertility is medium. Reaction is medium acid to neutral in the surface layer and subsoil and medium acid to mildly alkaline in the substratum, if lime has not been applied.

Most areas of this soil are woodland or pasture. A small acreage is idle or is in urban uses.

This soil is not suited to crop production, but if it is cleared of stones and is drained it is suited to corn and hay. Even if the soil is drained, however, wetness can delay planting and can damage crops. Deep ditches can be used to drain this soil if outlets are available. If this soil is farmed, runoff is slow and the hazard of erosion is slight. Periodic applications of lime and fertilizer are needed for optimum production. This soil is suited to ground-water ponds.

If drained, this soil is suited to tall grass or permanent bluegrass pasture. Stones on the surface limit the use of equipment. The major management needs are proper stocking rates to maintain desirable plant species, rotation of pastures, and periodic applications of lime and fertilizer.

This soil is also suited to use as woodland, but production is poor and there are equipment-use limitations. The most common trees are swamp white oak, red maple, white oak, hickory, white ash, black birch, beech, and sugar maple .

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the flooding hazard, the high water table, stones, slow permeability, and high frost action potential. Capability unit VIIs-45; woodland subclass 5w.

Md—Middlebury loam. This nearly level, moderately well drained or somewhat poorly drained, deep soil is on flood plains that are subject to occasional flooding. The areas are long and narrow and irregular and fingerlike and are 5 to 20 acres or more in size.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is mottled, dark yellowish brown loam about 10 inches thick. The substratum, to a depth of 62 inches, is stratified, mottled, brown fine sandy loam and grayish brown loamy sand.

Included in mapping are areas of a soil that has a loamy fine sand and fine sand substratum, areas of Hazen soils in slightly raised areas and on gravel bars, and Wayland soils in depressions. Also included are a few areas of Middlebury stony loam.

Permeability is moderate. The soil has a moderately high seasonal water table from February to April. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is very slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas are woodland. Some areas have been cleared for use as cropland or pasture.

This soil has fair potential for corn, small grains, soybeans, and hay. Flood damage can be expected every 3 or 4 years. Deep ditches can improve drainage. Early plantings can be delayed unless drainage is improved.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, and the limitations are slight for woodland management. Planting equipment can be used, although excess surface water may delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the flooding hazard, moderately high seasonal water table, and frost action potential. Capability unit IIw-32; woodland subclass 1o.

NaC—Nassau rocky silt loam, 8 to 15 percent slopes. This is a sloping, somewhat excessively drained, shallow soil on angular hillsides. The areas are 5 to 20 acres or more in size, and slate and shale bedrock outcrops in about 5 percent of the areas (fig. 5).

Typically, the surface layer is very dark grayish brown, shaly silt loam about 6 inches thick. The subsoil is yellowish brown, very shaly silt loam about 12 inches thick. Weathered shale and slate are at a depth of 18 inches.

Included in mapping are small areas of moderately deep and deep, well drained soils and a few areas of Bath and Venango soils in low positions. Also included are some severely eroded areas and some very shaly areas that have moderately rapid permeability.

Permeability is moderate. The available water capacity is very low. Runoff is medium, and the hazard of erosion is moderate. In most places, bedrock is at depth of less than 20 inches. Natural fertility is medium. Reaction is strongly acid, if lime is not applied.

Many areas have been cleared of trees for use as cropland and pasture. Other areas are woodland or are idle. A small acreage is in urban use.

This soil has poor potential for corn, small grains, and hay because of the very low available water capacity. The bedrock outcrops reduce suitability for crop production and make planting and cultivation difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Because of very low available water capacity, pasture yields are low.

This soil is suited to use as woodland. Production is poor because of the low available water capacity. The rooting depth is restricted by the shallow depth to bedrock. The most common trees are white oak, black oak, chestnut oak, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the shallow depth to hard bedrock, the slope, and the hazard of erosion. Capability unit IVe-15; woodland subclass 5d.

NbB—Nassau shaly silt loam, 3 to 8 percent slopes. This gently sloping, somewhat excessively drained, shallow soil is on broad, angular, convex uplands. The areas are 5 to 20 acres or more in size.

Typically, the surface layer is very dark grayish brown, shaly silt loam about 6 inches thick. The subsoil is yellowish brown, very shaly silt loam about 12 inches thick. Weathered shale and slate are at a depth of 18 inches.

Included in mapping are areas of Bath soils and moderately deep, well drained soils similar to this Nassau soil except that they have fewer coarse fragments. Also included are areas of Venango soils in low positions. Rock outcrop makes up about 5 percent of the mapped area. Also included are some very shaly soils that have moderately rapid permeability.

Permeability is moderate. The available water capacity is very low. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of less than 20 inches. Root penetration is restricted by the hard bedrock. Natural fertility is medium. Reaction is strongly acid, if lime is not applied.

Many areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle, and some are in urban use.

This soil has poor potential for corn, small grains, and hay. Where shale content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Because of the very low available water capacity, pasture yields are low.

This soil is suited to woodland use. Production is poor because of the low available water capacity. Rooting depth is restricted by the shallow depth to bedrock. The most common trees are white oak, black oak, chestnut oak, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the shallow depth to hard bedrock. Capability unit IIIe-15; woodland subclass 5d.

NFD—Nassau-Rock outcrop complex, 15 to 25 percent slopes. This complex is made up of steep, somewhat excessively drained, shallow Nassau soils and Rock outcrop. It is on hills that are inclined in many directions because of irregular exposures of bedrock. Most areas are long and oval and are 5 to 40 acres in size.

This complex is about 75 percent Nassau soils, 10 percent Rock outcrop, and 15 percent other soils.

The soils and Rock outcrop occur in such an intricate pattern that it was not practical to map them separately.

Typically, the surface layer of the Nassau soil is very dark grayish brown, shaly silt loam about 4 inches thick. The subsoil is yellowish brown, very shaly silt loam about 12 inches thick. Weathered shale and slate are at a depth of 16 inches. Rock outcrop consists of interbedded slate and shale. Generally, the upper 2 to 4 feet are partially weathered or weathered and rippable.

Included in mapping are areas of moderately deep and deep, well drained soils that do not have a fragipan, a few areas of Bath soils in gently sloping areas between complex slopes, and areas of somewhat poorly drained Venango soils and poorly drained Chippewa soils in closed depressions. Also included are some eroded areas.

Permeability is moderate. The available water capacity is very low. On farmed soils, runoff is rapid, and the hazard of erosion is high. In most places, bedrock is at a depth of less than 20 inches. Root penetration is restricted by the shallow depth to bedrock. Natural fertility is medium. Reaction is strongly acid, if lime is not applied.

Most areas are pasture or woodland. Only minor areas have been cleared for use as cropland. Very little acreage is in urban use.

This complex has poor potential for corn, small grains, and hay because of the high hazard of erosion and the shallow depth to bedrock. It is not suited to continuous row cropping. It could be used for hay production, but because of the steep slopes and the rock outcrop these areas are difficult to work. Diversion terraces and grassed waterways are needed in most areas to control runoff and erosion.

These soils are suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Because the depth to bedrock is shallow, yields are low.

This complex is suited to use as woodland. Production is poor because of the shallow depth to bedrock. There are equipment-use limitations because of the steep slopes. Rooting depth is restricted by the shallow depth to bedrock. The hazard of erosion is slight because of the forest cover. Care is needed, however, to prevent water from collecting on the harvesting skid trails. The most common trees are white oak, black oak, chestnut oak, black birch, and beech.

This complex is limited for urban uses because of the shallow depth to bedrock, steep slopes, and rock outcrops. If the vegetative cover is removed, this complex has a high hazard of erosion. Capability unit VIs-15; woodland subclass 5d.

NFE—Nassau-Rock outcrop complex, 25 to 45 percent slopes. This complex is made up of a very steep, somewhat excessively drained, shallow Nassau soil and Rock outcrop. It is on hills that are inclined in many directions because of irregular exposures of bedrock. Most areas are long and oval and are 5 to 30 acres of more in size.

This complex is about 70 percent Nassau soil, 20 percent Rock outcrop, and about 10 percent other soils.

The soils and Rock outcrop occur in such an intricate pattern that it was not practical to map them separately.

Typically, the surface layer of the Nassau soil is very dark grayish brown, shaly silt loam about 4 inches thick. The subsoil is yellowish brown, very shaly silt loam about 12 inches thick. Weathered shale and slate are at a depth of 16 inches. Rock outcrop consists of interbedded slate and shale. Generally, the upper 2 to 4 feet are partially weathered or weathered and rippable.

Included in mapping are areas of moderately deep and deep, well drained soils that do not have a fragipan, a few areas of Bath soils in gently sloping and sloping areas between complex hilly slopes, and areas of Venango soils in depressions.

Permeability is moderate in the Nassau soil. The available water capacity is very low. Where this soil is bare, runoff is very rapid and the hazard of erosion is very high. In most places, bedrock is at a depth of less than 20 inches. Root penetration is restricted by the shallow depth to bedrock. Natural fertility is medium. Reaction is strongly acid, if lime is not applied.

Most areas are woodland or pasture.

Because of the steepness, this complex is poorly suited to use as cropland. The hazard of erosion is high in plowed areas, and the equipment-use limitations are severe because of the slope.

This complex is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. Because of the very steep slopes, the use of equipment is limited. The hazard of erosion is high when this soil must be prepared for reseeding. Because the available water capacity is low, yields are low.

This complex is suited to use as woodland, but production is poor because of the very steep slopes. The hazard of erosion is moderate under woodland cover. Care is needed to prevent water from collecting on the harvesting skid trails. Hand planting is necessary in most places, because of the very steep slopes and bedrock outcrop. The rooting depth is restricted by the shallow depth to bedrock. The most common trees are white oak, black oak, chestnut oak, black birch, and beech.

This complex is limited for urban use, because of the very steep slopes, the hazard of erosion, shallow depth to bedrock, and bedrock outcrops. If vegetative cover is removed, the hazard of erosion is very high. Capability unit VIIs-21; woodland subclass 5d.

ORD—Oquaga-Swartswood-Rock outcrop association, steep. This association is made up of steep, well drained and moderately well drained, moderately deep and deep soils and Rock outcrop on the crest and side slopes of drumlins that generally are oriented in a northeast to southwest direction. Stones cover as much as 15 percent of the surface.

This association is about 65 percent moderately well drained, deep Oquaga soils; 25 percent deep, well drained and moderately well drained Swartswood soils; and 10 percent red sandstone and red shale Rock out-

crop and soils that are less than 20 inches deep. The areas are 20 to 50 acres or more in size.

Typically, the surface layer of the Oquaga soils in a wooded area is pinkish gray channery loam 4 inches thick. The subsoil is brown and reddish brown channery loam about 20 inches thick. The substratum is brown very channery loam about 6 inches thick. Shale and sandstone bedrock are at a depth of 30 inches. Permeability and the available water capacity are moderate. Natural fertility is medium.

Typically, the surface layer of the Swartswood soils in a wooded area is dark brown gravelly loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown and light yellowish brown gravelly loam about 20 inches thick, and the lower part is a very firm, brittle, reddish brown gravelly loam fragipan that extends to a depth of 70 inches.

Rock outcrop consists of interbedded slate and sandstone. In some areas the upper part of the outcrop is rippable, and in other areas it is not.

Included in mapping are scattered areas of deep, well drained soils that do not have a fragipan and areas of Wurtsboro and Chippewa soils in low positions on the landscape.

Some areas of this association are dominantly Oquaga soils, some are dominantly Swartswood soils, and a few are dominantly Rock outcrop, but both soils and Rock outcrop occur in each area.

The Oquaga soils have moderate permeability. The available water capacity is moderate. Natural fertility is low. The surface is extremely stony. Reaction is strongly acid or very strongly acid, if lime has not been applied.

The Swartswood soils have moderate permeability above the fragipan and moderately slow or slow permeability in the fragipan. The available water capacity is moderate, and natural fertility is medium. The surface is very stony or extremely stony. Reaction is very strongly acid, if lime has not been applied.

Most of the acreage is woodland, and much of the woodland is in state forests, national parks, or watershed protection land.

The soils in this association are not suited to cultivated crops. The potential for pasture is limited by the steep slopes, numerous stones, and rock outcrops. Clover, birdsfoot trefoil, orchardgrass, and bromegrass are the most suitable pasture plants.

The soils are suited to trees. Production is fair, but the use of harvesting and planting equipment is limited. The most common trees are black oak, white oak, chestnut oak, northern red oak, black birch, and white ash. Capability unit VIIs-22; woodland subclass 3x.

PaA—Palmyra gravelly fine sandy loam, 0 to 3 percent slopes. This is a nearly level, well drained, deep soil on glacial outwash terraces and stream terraces. The areas are nearly oval or long and broad and are 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, gravelly fine sandy loam 8 inches thick. The subsurface layer is grayish brown, gravelly fine sandy loam 4 inches thick. The subsoil is dark brown, gravelly fine sandy loam about 14 inches thick. The substratum is stratified, calcareous, grayish brown, gravelly fine sand to a depth of 60 inches or more.

Included in mapping are areas of Hero soils, mainly in low positions and in slight depressions. Also included are areas of more sloping Palmyra soils and areas of Hazen soils.

Permeability is moderate in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Irrigation generally benefits the high-value vegetable crops. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction ranges from slightly acid in the surface layer to mildly alkaline in the substratum, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. A small acreage is woodland. Some areas are in urban use.

This soil has good potential for corn, small grains, soybeans, hay, and vegetables. Where gravel content is high, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, hickory, black birch, and beech.

This soil has few or no limitations for urban use. Capability unit I-6; woodland subclass 2o.

PaB—Palmyra gravelly sandy loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on glacial outwash terraces and stream terraces. The areas are nearly oval or long and broad and are 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, gravelly fine sandy loam 8 inches thick. The subsurface layer is grayish brown, gravelly fine sandy loam 4 inches thick. The subsoil is dark brown, gravelly fine sandy loam about 14 inches thick. The substratum is stratified, calcareous, grayish brown, gravelly fine sand to a depth of 60 inches or more.

Included in mapping are areas of nearly level Palmyra soils; some areas of stony Palmyra soils, generally at the

base of other steep stony soils; and small areas of Hero soils, mainly in low positions in slight depressions.

Permeability is moderate in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Irrigation generally benefits the high-value vegetable crops. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is slightly acid in the surface layer and subsoil and mildly alkaline in the substratum, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban use. A small acreage is woodland.

The soil has good potential for corn, small grains, soybeans, hay, and vegetables. Where gravel content is high, it interferes with cultivation. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Contour planting, stripcropping, and cropland terraces can reduce the hazard of erosion. Diversion terraces and grassed waterways are effective in controlling excess runoff. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major managment need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, and there are no limitations for woodland management. The most common trees are northern oak, white oak, yellow-poplar, white ash, hickory, black birch, and beech.

This soil has few limitations for urban use. Capability unit IIe-6; woodland subclass 2o.

PbD—Parker gravelly sandy loam, 15 to 25 percent slopes. This steep, somewhat excessively drained, deep soil is on upland ridges and side slopes. The areas are long and narrow and are 10 to 20 acres in size.

Typically, the surface layer is dark brown, gravelly sandy loam about 6 inches thick. The subsoil is dark brown, gravelly loam about 24 inches thick. The substratum, to a depth of 60 inches or more, is brown, very gravelly loam that contains about 70 percent slightly weathered pieces of gneissic stones and pebbles.

Included in mapping are small areas of soils that are similar to Parker soils, except that they are moderately deep to bedrock, and some very stony and extremely stony Parker and Edneyville soils. Also included are areas of less sloping and areas of steeper Edneyville and Annandale soils.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is low. Runoff is rapid, and the hazard of erosion is high where the soil is bare. Bedrock is at a depth of 4 to 6 feet or more. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

Most areas are woodland. Some areas have been cleared of trees for use as cropland or pasture. Very little of the acreage is in urban use.

This soil has poor potential for corn, small grains, and hay, because of the high hazard of erosion. It is not suited to continuous row cropping. It can be used for hay, but the steep slopes are difficult to work. Diversion terraces and grassed waterways are needed in most areas to control runoff and erosion.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is fair, but there are equipment-use limitations because of the steep slopes. Available water capacity is low. The hazard of erosion is moderate because of the forest cover. Care is needed, however, to prevent water from collecting on the harvesting skid trails. The most common trees are northern red oak, white oak, black oak, chestnut oak, yellow-poplar, white ash, hickory, black birch, and beech.

This soil is limited for urban use, because of the steep slopes. If the vegetative cover is removed, the hazard of erosion is high. Capability unit IVe-58; woodland subclass 3f.

PbE—Parker gravelly sandy loam, 25 to 40 percent slopes. This is a very steep, somewhat excessively drained, deep soil on upland ridges. The areas are long and narrow to broad and are 10 to 30 acres or more in size.

Typically, the surface layer is dark brown, gravelly sandy loam about 5 inches thick. The subsoil is dark brown, gravelly loam about 24 inches thick. The substratum, to a depth of 60 inches, is brown, very gravelly loam that has about 70 percent slightly weathered pieces of gneissic stones and pebbles.

Included in mapping are areas of soils similar to Parker soils, except that they are moderately deep to bedrock, and very stony and extremely stony Parker and Edneyville soils. Also included are areas of gneissic bedrock outcrops, generally along crests.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is low. Runoff is very rapid, and the hazard of erosion is very high where the soil is bare. Bedrock is at a depth of 4 to 6 feet or more. Natural fertility is medium. Reaction is very strongly acid to strongly acid, if lime is not applied.

Most areas are woodland or pasture.

This soil is so steep that it is poorly suited to cropland. The hazard of erosion is high in plowed areas, and

because of the slopes the use of equipment is severely limited.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer. The very steep slopes and the stones limit the use of equipment. The hazard of erosion is high if this soil is prepared for reseeding.

This soil is suited to use as woodland. Production is fair, but equipment-use limitations are severe because of the very steep slopes. The hazard of erosion is moderate under woodland cover. Care is needed to prevent water from collecting on the harvesting skid trails. Hand planting is necessary in most places because of the very steep slopes. The most common trees are northern red oak, white oak, black oak, chestnut oak, yellow-poplar, white ash, hickory, black birch, and beech.

This soil is limited for urban uses because of the very steep slopes and the hazard of erosion. If vegetative cover is removed, the hazard of erosion is very high. Capability unit VIe-58; woodland subclass 3f.

Pc—Pits, muck. This map unit consists of abandoned pits that result from the mining of muck and peat. The pits are in areas of Carlisle and Adrian soils. They generally contain water, at least in spring; occasionally they are ponded all year. Capability unit and woodland subclass not assigned.

Pd—Pits, sand and gravel. This map unit consists of active and abandoned pits and adjoining areas of fill from overburden that result from the mining of sand and gravel. Most of the sand and gravel pits are in areas of Hazen, Pope, and Palmyra soils; a few pits are in areas of Hero soils. No pits are in the wet soils that would need dredging or suction equipment. Sand and gravel pits are the most extensive kinds of pits and are commonly associated with glacial outwash material, which is deposited in strata. Also included, in areas of Edneyville, Swartswood, and Wassaic soils, are some pits in unsorted material from which soil material has been taken.

Sand and gravel pits are frequently difficult to renovate because of low fertility, unless the soil overburden has been put into stock piles. Many pits have not been renovated. Capability unit and woodland subclass not assigned.

PnA—Pope fine sandy loam, high bottom, 0 to 3 percent slopes. This nearly level, well drained, deep soil is on broad terraces along the Delaware River. The areas are 15 to 50 acres or more in size. Most are at an elevation high enough above stream level that they are subject to flooding only about 1 year in 50 to 100 years.

Typically, the surface layer is dark brown, fine sandy loam about 9 inches thick. The subsoil is dark brown, friable, fine sandy loam about 27 inches thick. The substratum is dark reddish brown, light fine sandy loam to a depth of 65 inches or more.

Included in mapping are some areas of Pope gravelly fine sandy loam; some areas of soils similar to Pope soils, except that they have a sand or loamy sand substratum below a depth of 30 inches; and soils in low positions that have a seasonal water table. These areas may need to have the drainage improved.

Permeability is moderately rapid. The available water capacity is moderate. Irrigation generally benefits the high-value vegetable crops. Runoff is very slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is strongly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland. Some areas are in urban use. A small acreage is pasture and woodland.

This soil has good potential for corn, small grains, soybeans, hay, vegetables, and nursery stock. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses because of the hazard of flooding and frost action potential. Capability unit I-57; woodland subclass 2o.

PnB—Pope fine sandy loam, high bottom, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on broad terraces along the Delaware River. The areas are 15 to 50 acres or more in size. Most are at an elevation high enough above the stream level that they are subject to flooding only about 1 year in 50 to 100 years.

Typically, the surface layer is dark brown, fine sandy loam about 9 inches thick. The subsoil is dark brown, friable, fine sandy loam about 27 inches thick. The substratum is dark reddish brown, light fine sandy loam to a depth of 65 inches or more.

Included in mapping are areas of Pope gravelly fine sandy loam; some areas similar to Pope soils, except that they have a sand or loamy sand substratum below a depth of 30 to 40 inches; and soils, in slight depressions, that have a seasonal water table. Also included are some areas that are occasionally flooded.

Permeability is moderately rapid. The available water capacity is moderate. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is strongly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland. Some areas are pasture or woodland, and some are in urban use.

This soil has good potential for corn, soybeans, small grains, hay, vegetables, and nursery stock. Where gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system can maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses because of the flood hazard and frost action potential. Capability unit IIe-57; woodland subclass 2o.

PoA—Pope gravelly fine sandy loam, high bottom, 0 to 3 percent slopes. This nearly level, well drained, deep soil is on broad terraces along the Delaware River. The areas are 15 to 50 acres is size. Most are at an elevation high enough above stream level that they are subject to flooding only about 1 year in 50 to 100 years.

Typically, the surface layer is dark brown, gravelly fine sandy loam about 9 inches thick. The subsoil is dark brown, friable, gravelly fine sandy loam about 27 inches thick. The substratum is dark reddish brown, gravelly light fine sandy loam to a depth of 65 inches or more.

Included in mapping are soils similar to Pope soils, except that they have a sand or loamy sand substratum below 30 inches; areas of Pope fine sandy loam; and soils, in slight depressions and natural waterways, that have a seasonal high water table. These areas may need to have the drainage improved.

Permeability is moderate, and the available water capacity is moderate. Irrigation generally benefits the high-value crops. Runoff is very slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is strongly acid if lime is not applied.

Most areas have been cleared of trees for use as cropland. Some areas are pasture or woodland, and some are in urban use.

The soil has good potential for corn, small grains, soybeans, hay, vegetables, and nursery stock. Where gravel content is high, it interferes with cultivation and reduces the available water capacity. Maintaining the organic-matter content can help to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotation pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the hazard of infrequent flooding and frost action potential. Capability unit I-57; woodland subclass 2o.

PoB—Pope gravelly fine sandy loam, high bottom, 3 to 8 percent slopes. This gently sloping, nearly level, well drained, deep soil is on broad river terraces along the Delaware River. The areas are 15 to 50 acres in size. Most are at an elevation high enough above the stream level that they are subject to flooding only about 1 year in 50 to 100 years.

Typically, the surface layer is dark brown, gravelly fine sandy loam about 9 inches thick. The subsoil is dark brown, friable, gravelly fine sandy loam about 27 inches thick. The substratum is dark reddish brown, gravelly light fine sandy loam to a depth of 65 inches or more.

Included in mapping are soils similar to Pope soils, except that they have a sand or loamy sand substratum below 30 inches; areas of Pope fine sandy loam; and soils, in slight depressions and natural waterways, that have a seasonal high water table. These areas may need improved drainage. Also included are some areas that are occasionally flooded.

Permeability is moderate, and the available water capacity is moderate. Runoff is slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 6 feet. Natural fertility is medium. Reaction is strongly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland. Some areas are pasture or woodland, and some are in urban uses.

This soil has good potential for corn, soybeans, small grains, hay, vegetables, and nursery stock. Where gravel content is highest, it interferes with cultivation. Maintain-

ing the organic-matter content can help to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system can maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pasture, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, black oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the hazard of infrequent flooding and frost action potential. Capability unit IIe-57; woodland subclass 2o.

RcD—Rockaway very stony loam, 8 to 25 percent slopes. This sloping to steep, well drained and moderately well drained soil is on crests and side slopes of younger glaciated landscapes that generally are oriented in a northeast to southwest direction. Stones cover as much as 3 percent of the surface and are 5 to 30 feet apart. The areas are 20 to 40 acres or more in size. This soil has a fragipan in the lower part of the subsoil and in the substratum.

Typically, the surface layer is very dark grayish brown gravelly loam about 4 inches thick. The upper 26 inches of the subsoil is yellowish brown and dark yellowish brown, friable, gravelly loam. The lower part, extending to a depth of 48 inches, is a very firm and brittle fragipan of dark yellowish brown, gravelly heavy loam. The substratum, to a depth of 65 inches, is a firm and brittle fragipan of dark yellowish brown, gravelly sandy loam.

Included in mapping are less sloping areas of Rockaway soils; scattered, concave areas of Califon soils; and areas of Edneyville soils, generally near the top of the landscape. Also included are areas that are less than 4 feet to bedrock and some extremely stony areas.

Permeability is moderate above the fragipan but is very slow or slow in the fragipan. Small amounts of excess water generally are perched above the fragipan late in winter and early in spring but only for short periods. The available water capacity is moderate. Bedrock is dominantly at a depth of 4 to 6 feet or more. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is very strongly acid, if lime is not applied.

Because of many stones, strong slopes, and forest cover, this soil is not suited to crops and has limited use for pasture. The use of equipment for farming is severely limited by the many stones. The soil is best suited to woodland and recreation uses and for watershed protection. Woodland production is fair. The most common trees are the northern red oak, white oak, black oak, white ash, black birch, hickory, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the moderately slow or slow permeability in the fragipan, the frost action potential, the very stony surface, and the slope. Capability unit VIs-19; woodland subclass 3r.

ROF—Rock outcrop-Oquaga association, very steep. This association is composed of Rock outcrop and very steep, somewhat excessively drained to well drained, moderately deep soils on the crest and upper side slopes of Kittatinny Mountain. The areas are 20 to 50 acres or more in size. Stones cover as much as 15 percent of the surface and are 2-1/2 to 5 feet apart.

This association consists of 30 percent Rock outcrop; 50 percent Oquaga extremely stony loam; 20 percent deep, well drained Swartswood extremely stony loam and other soils with variable drainage and variable slopes.

Typically, Rock outcrop consists of interbedded hard red sandstone and soft red shale that are closely associated with tilted beds of quartzite. Rock outcrop supports very few, good quality trees.

Typically, the surface layer of the Oquaga soils in a wooded area is pinkish gray channery loam about 4 inches thick. The subsoil is brown and reddish brown channery loam about 20 inches thick. The substratum is brown, very channery loam about 6 inches thick. Reddish brown sandstone and shale bedrock are at a depth of 30 inches.

Included in mapping are areas of Swartswood extremely stony loam, generally between ridges. Also included are somewhat poorly drained soils in low depressions.

Some areas of this association are dominantly Rock outcrop, and others are dominantly Oquaga soils. But Rock outcrop and the soils occur in each area.

Oquaga soils have moderately rapid permeability. The available water capacity and natural fertility are low. The surface is extremely stony. Reaction is strongly acid or very strongly acid, if lime is not applied.

The soils in this association are not suited to crops and pasture. Most areas are woodland. Many areas are part of the national park land and watershed protection land.

This association is suited to use as woodland. The rock outcrops, many stones, and very steep slopes impose equipment-use limitations. The rate of growth is fair, but production is low because of the high percentage of rock outcrops, which cause poor stocking of quality trees. Capability unit VIIs-22, woodland subclass 3x.

RPF—Rock outcrop-Parker-Edneyville association, very steep. This association is composed of Rock outcrop and very steep, somewhat excessively drained and well drained, extremely stony soils. It is on the ridges and side slopes of hills. The areas are 20 to 50 acres or more in size. Stones cover as much as 15 percent of the surface and are 2-1/2 to 5 feet apart.

This association is about 20 percent Rock outcrop, 65 percent Parker extremely stony loam, and 15 percent Edneyville extremely stony loam and minor soils.

Rock outcrop consists of beds of gneiss. In some places, bedrock is highly weathered to a depth of 2 to 4 feet. In other places, it is only very slightly weathered. In most places, the rock is not rippable. The trees are sparsely stocked and are of poor quality.

Typically, the surface layer of the Parker soils is dark brown, gravelly loam about 4 inches thick. The subsoil is dark brown, very gravelly loam about 24 inches thick. The substratum, to a depth of 60 inches or more, is brown, very gravelly loam that has about 70 percent slightly weathered pieces of gneissic stones and pebbles.

Typically, the surface layer of the Edneyville soils is dark brown gravelly loam about 7 inches thick. The subsoil, extending to a depth of 15 inches, is yellowish brown, gravelly loam and to a depth of 15 inches, is gravelly heavy loam. The substratum is yellowish brown, gravelly sandy loam; it extends to a depth of 72 inches or more.

In places, some areas of this association are dominantly Rock outcrop. Other areas are dominantly Parker or Edneyville soils, but both soils and Rock outcrop occur in each area. These soils do not occur in a uniform pattern.

Parker soils are somewhat excessively drained. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is low because the content of stone and gravel is high. Natural fertility is medium. Reaction is very strongly acid to strongly acid, if lime is not applied. Bedrock is at a depth of 4 to 6 feet.

Edneyville soils are well drained. Permeability is moderate. The available water capacity is moderate. Natural fertility is medium. Reaction is medium acid to strongly acid. Bedrock is at a depth of more than 6 feet.

This association is woodland. Many areas are in state parks. Other areas are in watershed or woodland areas of farms.

The soils in this association are not suited to row crops, hay, or pasture. Woodland production is low because of the rock outcrops and the extremely stony surface of the Parker and Edneyville soils. The most common trees are red oak, white oak, black oak, chestnut oak, white ash, black birch, beech, and in places yellow-poplar.

Because of the rock outcrops, very steep slopes, and extremely stony surface, the use of equipment is severely limited. This association is best suited to watershed protection, wildlife habitat, and parks.

This association is not suited to urban uses because of the very steep slopes, rock outcrops, and extremely stony surface. Capability unit VIIs-22; woodland subclass 3x.

RRE—Rock outcrop-Rockaway-Parker association, very steep. This association is composed of Rock outcrop and very steep, well drained and moderately well drained Rockaway soils and somewhat excessively drained Parker soils. It is on the ridges and upper side slopes of hills. The areas are 20 to 50 acres in size. Stones cover as much as 15 percent of the surface and are 2-1/2 to 5 feet apart.

This association is about 30 percent Rock outcrop, 40 percent Rockaway extremely stony loam, and 30 percent Parker extremely stony loam and minor soils. The Rockaway soil has a fragipan in the lower part of the subsoil and in the substratum.

Rock outcrop consists of beds of gneiss. In some places, the bedrock is highly weathered to a depth of 2 to 4 feet. In other places, it is only slightly weathered. In most places the rock is not rippable. The trees are sparsely stocked and are of poor quality.

Typically, the surface layer of the Rockaway soils is very dark grayish brown gravelly loam about 4 inches thick. In the upper 26 inches, the subsoil is yellowish brown and dark yellowish brown, friable, gravelly loam. In the lower part, extending to a depth of 48 inches, it is a very firm and brittle fragipan of dark yellowish brown, gravelly heavy loam. The substratum, to a depth of 65 inches, is a firm and brittle fragipan of dark yellowish brown, gravelly sandy loam.

Typically, the surface layer of the Parker soils is dark brown, gravelly sandy loam about 4 inches thick. The subsoil is dark brown, very gravelly loam about 4 inches thick. The subsoil is dark brown, very gravelly loam about 24 inches thick. The substratum, to a depth of 60 inches or more, is brown, very gravelly loam that has about 70 percent partly weathered pieces of gneissic stones and pebbles.

Some areas of this association are dominantly Rock outcrop, Rockaway soils, or Parker soils, but Rockaway and Parker soils and Rock outcrop occur in each area though not in a uniform pattern.

Rockaway soils have moderate permeability above the fragipan and very slow or slow permeability in the fragipan. Small amounts of excess water generally are perched above the fragipan and move laterally on the fragipan for short periods late in winter and early in spring. The available water capacity is moderate. Runoff is high. The hazard of erosion is high, but it is reduced by the stone cover. Natural fertility is medium. Bedrock is dominantly at a depth of 4 to 10 feet or more. Root penetration is restricted by the fragipan. Reaction is very strongly acid or strongly acid, if lime is not applied.

Parker soils are somewhat excessively drained. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is low, because of the high content of stone and gravel in the profile. Natural fertility is medium. Reaction is very strongly acid to strongly acid, if lime is not applied. Bedrock is at a depth of 4 to 6 feet.

This association is woodland. Most areas are in state parks and state owned recreation land. Woodland production is low because of the rock outcrops and the extremely stony surface of the Rockaway and Parker soils. The most common trees are red oak, white oak, black oak, chestnut oak, white ash, black birch, beech, and in places yellow-poplar.

The very steep slopes, rock outcrops, and extremely stony surface are severe limitations for cropland, wildlife habitat, woodland, and urban uses. Capability unit VIIs-22 woodland subclass 3x.

RWD—Rock outcrop-Wassaic complex, 15 to 25 percent slopes. This complex is made up of Rock outcrop and steep, somewhat excessively drained to well drained, moderately deep, very stony Wassiac soils. It is on uplands on crests and hillsides in limestone areas that have small intervening valleys. Areas of this complex are 5 to 30 acres or more in size. Stones cover as much as 3 percent of the surface and are 5 to 30 feet apart.

This complex is about 25 percent Rock outcrop and soils that are less than 20 inches deep; 65 percent Wassaic very stony loam, gravelly loam, and loam; and 10 percent very stony, stony, and gravelly Washington soils.

Rock outcrop consists of limestone beds. In places the beds outcrop to a height of 10 to 20 feet, and in other places they are ledges on the surface or are 1 to 3 feet in height. In most places the bedrock is hard, but the hardness and rippability of the bedrock vary somewhat from area to area.

Typically, the surface layer of the Wassaic soil is very dark grayish brown gravelly loam about 6 inches thick. The subsurface layer is strong brown gravelly silt loam about 12 inches thick. The subsoil is dark brown gravelly clay loam about 12 inches thick. Hard limestone bedrock is at a depth of 30 inches.

Included in mapping are small areas of Washington soils and areas of moderately well drained to poorly drained soils that are mainly in slight depressions where there are no surface drainage outlets.

Wassaic soils are well drained. Permeability is moderate throughout the profile but is affected by the depth to bedrock, which is 20 to 40 inches, and by fractures in the rock. The available water capacity is moderate. Natural fertility is high.

This complex is mainly woodland. A few areas are in pasture. The complex is not suited to crops and is poorly suited to pasture. The steep slopes, rock outcrops, and the loose stones on the surface limit the use of equipment. Trees on the Wassaic soils have a fair rate of growth, but production is low because of the reduced stand of good quality trees in the rock outcrop areas.

The complex is poorly suited to urban uses because of the steep slopes, rock outcrops, and very stony surface. Capability unit VIIs-22; woodland subclass 3r.

RWF—Rock outcrop-Wassaic complex, 25 to 45 percent slopes. This complex is made up of Rock outcrop and very steep, well drained, moderately deep, very stony Wassaic soils. It is on uplands on crests of limestone areas that have small intervening valleys. The areas are 10 to 50 acres or more in size. Stones cover as much as 5 percent of the surface and are 5 to 30 feet apart.

This complex is about 30 percent Rock outcrop and soils that are less than 20 inches deep; 65 percent Wassaic very stony loam, gravelly loam, and loam; and 5 percent very stony, stony, and gravelly Washington soils.

Rock outcrop consists of limestone beds. In most places, the beds outcrop to a height of 10 to 20 feet, and in some places they are ledges on the surface or are 1 to 3 feet in height. Stocking of trees is sparse, and the quality is poor.

Typically, the surface layer of the Wassaic soil is very dark grayish brown, gravelly loam about 4 inches thick. The subsurface layer is strong brown, gravelly silt loam 12 inches thick. The subsoil is dark brown, gravelly clay loam about 12 inches thick. Hard limestone bedrock is at a depth of 30 inches.

Included in mapping are areas of Washington soils, mainly in the lowest position of the narrow, closed-end valleys between ridges of Wassaic soils and Rock outcrop.

Wassaic soils are well drained. Permeability is moderate throughout the profile, but it is affected by the depth to bedrock, which is 20 to 40 inches, and by fractures in the rock. The available water capacity is moderate. Natural fertility is high.

This complex is mainly woodland. It is not suited to row crops, hay, or pasture. The very steep slopes and rock outcrops severely limit the use of equipment.

The most common trees are black oak, white oak, chestnut oak, black birch, beech, white ash, and some red oak and yellow-poplar. The stocking of quality trees is severely reduced by the rock outcrops and the extremely stony surface of the Wassaic soils. The use of harvesting equipment is severely limited.

This complex is not suited to urban uses, because of the very steep slopes, rock outcrops, and extremely stony surface. Capability unit VIIs-23; woodland subclass 3r.

StC—Steinsburg fine sandy loam, 8 to 15 percent slopes. This is a sloping, well drained, moderately deep

soil on dissected uplands and on short, complex, rolling slopes. The areas are 100 acres or more in size.

Typically, the surface layer is dark brown, fine sandy loam about 8 inches thick. The subsoil is dark brown, fine sandy loam 10 inches thick. The substratum is dark brown sandy loam about 18 inches thick. Red sandstone and red shale bedrock are at a depth of 36 inches.

Included in mapping are areas of soils similar to Steinsburg soils, but they are less than 20 inches deep to bedrock; a few areas of moderately well drained to poorly drained soils in slight depressions and natural drainageways; and a few areas of red sandstone and red shale outcrops. Also included are more sloping Steinsburg soils and small areas of stony or very stony Steinsburg soils.

Permeability is moderately rapid. The available water capacity is low. Runoff is medium, and the hazard of erosion is moderate. In most places, bedrock is at a depth of 30 to 40 inches. Root penetration is restricted in most places by bedrock. Natural fertility is medium. Reaction is very strongly acid to strongly acid, if lime is not applied.

Many areas are woodland. Some areas have been cleared of trees for use as cropland and pasture, and some have been planted to woodland seedlings.

This soil has poor potential for corn, small grains, and hay, because of the low available water capacity and hazard of erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is fair, and the limitations for woodland management are slight. The rooting depth is restricted by the moderate depth to bedrock. The most common trees are northern red oak, white oak, black oak, chestnut oak, white ash, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the moderate depth to bedrock, the slope, and the frost action potential. Capability unit IIIe-16; woodland subclass 3f.

SuB—Swartswood gravelly loam, 3 to 8 percent slopes. This gently sloping, deep, well drained and moderately well drained soil is on crests and toe slopes of low convex landscapes. The areas are oval or elongated in shape and are 5 to 10 acres or more in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark brown, gravelly loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown and light yellowish brown, friable, gravelly loam about 20 inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, reddish brown, gravelly loam. It extends to a depth of 70 inches or more.

Included in mapping are more sloping Swartswood soils, areas of moderately deep Oquaga soils, and areas of Wurtsboro soils in slight depressions and along the base of more sloping soils. Cobblestones and stones are common in places.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. Excess water is perched seasonally over the fragipan and moves laterally over the pan. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted by the fragipan. Reaction is very strongly acid or strongly acid to slightly acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban uses. A small acreage is woodland or is idle.

This soil has fair potential for corn, small grains, and hay. Where gravel content is highest, cultivation is difficult. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is fair, and there are no limitations for woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, white ash, black oak, sugar maple, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the slow permeability in the fragipan, the seasonal water table, and the frost action potential. Capability unit IIe-3; woodland subclass 3o.

SvB—Swartswood very stony loam, 3 to 8 percent slopes. This gently sloping, well drained and moderately well drained, deep soil is on crests and toe slopes of low convex landscapes and on some concave landscapes in drainageways. The areas are oval or broad and elongated in shape and are 10 to 40 acres or more in size. Stones cover 0.1 to 3 percent of the surface and are 5

to 30 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer, in a wooded area, is dark brown, gravelly loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown and light yellowish brown, friable, gravelly loam about 20 inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, reddish brown, gravelly loam. It extends to a depth of 70 inches or more.

Included in mapping are areas of Wurtsboro soils in slight depressions, areas of Swartswood extremely stony loam, and small areas of moderately deep Oquaga very stony loam.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. Excess water is perched seasonally over the fragipan and moves laterally over the pan. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is slow. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is very strongly acid to strongly acid, if lime is not applied.

This area is mainly woodland. Some areas are pasture, and some are used as sites for homes. Surface stones are a major limitation for most uses.

If trees and stones are removed, this soil has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but because of the many stones the use of equipment is limited. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to woodland use. Production is fair, and there are no equipment-use limitations for woodland management. Rooting depth is restricted by the firm fragipan. The most common trees are northern red oak, white oak, black oak, white ash, sugar maple, black birch, hickory, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations and roads, because of the slow permeability, many stones, seasonal water table, and frost action potential. Capability unit VIs-19; woodland subclass 3o.

SvC—Swartswood very stony loam, 8 to 15 percent slopes. This sloping, well drained and moderately well drained, deep soil is on side slopes of convex landscapes. The areas are elongated and oval in shape and are 10 to 20 acres or more in size. Stones cover from 0.1 to 3 percent of the surface and are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer in a wooded area is dark brown, gravelly loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown and light yellowish brown, friable, gravelly loam about 20 inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, reddish brown, gravelly loam. It extends to a depth of 70 inches or more.

Included in mapping are areas of moderately deep Oquaga very stony loam soils and soils similar to Swartswood soils, except that they are redder. Also included are a few areas of Wurtsboro soils in seep spots with slopes of 3 to 8 percent and 8 to 15 percent.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. Excess water is perched seasonally over the fragipan and moves laterally over the pan. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is medium. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

Most areas are woodland. Some areas are pasture; others are in urban uses.

Because of the many stones, this soil is not suited to crops. If stones and trees are removed, it has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but because of the many stones equipment-use is limited. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is fair, and the use of equipment is not limited in woodland management. Rooting depth is restricted by the firm fragipan. The most common trees are northern red oak, white oak, black oak, white ash, sugar maple, black birch, hickory, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, slow permeability, seasonal water table, and frost action potential. Capability unit VIs-19; woodland subclass 3o.

SvD—Swartswood very stony loam, 15 to 25 percent slopes. This steep, well drained and moderately well drained, deep soil is on crests and side slopes of convex landscapes. The areas are elongated and oval in shape and are 10 to 20 acres of more in size. Stones cover 0.1 to 3 percent of the surface and are 5 to 30 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer in a wooded area, is dark brown, gravelly loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown and light yellowish brown, friable, gravelly loam about 20 inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, reddish brown, gravelly loam. It extends to a depth of 70 inches or more.

Included in mapping are areas of moderately deep, Oquaga very stony loam and areas of Wurtsboro gravelly

loam and very stony loam in slight depressions and in seep spots along the boundary of other soils.

Permeability is moderate above the fragipan but is moderately slow or slow in the fragipan. Excess water is perched seasonally over the fragipan and moves laterally over the pan. The available water capacity is moderate, but additional water is available because of the seasonal water table. Runoff is rapid. In most places, bedrock is at a depth of more than 5 feet. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is very strongly acid or strongly acid, if lime is not applied.

Most areas are woodland. Some areas are pasture.

Because of the many stones, this soil is not suited to crops. If stones and trees are removed, it has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but because of the many stones equipment-use is limited. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is fair, and there are some equipment-use limitations for woodland management because of the steep slopes. Rooting depth is restricted by the firm fragipan. The most common trees are northern red oak, white oak, black oak, white ash, sugar maple, black birch, hickory, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, steep slopes, seasonal water table, and slow permeability. Capability unit VIs-19; woodland subclass 3r.

SxC—Swartswood-Oquaga extremely stony loams, 8 to 15 percent slopes. This complex is made up of sloping, deep to moderately deep, moderately well drained to excessively drained soils. It is on low crests and side slopes of convex landscapes. The areas are 10 to 30 acres or more in size. Stones make up 3 to 15 percent of the surface. They are 2-1/2 to 5 feet apart.

This complex is 60 percent Swartswood soils, 30 percent Oquaga soils, and 10 percent other soils. The pattern of soils is so intricate that mapping them separately was impractical. Swartswood soils have a fragipan in the lower part of the subsoil.

Typically, the surface layer of Swartswood soils, in a wooded area, is dark brown, gravelly loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown and light yellowish brown, friable, gravelly loam about 20 inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, reddish brown, gravelly loam. It extends to a depth of 70 inches or more.

Typically, the surface layer of Oquaga soils, in a wooded area, is pinkish gray channery loam about 4 inches thick. In the upper 6 inches, the subsoil is brown channery loam. The lower part is reddish brown channery loam about 14 inches thick. The substratum is brown very channery loam about 6 inches thick. It is underlain by shale and sandstone bedrock at a depth of about 30 inches.

Included in mapping are a few areas of Swartswood gravelly loam and stony loam with 3 to 8 percent slopes and 8 to 15 percent slopes and scattered areas of Wurtsboro soils in slight depressions and in seep spots along the boundary of other soils. Also included are a few ledges of red sandstone and red shale bedrock.

In Swartswood soils, permeability is moderate above the fragipan and moderately slow or slow in the fragipan. These soils have a moderately high seasonal water table that is perched over the fragipan from November to March. The available water capacity is moderate. Runoff is medium. In most places, depth to sandstone or shale bedrock is more than 5 feet. Root penetration is restricted by the strongly developed fragipan. Natural fertility is medium. Reaction is very strongly acid to strongly acid, if lime is not applied.

In Oquaga soils, permeability is moderately rapid. The available water capacity is low. Runoff is medium. In most places, bedrock is at a depth of 20 to 40 inches. Root penetration is restricted by the moderate depth to bedrock. Reaction is very strongly acid or strongly acid, if lime is not applied.

This complex is not suited to cultivated crops. It is better suited to use as woodland, and most areas are woodland. The many stones on the surface make farming impractical.

This complex is poorly suited to use as pasture mainly because of the many stones on the surface.

Woodland production is fair, but there are limitations for woodland management. Rooting depth is restricted by the very firm fragipan in Swartswood soils. Equipment use is limited by the many stones. The most common trees are northern red oak, chestnut oak, black oak, white oak, white ash, sugar maple, black birch, and beech. Tree stands are somewhat reduced in the area that is covered by stones.

The soils in this complex are limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the extremely stony surface. Depth to bedrock is a limitation of Oquaga soils, and slow permeability in the fragipan is a limitation of Swartswood soils. Capability unit VIIs-22; woodland subclass 3x.

VeA—Venango silt loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained, deep soil is in slight depressions between convex ridges and along drainageways. The areas are 5 to 10 acres in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark grayish brown, friable, silt loam about 8 inches thick. The upper part of the subsoil is light olive brown about 7 inches thick. The fragipan in the lower part of the subsoil is very firm and

brittle, mottled, light olive brown, gravelly loam that extends to a depth of 60 inches or more.

Included in mapping are small areas of more sloping Venango soils, areas of Bath soils in slightly raised positions, and small areas of poorly drained Chippewa soils in low positions.

Permeability is moderate above the fragipan but is very slow in the fragipan. This soil has a seasonal water table that is perched at a depth of 6 to 18 inches above the fragipan from January to April. When the soil is saturated, water moves laterally over the fragipan. The available water capacity is low, but additional water is available because of the seasonal water table. Runoff is very slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Root penetration is restricted in the fragipan. Natural fertility is medium. Reaction is strongly acid to medium acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban uses. A small acreage is woodland or is idle.

The soil has fair potential for corn, small grains, and hay. Maintaining the organic matter content helps to reduce runoff and erosion. Green manure crops, cover crops, and minimum tillage can be used in the cropping system to improve soil structure and reduce erosion. Shallow surface ditches can improve drainage. Early plantings will be delayed unless drainage is improved. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but there are some equipment-use restrictions for woodland management, because of the seasonal water table. Rooting depth is restricted by the very firm fragipan. Planting equipment can be used, although excess water may delay planting early in spring in some years. The most common trees are northern red oak, white oak, black oak, white ash, black birch, beech, and sugar maple.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the slow permeabillity, the moderately high seasonal water table, and the frost action potential. Capability unit IIIw-28; woodland subclass 2w.

VnB—Venango gravelly loam, 3 to 8 percent slopes. This gently sloping, somewhat poorly drained, deep soil is on crests and in depressions. The areas are oval or elongated in shape and are 5 to 15 acres or more in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark grayish brown, friable, gravelly loam about 8 inches thick. The upper part of the subsoil is light olive brown, gravelly loam about 12 inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, mottled, light olive brown, gravelly loam. It extends to a depth of 60 inches or more.

Included in mapping are less sloping and more sloping Venango soils. Also included are areas of poorly drained soils, which are mainly in small depressions, and small areas of Bath soils on low convex landscapes.

Permeability is moderate above the fragipan and very slow in the fragipan. Excess water is perched over the fragipan from January to April. If the soil is saturated, water flows laterally over the fragipan. The available water capacity is low, but additional water is available because of the seasonal water table. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is strongly acid to medium acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban uses. A small acreage is woodland or is idle.

This soil has fair potential for corn, small grains, and hay. Diversion terraces, random subsurface drains, and shallow ditches are used to reduce seasonal wetness. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce runoff and control erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants through proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but there are limitations for woodland management because of the water table. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, white ash, black birch, beech, and sugar maple.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the slow permeability in the fragipan and frost action potential. Capability unit IIIw-28; woodland subclass 2w.

VnC—Venango gravelly loam, 8 to 15 percent slopes. This sloping, somewhat poorly drained, deep soil is on side slopes of convex landscapes. The areas are oval or elongated in shape and are 5 to 15 acres or more in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark grayish brown, friable, gravelly loam about 8 inches thick. The upper part of the subsoil is light olive brown, gravelly loam about 12

inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, mottled, light olive brown, gravelly loam. It extends to a depth of 60 inches or more.

Included in mapping are less sloping areas of Venango soils; soils similar to Venango soils, but they are moderately well drained; scattered areas of Bath soils on low, domelike areas; and areas of Chippewa soils in depressions.

Permeability is moderate above the fragipan but is very slow in the fragipan. This soil has a seasonal water table that is perched at a depth of 6 to 18 inches above the fragipan. If the soil is saturated, water moves laterally over the fragipan. The available water capacity is low, but additional water is available because of the seasonal water table. Runoff is medium, and the hazard of erosion is moderate. In most places, bedrock is at a depth of more than 6 feet. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is strongly acid to medium acid, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or are idle. A small acreage is in urban uses.

This soil has fair potential for corn, small grains, and hay. Random subsurface drains or shallow ditches are used to reduce seasonal wetness. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to use as woodland. Production is good, but because of the seasonal water table the use of equipment is limited in woodland management. Rooting depth is restricted by the very firm fragipan. The most common trees are northern red oak, white oak, black oak, white ash, black birch, beech, and sugar maple.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the slope, slow permeability, and frost action potential. Capability unit IIIe-28; woodland subclass 2w.

VsB—Venango very stony loam, 3 to 8 percent slopes. This is a gently sloping, somewhat poorly drained, deep soil on crests and in slight depressions and drainageways. The areas are oval or elongated in shape and are 5 to 10 acres or more in size. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is dark grayish brown, gravelly loam about 8 inches thick. The upper part of the subsoil is light olive brown, gravelly loam about 12 inches thick. A fragipan in the lower part of the subsoil is very firm and brittle, mottled, light olive brown, gravelly loam. It extends to a depth of 60 inches or more.

Included in mapping are areas of Venango gravelly loam, areas of Bath soils on low convex landscapes, areas of Chippewa silt loam and Chippewa very stony silt loam.

Permeability is moderate above the fragipan and very slow in the fragipan. Excess water is perched over the fragipan from January to April. If the soil is saturated, water flows laterally over the pan. The available water capacity is low, but additional water is available because of the seasonal water table. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Root penetration is restricted by the fragipan. Natural fertility is medium. Reaction is strongly acid to medium acid, if lime is not applied.

This area is mainly woodland. Some areas are pasture, and some are used as sites for homes. Surface stones are a major limitation for most uses.

If trees and stones are removed, this soil has fair potential for corn, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but because of the many stones there are equipment-use limitations. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, but there are some equipment-use limitations for woodland management. Rooting depth is restricted by the firm fragipan. The most common trees are northern red oak, white oak, black oak, white ash, black birch, hickory, beech, and sugar maple.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, slow permeability, and frost action potential. Capability unit VIs-22; woodland subclass 2w.

WaA—Washington loam, 0 to 3 percent slopes. This nearly level, well drained, deep soil is on broad landscapes. The areas are oval or elongated in shape and are 5 to 30 acres or more in size.

Typically, the surface layer is brown loam about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown, and from 50 to 60 inches it is yellowish brown loam.

Included in mapping are areas of Washington loam, 3 to 8 percent slopes, and areas of Washington gravelly loam and shaly loam. Also included are areas of the moderately deep Wassaic soils and areas of Bartley soils. The Bartley soils may need drainage improvement.

Permeability is moderate. The available water capacity is high. Runoff is very slow, and the hazard of erosion is slight. In most places, limestone bedrock is at a depth of

more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas have been cleared of trees for use as cropland. Extensive areas are in urban use. A small acreage is pasture or woodland.

This soil has good potential for corn, soybeans, small grains, and hay. Green manure crops, cover crops, and minimum tillage help to maintain soil structure. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses because of the frost action potential. In most places, this soil is underlain by limestone bedrock, which is cavernous in places (fig. 6). The location of the caverns is not predictable, but where they occur, the soil has limitations for uses including onsite sewage disposal, building foundations, and roads. Capability unit I-54; woodland subclass 1o.

WaB—Washington loam, 3 to 8 percent slopes. This is a gently sloping, well drained, deep soil on broad landscapes. The areas are nearly oval or elongated in shape and are 5 to 30 acres or more in size.

Typically, the surface layer is brown loam about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown loam; and, to a depth of 60 inches, it is yellowish brown loam.

Included in mapping are areas of Washington loam, 0 to 3 percent slopes, and areas of Washington gravelly loam and shaly loam. Also included are areas of moderately deep Wassaic soils, and areas of Bartley soils, mainly in closed depressions.

Permeability is moderate. The available water capacity is high. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas have been cleared of trees for use as cropland. Extensive areas are in urban uses. A small acreage is in woodland or pasture.

This soil has good potential for corn, small grains, and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass of legume sod in the cropping system helps to maintain soil structure. Contour farming, stripcropping, grassed waterways, and terraces or diversion terraces may be needed to help reduce erosion (fig. 7). Periodic applications of lime and fertilizer are needed for optimum production. Sinkhole formation is a hazard in places.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotation of pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for most urban uses because of the frost action potential. In most places, this soil is underlain by limestone, which is cavernous in places. The location of the caverns is not predictable, but where they occur, the soil has limitations for onsite sewage disposal, building foundations, and roads. Capability unit IIe-54; woodland subclass 1o.

WaC2—Washington loam, 8 to 15 percent slopes, eroded. This sloping, well drained, deep soil is on side slopes. The areas are broad and long and are 5 to 20 acres or more in size.

Typically, the surface layer is brown loam about 3 inches thick. The subsoil, to a depth of 50 inches, is dark brown loam, and, to a depth of 60 inches, it is yellowish brown loam.

Included in mapping are areas of moderately deep Wassaic soils, areas of severely eroded Washington soils, and areas of Washington gravelly loam or shaly loam. A few Bartley soils are also included, mainly in small, closed depressions and along the boundary with surrounding areas.

Permeability is moderate. The available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. In most places, limestone bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or in urban uses.

This soil has fair potential for corn, soybeans, small grains, and hay. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production. Sinkhole formation is a hazard in places.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland man-

agement. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for some urban uses because of slopes and the frost action potential. In most places, this soil is underlain by limestone bedrock, which is cavernous in places. The location of the caverns is not predictable, but where they occur, the soil has limitations for uses including onsite sewage disposal, building foundations, and roads. Capability unit IIIe-54; woodland subclass 1o.

WaD2—Washington loam, 15 to 25 percent slopes, eroded. This steep, well drained, deep soil is on long and narrow, or hilly landscapes. The areas are 5 to 10 acres or more in size.

Typically, the surface layer is brown loam about 3 inches thick. The subsoil, to a depth of 50 inches, is dark brown loam, to a depth of 60 inches, it is yellowish brown loam.

Included in mapping are areas of moderately deep Wassaic soils, areas of severely eroded Washington soils with some active or partially healed gullies, and some areas with slopes of more than 25 percent.

Permeability is moderate. The available water capacity is high. Runoff is rapid, and the hazard of erosion is high if the soil is cleared of vegetation. In most places, limestone bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral if lime is not applied.

Extensive areas have been cleared of trees for use as cropland and pasture. Other extensive areas are woodland or are idle. Very little of the acreage is in urban use.

This soil has poor potential for corn, small grains, and hay because the hazard of erosion is high. It is not suited to continuous row cropping. It could be used for hay production, but the steep slopes are difficult to work. Diversion terraces and grassed waterways are needed in most areas to control runoff and erosion.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but the use of equipment is moderately limited by the steep slopes. If the soil is protected by forest cover, the hazard of erosion is slight. Care is needed, however, to prevent water from collecting on the harvesting skid trails. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses because of the steep slopes and the frost action potential. If the vegetative cover is removed, the hazard of erosion is high. Capability unit IVe-54; woodland subclass 1r.

WgB—Washington gravelly loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on long and narrow or irregularly shaped landscapes. The areas are 5 to 15 acres in size.

Typically, the surface layer is brown, gravelly loam about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown gravelly loam, and, to a depth of 60 inches, it is yellowish brown, gravelly sandy clay loam.

Included in mapping are areas of Washington loam, 0 to 3 percent slopes and 3 to 8 percent slopes; areas of Wassaic soils; and areas of Bartley soils, in slight depressions. Also included in places is a well drained soil that has a thin, weakly developed fragipan.

Permeability is moderate. The available water capacity is high. Runoff is slow, and the hazard of erosion is slight. In most places, limestone bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas have been cleared of trees for use as cropland. Some areas are in urban uses. A small acreage is woodland or pasture.

This soil has good potential for corn, small grains, and hay. Where the gravel content is highest, the gravel interferes with cultivation. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system help to maintain soil structure. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production. Sinkhole formation is a hazard in places.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for most urban uses because of the frost action potential and the slopes. In most places, this soil is underlain by limestone, which is cavernous in places. The location of the caverns is not predictable, but where they occur, the soil has limitations for uses including onsite sewage disposal, building foundations, and roads. Capability unit IIe-54; woodland subclass 1o.

WgC—Washington gravelly loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on side slopes. The areas are oval, irregular, and long and narrow in shape and are 5 to 15 acres or more in size.

Typically, the surface layer is brown, gravelly loam about 7 inches thick. The subsoil to a depth of 50 inches

is dark brown, gravelly loam, and to a depth of 60 inches it is yellowish brown, gravelly sandy clay loam.

Included in mapping are areas of Washington soils, 3 to 8 percent slopes and 15 to 25 percent slopes; some areas of eroded Washington soils; small areas that have a cobbly surface layer; and areas of Wassaic soils. Also included in small, closed depressions are Bartley soils that act as miniature catch basins.

Permeability is moderate. The available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are woodland or in urban use.

This soil has fair potential for corn, soybeans, small grains, and hay. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and terraces or diversion terraces generally are needed to reduce erosion. Eroded areas need special treatment such as the addition of organic matter. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, and there are no limitations for woodland management. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses because of the slope and the frost action potential. Where the underlying limestone bedrock is cavernous, this soil has limitations for uses including onsite sewage disposal, building foundations, and roads. Capability unit IIIe-54; woodland subclass 1o.

WgD—Washington gravelly loam, 15 to 25 percent slopes. This is a steep, well drained, deep soil on side slopes. The areas are oval and irregular and long and narrow in shape and are 5 to 20 acres in size.

Typically, the surface layer is brown, gravelly loam about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown, gravelly loam, and, to a depth of 60 inches, it is yellowish brown, gravelly sandy clay loam.

Included in mapping are areas of less sloping soils and very steep soils, small areas of soils that have a cobbly surface layer, and areas of Wassaic soils.

Permeability is moderate. The available water capacity is high. Runoff is rapid, and if this soil is cleared of vegetation, the hazard of erosion is high. In most places, limestone bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Many areas have been cleared of trees for use as cropland and pasture. Extensive areas are woodland. Very little of the acreage is in urban uses.

This soil has poor potential for corn, soybeans, small grains, and hay because the hazard of erosion is high. It is not suited to continuous row cropping. It can be used for hay production, but because of the steep slopes it is difficult to work. Diversion terraces and grassed waterways are needed in most areas to control runoff and erosion.

This soil is suited to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but the equipment-use limitations are moderate because of the steep slopes. If the soil is protected by forest cover, the hazard of erosion is slight. Care is needed, however, to prevent water from collecting on the harvesting skid trails. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, and beech.

This soil is limited for urban uses because of the steep slopes and the frost action potential. If the vegetative cover is removed, the hazard of erosion is high. Capability unit IVe-54; woodland subclass 1r.

WkB—Washington very stony loam, 3 to 8 percent slopes. This gently sloping, well drained, deep soil is on undulating landscapes, generally at the base of the more sloping areas. The areas are oval and irregular in shape, and they are 5 to 15 acres or more in size. Stones cover as much as 3 percent of the surface and are 5 to 30 feet apart.

Typically, the surface layer is dark brown, very stony loam about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown, gravelly loam, and, to a depth of 60 inches, it is yellowish brown, gravelly clay loam.

Included in mapping are some dominantly cobbly areas, some areas of Wassaic soils, and areas of Bartley soils in slight depressions. Also included in places is a well drained soil that has a thin, weakly developed fragipan.

Permeability is moderate. The available water capacity is high. Runoff is slow, and the hazard of erosion is slight. In most places, bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas are woodland. Some areas are pasture, and some are used as sites for homes. Surface stones are a major limitation for most uses.

If trees and stones are removed, this soil has fair potential for corn, soybeans, small grains, and hay.

This soil is suited to tall grass of permanent bluegrass pasture, but because of the many stones there are equipment-use limitations. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, but there are some equipment-use limitations in woodland management. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for some urban uses, including onsite sewage disposal, building foundations, and roads, because of the slopes, the many stones, and the frost action potential. Capability unit VIs-19; woodland subclass 1o.

WkC—Washington very stony loam, 8 to 15 percent slopes. This sloping, well drained, deep soil is on rolling side slopes. The areas are oval or irregular in shape and are 5 to 15 acres or more in size. Stones cover as much as 3 percent of the surface and are 5 to 30 feet apart.

Typically, the surface layer is dark brown, very stony loam about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown, gravelly loam, and, to a depth of 60 inches, it is yellowish brown, gravelly clay loam.

Included in mapping are some areas of extremely stony loam, small areas of nonstony and stony Wassaic soils, and Bartley soils in seep spots and closed depressions.

Permeability is moderate. The available water capacity is high. Runoff is medium. In most places, limestone bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas are woodland. Some areas are pasture; others are in urban use.

Because of the many stones, this soil is not suited to use as cropland. If stones and trees are removed, this soil has fair potential for corn, soybeans, small grains, and hay.

This soil is suited to tall grass or permanent bluegrass pasture, but because of the many stones there are equipment-use limitations. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland use. Production is good, but there are some equipment-use limitations for woodland management. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, the slope, and the frost action potential. Capability unit VIs-19; woodland subclass 1o.

WkD—Washington very stony loam, 15 to 25 percent slopes. This steep, deep, well drained soil is on hilly landscapes. The areas are long, slender, and irregular in shape and are 5 to 15 acres or more in size. Stones cover as much as 3 percent of the surface and are 5 to 30 feet apart.

Typically, the surface layer is dark brown, very stony loam, about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown, gravelly loam, and, to a depth of 60 inches, it is yellowish brown, gravelly clay loam.

Included in mapping are areas of extremely stony loam, areas of stony and nonstony Wassaic soils, and some areas of less sloping Washington soils.

Permeability is moderate. The available water capacity is high. Runoff is high. In most places, limestone bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas are woodland. Some areas are pasture.

Because of the many stones and steep slopes, this soil is not suited to use as cropland.

This soil is suited to tall grass or permanent bluegrass pasture, but because of the many stones there are equipment-use limitations. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but there are some equipment-use limitations for woodland management. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, steep slopes, and frost action potential. If the vegetative cover is removed, the hazard of erosion is high. Capability unit VIs-19; woodland subclass 1r.

WkE—Washington very stony loam, 25 to 40 percent slopes. This very steep, well drained, deep soil is on ridges or side slopes. The areas are long and irregular in shape and are 5 to 15 acres or more in size. Stones cover as much as 3 percent of the surface and are 5 to 30 feet apart.

Typically, the surface layer is dark brown, very stony loam about 7 inches thick. The subsoil, to a depth of 50 inches, is dark brown, gravelly loam, and, to a depth of 60 inches, it is yellowish brown, gravelly clay loam.

Included in mapping are areas of extremely stony loam, areas of Wassaic soils with and without a stony surface layer, and areas of less sloping Washington soils.

Permeability is moderate. The available water capacity is high. Runoff is very rapid. In most places, limestone

bedrock is at a depth of more than 6 feet. Natural fertility is high. Reaction is medium acid to neutral, if lime is not applied.

Most areas are woodland. Some areas are pasture.

Because of the many stones and very steep slopes, this soil is not suited to use as cropland.

This soil is poorly suited to tall grass or permanent bluegrass pasture. Because of the many stones, there are equipment-use limitations. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is good, but there are some equipment-use limitations in woodland management because of the very steep slopes. The most common trees are northern red oak, white oak, yellow-poplar, white ash, black birch, hickory, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the many stones, very steep slopes, and the frost action potential. Capability unit VIIs-19; woodland subclass 1r.

WmA—Wassaic gravelly loam, 0 to 3 percent slopes. This nearly level, well drained, moderately deep soil is on upland swales and in slight depressions in the valleys. The areas are oval or elongated in shape, 5 to 10 acres in size, and 150 to 175 feet in width.

Typically, the surface layer is very dark grayish brown, gravelly loam 6 inches thick. The subsoil, in the upper 12 inches, is dark yellowish brown, gravelly silt loam. In the lower part, it is dark brown gravelly clay loam about 12 inches thick. Hard gray limestone or shaly limestone is at a depth of 30 inches (fig. 8).

Included in mapping are areas of Washington loam and gravelly loam on slight rises and Bartley soils in depressions. Also included are small areas of limestone ledges and soils that are less than 20 inches deep to bedrock.

Permeability is moderate, and the available water capacity is moderate. In most places, bedrock is at a depth of 20 to 40 inches. Root penetration is restricted by the hard limestone bedrock. Runoff is slow, and the hazard of erosion is slight.

Most areas have been cleared of trees for use as cropland, hay, and pasture. Some areas are in urban uses. A small acreage is woodland or is idle.

This soil has good potential for corn, soybeans, small grains, vegetables, and hay. Where gravel content is highest, cultivation is difficult. Runoff is slow, and the hazard of erosion is slight. Droughtiness is the main limitation. Maintaining the organic-matter content helps to reduce runoff and erosion and to increase the available water capacity. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system help to maintain soil structure. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to legumes and to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to woodland. Production is fair, and the limitations are slight for woodland management. Rooting depth is restricted by the hard limestone bedrock. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the depth to bedrock and frost action potential. The limestone bedrock has solution caverns in places. These caverns are a continuing hazard to ground water and to foundations. Capability unit IIs-3; woodland subclass 3o.

WmB—Wassaic gravelly loam, 3 to 8 percent slopes. This gently sloping, moderately deep, well drained soil is on undulating landscapes on uplands. The areas are 5 to 10 acres in size.

Typically, the surface layer is very dark brown, gravelly loam 6 inches thick. The upper 12 inches of the subsoil is dark yellowish brown, gravelly silt loam. The lower part is dark brown, gravelly clay loam about 12 inches thick. Hard gray limestone or shaly limestone is at a depth of 30 inches.

Included in mapping are areas of Washington loam and gravelly loam and areas of Bartley soils in slight depressions. Also included are small areas of limestone ledges, generally in high spots of the mapped areas.

Permeability is moderate. The available water capacity is moderate. Bedrock is at a depth of 20 to 40 inches. Root penetration is restricted by the hard limestone bedrock. Runoff is slow, and the hazard of erosion is slight. Natural fertility is high. Reaction is medium acid to alkaline, if lime is not applied.

Most areas have been cleared of trees for use as cropland and pasture. Some areas are in urban uses. A small acreage is woodland or is idle.

This soil has good potential for corn, soybeans, small grains, vegetables, and hay. Where gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legume sod in the cropping system help to maintain soil structure. Contour farming, strip-cropping, grassed waterways, and terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to legumes and to tall grass or permanent bluegrass pasture. The major management

need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and the limitations are slight for woodland management. The root zone is restricted by the hard limestone bedrock. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the depth to bedrock and frost action potential. The limestone bedrock has solution caverns in places. These caverns can cause ground-water pollution and unstable foundations. Capability unit IIe-3; woodland subclass 3o.

WnC—Wassaic rocky gravelly loam, 8 to 15 percent slopes. This is a sloping, well drained, moderately deep soil on uplands, in valleys, and in narrow areas parallel to streams or other drainageways. The areas are oval or elongated in shape and are 5 to 20 acres in size. Rocks cover 20 percent of the surface.

Typically, the surface layer is very dark grayish brown, gravelly loam about 6 inches thick. The upper part of the subsoil is dark yellowish brown, gravelly silt loam about 12 inches thick. The lower part is brown gravelly clay loam about 12 inches thick. Hard limestone bedrock or shaly limestone is at a depth of 30 inches.

Included in mapping are areas of Wassaic gravelly loam, 3 to 8 percent slopes, and soils less than 20 inches deep to bedrock. Also included are areas of Washington soils and small areas of Lyons soils.

Permeability is moderate, and the available water capacity is moderate. Bedrock is at a depth of 20 to 40 inches, but in most places the depth to bedrock is 20 to 30 inches. Root penetration is somewhat restricted by the hard limestone bedrock. Runoff is medium, and the hazard of erosion is moderate. Natural fertility is high. Reaction is medium acid to alkaline, if lime is not applied.

Most areas have been cleared of trees for use as cropland, hay, and pasture. Some areas are woodland or are idle. A small acreage is in urban uses.

This soil has fair potential for corn, small grains, and hay. Where gravel content is highest, cultivation is difficult. Maintaining the organic-matter content helps to reduce runoff and erosion. Green manure crops, cover crops, minimum tillage, and the use of grass and legumes in the cropping system generally are needed to maintain soil structure and reduce erosion. Contour farming, stripcropping, grassed waterways, and cropland terraces or diversion terraces generally are needed to reduce erosion. Periodic applications of lime and fertilizer are needed for optimum production.

This soil is suited to legumes and to tall grass or permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is well suited to use as woodland. Production is fair, and the limitations are slight for woodland management. The rooting depth is restricted by the hard limestone bedrock. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech. Tree density is reduced by the rocks at the surface.

This soil is limited for urban uses, including onsite sewage disposal, building foundations, and roads, because of the depth to bedrock, the slope, and the frost action potential. The limestone bedrock has solution caverns in places. The caverns are a hazard to ground water and to foundations. Capability unit IIIe-3; woodland subclass 3o.

WnD—Wassaic rocky gravelly loam, 15 to 25 percent slopes. This steep, well drained, moderately deep soil is on hilly landscapes on the uplands; on side slopes; and in long, narrow areas parallel to streams or other drainageways in the valleys. The areas are elongated in shape and are 5 to 20 acres in size. Rocks cover 2 to 10 percent of the surface.

Typically, the surface layer is very dark grayish brown, gravelly loam about 6 inches thick. The upper part of the subsoil is dark yellowish brown, gravelly silt loam about 12 inches thick. The lower part is dark brown, gravelly clay loam about 12 inches thick. Hard gray limestone or shaly limestone is at a depth of 30 inches.

Included in mapping are areas of Wassaic gravelly loam and soils that are less than 20 inches deep to bedrock. Also included are areas of Washington soils and Wassaic soils that have slopes of more than 25 percent and less than 15 percent.

Permeability and the available water capacity are moderate. Bedrock is at a depth of 20 to 40 inches. Root penetration is restricted by the hard limestone bedrock. Natural fertility is high. Reaction is medium acid to alkaline, if lime is not applied. Runoff is rapid in farmed areas, and the hazard of erosion is high.

Extensive areas have been cleared of trees for use as cropland, hay, and pasture. Other extensive areas are woodland or are idle. Very few areas are in urban uses.

This soil has poor potential for corn, small grains, and hay because of the high hazard of erosion and the depth to bedrock. It is not suited to continuous row crops.

The soil could be used for hay production, but because of the steep slopes it is difficult to work. Diversion terraces and grassed waterways are needed in most areas to control runoff and erosion.

This soil is suited to legumes and to tall grass or permanent bluegrass or fescue pasture. Because of the steep slopes, the bedrock ledges, and the shallow soil, the production potential of this soil is moderate. The major management need is maintaining desirable plants

by rotating pastures and by applying lime and fertilizer periodically.

This soil is well suited to use as woodland. Production is fair, but the equipment-use limitations are moderate because of the steep slopes. The rooting depth is restricted by the hard limestone bedrock. Because the forest cover protects the soil, the hazard of erosion is slight. Water should be prevented from collecting on the harvesting skid trails. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This soil is limited for urban uses because of the steep slopes, bedrock ledges, and moderate depth to bedrock. If the vegetative cover is removed, the hazard of erosion is high. Capability unit IVe-3; woodland subclass 3r.

WOB—Wassaic-Rock outcrop complex, 3 to 8 percent slopes. This complex is made up of gently sloping, moderately deep, well drained, very stony Wassaic soils and Rock outcrop. It is on the uplands. Most areas are long and oval and are about 5 to 20 acres in size. Stones that are 5 to 30 feet apart are on the surface.

This complex is about 65 percent Wassaic soils, 20 percent Rock outcrop, and 15 percent other soils. Wassaic soils and Rock outcrop occur in such an intricate pattern that they were not mapped separately.

Rock outcrop consists of limestone beds. In places, the beds outcrop to a height of 10 to 20 feet, and in other places they are ledges on the surface or are 1 to 3 feet in height. The variation in the hardness and rippability of the bedrock is slight.

Typically, the surface layer of the Wassaic soils is very dark grayish brown, very stony loam about 6 inches thick. The subsoil is about 24 inches thick. In the upper 12 inches it is dark yellowish brown, gravelly silt loam, and in the lower 12 inches it is dark brown, gravelly clay loam. Dark gray limestone bedrock is at a depth of 30 inches.

In Wassaic soils, permeability is moderate, and the available water capacity is moderate. Natural fertility is high. Roots are restricted by the hard limestone bedrock. Reaction is medium acid to alkaline, if lime is not applied. There are coarse fragments of limestone and shale throughout this soil. Bedrock is at a depth of 20 to 40 inches.

Most areas are woodland and pasture. This complex is not suited to row crops and is fair for pasture because of the very stony surface, the rock outcrops, and the moderate depth of the soils. Because of the high content of limestone and shale fragments in Wassaic soils the wear of farm machinery is excessive. Droughtiness is a problem for crops if they are planted near rock outcrops.

This complex is suited to legumes, tall grasses, and permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This complex is suited to use as woodland. Production is fair, and the limitations are slight for woodland management. The rooting depth is restricted by the hard limestone bedrock. The Wassaic soils are suited to most northern hardwoods. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech. Tree density is reduced by the Rock outcrop and by the stony surface of the Wassaic soils.

This complex varies in suitability for urban use. The Wassaic soils have limitations for septic tank absorption fields because of the moderate depth to bedrock and the very stony surface. Frost action is a problem for dwellings without basements. The Wassaic soils are moderately deep to bedrock and are difficult to excavate, but they are suited to certain recreation uses. Capability unit VIIs-21; woodland subclass 3o.

WOC—Wassaic-Rock outcrop complex, 8 to 15 percent slopes. This complex is made up of sloping, moderately deep, well drained, very stony Wassaic soils and Rock outcrop. It is on the uplands. Most areas are long and oval and are about 5 to 20 acres in size. Stones that are 5 to 30 feet apart are on the surface.

This complex is about 65 percent Wassaic soils, 25 percent Rock outcrop, and 10 percent other soils. Wassaic soils and Rock outcrop occur in such an intricate pattern that they were not mapped separately.

Rock outcrop consists of limestone beds. In places the beds outcrop to a height of 10 to 20 feet, and in other places they are ledges on the surface or are 1 to 3 feet in height. The variation in the hardness and rippability of the bedrock is slight.

Typically, the surface layer of the Wassaic soils is very dark grayish brown, very stony loam about 6 inches thick. The subsoil is about 24 inches thick. In the upper 12 inches it is dark yellowish brown, gravelly silt loam, and in the lower 12 inches it is dark brown, gravelly clay loam. Dark gray limestone bedrock is at a depth of 30 inches.

Included in mapping are small areas between ledges of bedrock of very stony and stony Washington soils and a few areas of Bartley soils in small closed depressions.

In Wassaic soils, permeability is moderate, and the available water capacity is moderate. Natural fertility is high. Roots are restricted by the hard limestone bedrock. Reaction is medium acid to alkaline, if lime is not applied. There are coarse fragments of limestone and shale throughout this soil. Bedrock is at a depth of 20 to 40 inches.

Most areas are woodland. This complex has limitations for many urban uses. It is not suited to row crops and is fair for pasture because of the very stony surface, rock outcrops, and moderate soil depth. The high percentage of limestone outcrops and slate fragments in Wassaic soils restricts the use of farm equipment. Droughtiness is a problem for crops if they are planted near the rock outcrops.

This complex is suited to legumes, tall grasses, and permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This complex is suited to woodland use, but production is only fair, and the limitations for woodland management are severe. The use of equipment in planting and harvesting is limited by the many rock outcrops. The rooting depth is restricted by the hard limestone bedrock. The Wassaic soils are suited to most northern hardwoods. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech. Tree density is reduced by the rock outcrops and stony surface of Wassaic soils.

This complex is poorly suited to urban uses. The Wassaic soils have limitations for septic tank absorption fields because of the moderate depth to bedrock and the very stony surface. Frost action is a problem for dwellings without basements. The Wassaic soils are difficult to excavate, but they are suited to certain recreation uses. The areas of Rock outcrop have little or no potential for urban uses. Capability unit VIIs-21; woodland subclass 3o.

WOD—Wassaic-Rock outcrop complex, 15 to 25 percent slopes. This complex is made up of steep, moderately deep, well drained, very stony Wassaic soils and Rock outcrop. It is on hilly and steep landscapes on the uplands. The areas are long and narrow and are parallel to streams and other drainageways. Most are about 10 to 30 acres in size. Stones that are 5 to 30 feet apart dot the surface.

This complex is about 65 percent Wassaic soils, 25 percent Rock outcrop, and 15 percent other soils. Wassaic soils and Rock outcrop occur in such an intricate pattern that they were not mapped separately.

Rock outcrop consists of limestone beds. In places the beds outcrop to a height of 10 to 20 feet, and in other places they are ledges on the surface or are 1 to 3 feet in height. The variation in the hardness and rippability of the bedrock is slight.

Typically, the surface layer of Wassaic soils is very dark grayish brown, very stony loam about 6 inches thick. The subsoil is about 24 inches thick. In the upper 12 inches it is dark yellowish brown, gravelly silt loam. In the lower part it is dark brown, gravelly clay loam. Dark gray limestone bedrock is at a depth of 30 inches.

Included in mapping are small areas, between ledges of bedrock, of very stony and stony Washington soils and a few areas of Bartley soils in small closed depressions.

In Wassaic soils, permeability and the available water capacity are moderate. Natural fertility is high. Roots are restricted by the hard limestone bedrock. Reaction is medium acid to alkaline, if lime is not applied. There are coarse fragments of limestone and shale throughout this soil. Bedrock is at a depth of 20 to 40 inches.

Most areas are woodland and pasture. This complex has limitations for many urban uses. It is not suited to row crops and is fair for pasture because of the very stony surface, steep slopes, rock outcrops, and moderate depth of the soil material. The many limestone outcrops and shale fragments in Wassaic soils restrict the use of farm equipment. Droughtiness is a problem for crops if they are planted near the rock outcrops.

This complex is suited to legumes, tall grasses, and permanent bluegrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This complex is suited to woodland use, but production is only fair, and the limitations for woodland management are severe. The slopes and rock outcrops restrict the use of equipment in planting and harvesting. The rooting depth is restricted by the hard limestone bedrock. The Wassaic soils are suited to most northern hardwoods. The most common trees are northern red oak, white oak, black oak, yellow-poplar, black birch, and beech.

This complex varies in suitability for urban uses. The Wassaic soils have limitations for septic tank absorption fields because of the moderate depth to bedrock, steep slopes, and the very stony surface. Frost action is a problem for dwellings without basements. The Wassaic soils are moderately deep to bedrock and are difficult to excavate, but they are suited to certain recreation uses. Capability unit VIIs-21; woodland subclass 3r.

Wp—Wayland silt loam. This is a nearly level, poorly drained and very poorly drained, deep, alluvial soil on flood plains that are subject to frequent flooding. It is in low areas or in depressions. The areas are long and narrow and irregular and fingerlike in shape, generally parallel to the drainage pattern. They are 5 to 20 acres or more in size. Slopes are smooth.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The substratum to a depth of 48 inches is dark gray and gray silt loam, and to a depth of 60 inches it is stratified gray gravelly sand.

Included in mapping are soils that have a substratum of loamy fine sand and fine sand, areas of Carlisle and Adrian muck in closed depressions, some gravel bars, and Middlebury soils on slight rises. Also included are a few areas of Fredon and Halsey soils.

Permeability is slow. This soil has a seasonally high water table from November to June. The available water capacity is high, and additional water is available because of the high water table. Runoff is very slow, and the hazard of erosion is slight. Bedrock is at a depth of more than 5 feet. The rooting zone is deep, but some plant roots cannot tolerate the excess water. Natural

fertility is medium. Reaction is strongly acid to slightly acid, if lime is not applied.

Most areas are woodland. Some areas have been cleared for use as cropland, pasture, or natural wildlife habitat.

This soil has poor potential for corn, small grains, soybeans, and hay. Deep ditches can improve drainage. Plantings will be delayed in nearly all seasons.

This soil is suited to tall grass or permanent Reed canarygrass pasture. The major management need is maintaining desirable plants by proper stocking rates, rotating pastures, and periodic applications of lime and fertilizer.

This soil is suited to woodland use, but production is only fair, and the limitations for woodland management are severe. In most years, planting equipment cannot be used because of excess water. The most common trees are red maple, black birch, and sycamore.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the flooding hazard, the seasonally high water table, and the frost action potential. Capability unit VIw-46; woodland subclass 4w.

WvB—Wurtsboro extremely stony loam, 3 to 8 percent slopes. This is a gently sloping, somewhat poorly drained, deep soil on ground moraines and in slight depressions. The areas are nearly oval or long and slender and are 5 to 20 acres in size. Stones occupy 3 to 15 percent of the surface and are 2-1/2 to 5 feet apart.

Typically, the surface layer is very dark gray, gravelly loam about 4 inches thick. The subsurface layer to a depth of 12 inches, is dark grayish brown, gravelly loam. The subsoil, to a depth of 18 inches, is mottled, yellowish brown, gravelly fine sandy loam. The fragipan is very firm and brittle, mottled, light olive brown, gravelly fine sandy loam; it extends to a depth of 70 inches or more.

Included in mapping are areas of moderately well drained Swartswood soils in a complex pattern with Wurtsboro soils and a few areas of Wurtsboro soils that have slopes of less than 8 percent and more than 15 percent.

Permeability is moderate above the fragipan and slow in the fragipan. This soil has a moderately high seasonal water table that is perched over the fragipan from November to May. If the soil is saturated, water moves laterally over the fragipan. The available water capacity is moderate. Runoff is slow. In most places, sandstone or shale bedrock is at a depth of more than 5 feet. Root penetration is somewhat restricted in the strongly developed fragipan. Natural fertility is medium. Reaction is very strongly acid to strongly acid, if lime is not applied.

This soil is not suited to cultivated crops. It is better suited to pasture and trees. Because of the many stones on the surface, farm machinery is very difficult or impossible to use. If the stones are removed, drainage is necessary for the best growth of most crops and for many other uses. Shallow surface ditches or random interceptor tile lines where the fragipan is deep can improve drainage. Diversion terraces and grassed waterways can be effective in controlling excess runoff.

This soil is poorly suited to use as pasture, mainly because of the many stones on the surface and the seasonal perched water table. Water-tolerant grasses and legumes are best suited to this soil.

This soil is suited to woodland use. Production is fair, and there are limitations for woodland management. The rooting depth is somewhat restricted by the very firm fragipan. Harvesting equipment cannot be used because of the many stones. The most common trees are northern red oak, white oak, sugar maple, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the slow permeability, the moderately high seasonal water table, and the frost action potential. Capability unit VIIs-19; woodland subclass 3x.

WvC—Wurtsboro extremely stony loam, 8 to 15 percent slopes. This sloping, deep, somewhat poorly drained soil is on side slopes of ground moraines. The areas are long and slender or nearly oval and are 5 to 20 acres or more in size. Stones occupy 3 to 15 percent of the surface and are 2-1/2 to 5 feet apart. This soil has a fragipan in the lower part of the subsoil.

Typically, the surface layer is very dark gray, gravelly loam about 4 inches thick. The subsurface layer, to a depth of 12 inches, is dark grayish brown, gravelly loam. The upper part of the subsoil, extending to a depth of 18 inches, is mottled, yellowish brown, gravelly fine sandy loam. The lower part is a very firm and brittle fragipan of mottled, light olive brown, gravelly fine sandy loam; it extends to a depth of 70 inches or more.

Included in mapping are areas of moderately well drained Swartswood soils in a complex pattern with Wurtsboro soils and a few areas of Wurtsboro soils that have slopes of less than 8 percent and more than 15 percent.

Permeability is moderate above the fragipan and slow in the fragipan. This soil has a moderately high seasonal water table that is perched over the fragipan from November to May. The available water capacity is moderate. Runoff is medium. In most places, sandstone or shale bedrock is at a depth of more than 5 feet. Root penetration is somewhat restricted by the strongly developed fragipan. Natural fertility is medium. Reaction is very strongly acid, if lime is not applied.

This soil is not suited to cultivated crops. It is better suited to pasture and trees. Because of the many stones on the surface, farm machinery is very difficult or impossible to use. If the stones are removed, drainage is necessary for the best growth of most crops and for many other uses. Shallow surface ditches or random interceptor tile lines where the fragipan is deep can im-

prove drainage. Diversion terraces and grassed waterways can effectively control excess runoff.

This soil is poorly suited to use as pasture, mainly because of the many stones on the surface and the seasonal perched water table. Water-tolerant grasses and legumes are best suited to this soil.

This soil is suited to use as woodland. Production is fair, and there are limitations for woodland management. The rooting depth is somewhat restricted by the very firm fragipan. Harvesting equipment cannot be used, because of the many stones. The most common trees are northern red oak, white oak, sugar maple, black birch, and beech.

This soil is limited for many urban uses, including onsite sewage disposal, building foundations, and roads, because of the slow permeability, the moderately high seasonal water table, and the frost action potential. Capability unit VIIs-19; woodland subclass 3x.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Field crops commonly grown in Warren County are corn, wheat, and soybeans. Plants suitable for pasture or hay are alfalfa, alsike clover, ladino clover, red clover, birdsfoot trefoil, timothy, orchardgrass, bromegrass, and bluegrass. Special crops commonly grown are sweet corn, tomatoes, lettuce, onions, sod, fruit, and nursery crops.

Although the soils vary in their suitability for specific crops and require different management, some basic or general management is needed on most of the soils. The major management needs are maintaining fertility, controlling erosion, and providing drainage. Specific information can be obtained by consulting a representative of the Soil Conservation Service, the Agricultural Extension Service, or the Agricultural Experminent Station at Rutgers University.

Because most soils in the survey area are naturally acid and low in content of plant nutrients, lime and fertilizer must be added. These additions should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. For help in determining the kind and amount of fertilizer and lime to apply, consult the County Agricultural Extension Service.

The organic-matter content is naturally medium on most soils of Warren County. It can be maintained or increased by residue management such as plowing cover crops under, growing a sod crop in the cropping sequence, using animal manure on the soil, and returning crop residue to the soil. Most crops respond well to commerical fertilizer. More than one application of fertilizer during a growing season is beneficial on soils that are subject to rapid leaching.

Controlling erosion is one of the main needs of management on the gently sloping to steep soils that are cultivated. Erosion is a hazard on about 90 percent of the cultivated acreage. Because erosion is most serious when the cultivated crop is growing, or soon after the crop has been harvested, a cropping sequence should be selected that keeps the loss of soil and water to a minimum. Practices of erosion control commonly used in the county are contour stripcropping; contour tillage;

minimum tillage; utilizing crop residue; plant cover crops; and constructing diversions, terraces, and waterways.

Wetness is a hazard on about 10 percent of the acreage suitable for cultivated crops. Few practices are needed for improving drainage on moderately well drained soils. Crops grow well on most of the somewhat poorly drained, poorly drained, and very poorly drained soils if excess water is removed by surface or subsurface drains, or both. Many soils are wet because of runoff from adjacent areas, a slowly permeable subsoil, a fluctuating water table, or a combination of these. In some places, runoff from adjacent higher areas can be diverted. In places, random or parallel subsurface drains or shallow surface drains are needed to carry water to the main natural waterways or to deep open ditches. Such soils as Bartley, Califon, and Chippewa are underlain by a fragipan and are slowly permeable in the subsoil.

Where they are practical to install, subsurface drains provide better drainage than open ditches. But, soils that have a fragipan are difficult to drain, and they can be drained better by open ditches than by subsurface drains. Open ditches are more effective if they intercept the water as it moves laterally above the pan. Suitable outlets are essential for subsurface drainage systems and for open ditches.

Special crops

Warren County has more than 3,500 acres of deep organic soils, which, with proper management, are capable of intensive production of high value crops, such as vegetables or sod. Management needs include flood protection, drainage, and water management. The organic soils are mainly the Carlisle soils.

Lettuce and onions are the most extensively grown vegetable crops. Most farmers use irrigation. Two crops of lettuce generally are grown, and the total production ranges from 8 to 10 tons per acre. Onion yields range from 27 to 30 tons per acre under a high level of management. Because the labor costs of vegetable production and the demand for sod in urban development are high, the type of crop produced has shifted from vegetables to sod. Presently, more than 60 percent of the organic soils in crop production is in sod.

In the late 1950's and early 1960's, to reduce flooding on the organic soils, the channel of the Pequest River in places was straightened, deepened, or widened to contain the flow when rainfall is heavy.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 6.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations and the risk of damage if they are used for field crops and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or

other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is indicated in table 7. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pastures may be in low-intensity use, for example, soils in capability classes I and II.

The capability unit is identified in the description of each soil map unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

Woodland management and productivity

David Edelman, area forester for Warren and Sussex Counties, New Jersey, Bureau of Forestry, helped prepare this section.

About 43 percent, or 98,800 acres, of Warren County is commercial forest land (*8*), and 89 percent of this area is privately owned by about 3,600 landowners. Most of the publicly owned commercial forest land is in Worthington State Forest and in Jenny Jump State Forest.

The largest, 41,900 acres, and most important part of the forest, consists mainly of central hardwoods of the oak-hickory type. The rest consists of 37,500 acres of the beech-birch-maple type, 10,800 acres of the oak-pine type, and 8,600 acres of the elm-ash-red maple type.

The kind of birch growing in the survey area is sweet birch. Idle fields initially seed naturally with red cedar, red maple, aspen, gray birch, sweet birch, and ash. The more commercially valuable species, such as oak, hickory, and sugar maple, follow the "old field" species in plant succession.

Almost half of the woodland, or 41,100 acres, is of sawtimber-size. About one-quarter, or 26,700 acres, is in pole-size timber and needs timber stand improvement to some extent. There are 25,800 acres of sapling-seedling stands; the nonstocked acreage is 5,200.

Table 8 contains information useful to woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or

restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 8 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Ornamental plantings

The suitability of different kinds of trees and shrubs for use in landscaping varies widely because of different soils and site conditions. In planting, such factors as height and shape of the plants, the need for sun, acidity requirements, protection from wind, screening of unsightly areas, general beauty of neighborhoods, seasonal variations in color, and the value of fruit for birds and wildlife should be considered.

The plants listed in table 9 have been selected on the basis of the typical available water capacity of the soils and the tolerance of the plants to excess water in soils that have a seasonal high water table. The selected plants are hardy for the area. The hazard of disease and insects is minimal. Many plants are used in landscaping and as food and cover for birds and wildlife.

Engineering

Carmelo J. Montana, state conservation engineer, helped prepare this section.

This section provides information about use of the soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. If pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make

preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil are included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 10 shows, for each kind of soil, the degree and kind of limitations for building site development; table 11, for sanitary facilities; and table 13, for water management. Table 12 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitation that affects shallow excavations, dwellings with and without a basement, small commercial buildings, local roads and streets, and lawns and landscaping are indicated in table 10. A *slight* limitation indicates that soil properties generally are favorable for the specified use and that limitations are minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils that are rated severe, costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 10 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 10 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Lawns and landscaping require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over bedrock or hardpan to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 11 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, and *poor*, which mean about the same as *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard if the seasonal high water table is above the level of the lagoon floor. If the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 11 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A

horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the site should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 12 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 16 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low frost action potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 13 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 12 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

In 1974 about 10 percent of Warren County, or 22,000 acres, was federal, state, and county land available for recreation. Most of this acreage is in the Delaware Water Gap National Recreation Area or in State forests and game management areas.

The soils of the survey area are rated in table 14 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 14 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 11, and interpretations for dwellings without basements and for local roads and streets, given in table 10.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the

annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They should have a surface that is free of stones and boulders and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

Wildlife habitat

About 50 percent of the county is good for openland wildlife habitat. The areas include agricultural soils, such as Washington, Annandale, and Edneyville soils. About 10 percent of the county is fair, and 40 percent is poor.

About 55 percent of the county is good for woodland wildlife habitat. About 30 percent is fair, and 15 percent is poor.

About 8 percent of the county is good for wetland wildlife habitat. About 2 percent is poor, and 90 percent is very poor.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments (*1*). The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 15, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are wildrye, goldenrod, beggarweed, and dandelion.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of hardwood plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil

properties affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed and wild millet and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features and engineering test data.

Engineering properties

Table 16 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 16 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 16 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*2*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from

A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 19. The estimated classification, without group index numbers, is given in table 16. Also in table 16 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 17 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil

is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Soil and water features

Table 18 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 1 month during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table K are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 19.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the College of Engineering, Rutgers University, in accordance with the 1950 standard procedures established by the American Association of State Highway and Transportation Officials.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in paren-

theses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The code for the Unified classification is assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-49); Unified classification (D-2487); mechanical analysis (T88); liquid limit (T89); plasticity index (T90); moisture-density, method A (T99).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 20, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Fluvaquents (*Fluvius*, meaning river, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Mollic Fluvaquents (the adjective *Mollic* is derived from the Latin word mollis, which means soft).

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, nonacid, mesic Mollic Fluvaquents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*7*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Adrian series

The Adrian series consists of sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists. These are very poorly drained organic soils that are 18 to 50 inches deep over sandy material. They formed in low areas, in bogs and swamps that were formerly lakes or ponds, and on flood plains. Over a period of thousands of years these areas have been filled gradually with an accumulation of plant remains and mineral sediments and a small proportion of animal remains. Slopes range from 0 to 3 percent.

Adrian soils are associated with Wayland, Halsey, Chippewa, Carlisle, and Hazen soils. Wayland, Halsey, Chippewa, and Hazen soils do not have the organic deposits that are characateristic of Adrian soils. Carlisle

soils have organic deposits that are more than 51 inches thick. In some spots, the associated soils have a mucky surface layer that is less than 15 inches thick.

Typical pedon of Adrian muck, in wooded area east of unnamed lane, 1,700 feet northwest of U.S. 46 and Great Meadows, Independence Township, Warren County, New Jersey:

Oa1—0 to 24 inches; sapric material (muck), black (10YR 2/1) broken face, (N 2/1) rubbed; about 10 percent fiber, about 2 percent when rubbed; moderate coarse granular structure; nearly equal parts of woody and herbaceous fibers; neutral; abrupt wavy boundary.

IIC—24 to 60 inches; light gray (5Y 6/1) loamy fine sand; common medium distinct brownish yellow (10YR 6/8 and 6/6) mottles; single grained; loose; neutral.

The sandy IIC horizon is at a depth of 18 to 50 inches. The organic material is dominantly sapric, but in some places there are thin layers of hemic material. Woody fragments of twigs, branches, logs, or stumps may be present in any part of the profile. They range from few to common. Bedrock is at a depth of 10 feet or more. Reaction ranges from strongly acid to neutral if lime is not applied.

In some places, a subsurface tier is present. It ranges from black (10YR 2/1) to dark reddish brown (5YR 3/3). Rubbed colors are similar but can vary 1 or 2 units in value or chroma. The subsurface tier is massive or has weak granular or subangular blocky structure. The IIC horizon is dominantly gray sand, loamy sand, or gravelly loamy sand. In some places, the material in the upper 3 to 6 inches is dark gray or black.

Annandale series

The Annandale series consists of fine-loamy, mixed, mesic Typic Fragiudults. These are deep, well drained soils that have a fragipan in the lower part of the subsoil. They formed in old, highly weathered, dominantly granitic glacial till and colluvium. The soils typically are more than 15 percent gravel and cobbles throughout. Stones are few to common. Slopes range from 3 to 25 percent.

Annandale soils are associated with Edneyville, Parker, Califon, and Cokesbury soils. Unlike Edneyville soils, Annandale soils have a fragipan. They have less coarse fragments than Parker soils. Annandale soils are better drained than Califon soils and Cokesbury soils. They do not have the mottles of Califon soils and the light brownish gray subsoil of Cokesbury soils.

Typical pedon of Annandale gravelly loam, 3 to 8 percent slopes, eroded, in Independence Township, on north roadbank of Cheryl Drive, 200 feet west of Russling Road:

Ap—0 to 8 inches; dark brown (10YR 4/3) gravelly loam; moderate medium granular structure; friable; many fine and medium roots; 15 percent angular partially weathered gneissic pebbles; medium acid; abrupt clear boundary.

B21t—8 to 17 inches; yellowish brown (10YR 5/6) gravelly heavy loam; moderate medium subangular blocky structure; friable, slightly plastic; few patchy clay films on ped faces; many fine and medium roots; 15 percent angular partially weathered pebbles; medium acid; gradual wavy boundary.

B22t—17 to 24 inches; strong brown (7.5YR 5/6) gravelly clay loam; strong coarse subangular blocky structure; firm, plastic; many medium to thick clay films on ped faces and in pores; few medium and coarse roots; 20 percent angular partially weathered pebbles; medium acid; gradual wavy boundary.

Bx—24 to 52 inches; dark brown (7.5YR 4/4) gravelly clay loam; weak coarse prismatic structure parting to strong very coarse subangular blocky; very firm, brittle; patchy clay films along some prism faces; few fine roots in upper part along ped faces; 25 percent angular partially weathered pebbles; medium acid; gradual clear boundary.

C—52 to 60 inches; dark brown (7.5YR 4/4) gravelly loam; massive parting to blocky structure; very friable; 25 percent angular partly weathered pebbles; medium acid.

The solum is 48 to 60 inches thick. The fragipan is at a depth of 24 to 36 inches. Bedrock is at a depth of 6 to 10 feet or more. Angular gneissic fragments range from 15 to 35 percent throughout the profile. Reaction is strongly acid to very strongly acid if lime is not applied.

The A horizon is gravelly loam or very stony loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. Texture is clay loam or loam or the gravelly analogs. Consistence is firm to friable.

The Bx horizon has colors similar to those of the Bt horizon. Texture of the fine earth fraction is loam, clay loam, or sandy clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is commonly variegated because of the difference in the degree of weathering of the saprolite. Texture of the fine earth fraction is clay loam, loam, sandy clay loam, or sandy loam.

Bartley series

The Bartley series consists of fine-loamy, mixed, mesic Typic Fragiudalfs. These are deep, moderately well drained soils that have a moderately developed fragipan in the lower part of the subsoil. They formed in valley deposits of glacial drift that was dominantly limestone and gneissic materials. The soils are in waterways, in depressions in broad nearly level areas, and on gently sloping and sloping terraces. Slopes range from 3 to 15 percent.

Bartley soils are associated with Washington and Lyons soils. They have mottles in the subsoil that distinguish them from Washington soils. Bartley soils do not have the low chroma horizons that are common in Lyons soils.

Typical pedon of Bartley loam, 3 to 8 percent slopes, in Washington Township, Jackson Valley Road, 30 feet into field across the road from Warren Hills Senior High School:

Ap—0 to 12 inches; dark brown (10YR 4/3) loam; strong medium granular structure; friable; many roots; 5 percent angular pebbles; medium acid; gradual wavy boundary.

B1—12 to 20 inches; strong brown (7.5YR 5/6) loam; fine faint yellowish red (5YR 5/6) mottles; strong medium subangular blocky structure; slightly firm; many fine and medium roots; 5 percent angular pebbles; medium acid; gradual smooth boundary.

B2t—20 to 30 inches; yellowish brown (10YR 5/4) clay loam; common fine faint olive yellow (2.5Y 6/6) mottles; strong medium and strong coarse subangular blocky structure; firm, plastic, very sticky; thin discontinuous clay films on peds; 5 percent angular pebbles; medium acid; gradual smooth boundary.

Bx—30 to 52 inches; light yellowish brown (10YR 6/4) gravelly sandy clay loam; common fine and medium distinct strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure; firm, brittle; thick patchy clay films on peds and in voids; 20 percent pebbles; slightly acid; gradual smooth boundary.

C—52 to 65 inches; yellowish brown (10YR 5/6) gravelly loam; few fine distinct light brownish gray (10YR 6/2) mottles; massive; friable; 20 percent angular pebbles; slightly acid.

The solum is 40 to 60 inches thick. The fragipan is at a depth of 20 to 36 inches. Bedrock is at a depth of 6 feet or more, and in most places it is limestone. Coarse fragments range from 5 to 20 percent throughout the solum. Reaction ranges from medium acid near the surface to neutral in the lower part of the pedon if lime is not applied.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Texture is loam or gravelly loam.

Matrix colors in the B horizon have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Bright mottles have hue of 5YR, 7.5YR, and 10YR, value of 5 or 6, and chroma of 6 to 8. Pale mottles have hue of 7.5YR to 2.5Y, value of 6 or 7, and chroma of 1 to 3. Mottles are at a depth of 12 to 28 inches. Texture of the fine earth fraction is heavy loam to clay loam. Structure above the fragipan is subangular or angular blocky. In the fragipan, structure is weak coarse prismatic with platy and subangular blocky secondary structure, or the horizon is massive. Consistence is friable to firm above the fragipan and firm to very firm within the pan.

Texture of the C horizon is loam to sandy loam and the gravelly analogs.

Bath series

The Bath series consists of coarse-loamy, mixed, mesic Typic Fragiochrepts. These are deep, well drained soils that have a fragipan in the lower part of the subsoil. They formed in glacial till that was derived predominantly from gray sandstone, siltstone, and interbedded slate and shale. These soils are on crests and side slopes on uplands. The landscape is distinctly convex. Slopes range from 3 to 40 percent but are dominantly 3 to 15 percent.

Bath soils are associated with Venango, Chippewa, and Nassau soils. They are better drained than Venango soils, and unlike Chippewa soils, they do not have gray matrix colors in the subsoil. Bath soils are deeper to bedrock and have a lower content of coarse fragments than Nassau soils.

Typical pedon of Bath gravelly loam, 3 to 8 percent slopes, in Blairstown Township, 1-1/4 miles south of Spring Valley Road, on east side of Maple Lane, at the foundation of the Presbyterian parsonage:

Ap—0 to 8 inches; dark brown (10YR 3/3) gravelly loam; moderate medium granular structure; friable; many fine and medium roots; 20 percent fine and medium pebbles; slightly acid; clear wavy boundary.

B21—8 to 15 inches; yellowish brown (10YR 5/4) gravelly loam; weak medium subangular blocky structure; friable; common medium roots; 20 percent medium and fine pebbles; slightly acid; gradual wavy boundary.

B22—15 to 34 inches; yellowish brown (10YR 5/4) gravelly loam; strong medium subangluar blocky structure; slightly firm; few medium and large roots; 20 percent medium and fine pebbles; slightly acid; gradual wavy boundary.

Bx—34 to 72 inches; dark yellowish brown (10YR 4/4) gravelly loam; common fine and medium yellowish brown (10YR 5/8) and pale brown (10YR 6/3) mottles; weak very coarse prismatic structure; very firm, brittle; patchy clay films on some prisms and in some pores; 35 percent pebbles; medium acid.

The solum is 48 to more than 60 inches thick. The fragipan is at a depth of 26 to 36 inches; in many places, it extends into the C horizon. Bedrock is at a depth of 5 to 10 feet or more. The content of angular and semiround coarse fragments, which are dominantly gravel but range to cobblestones and stones, ranges from 10 to 30 percent in the A and B2 horizons and from 20 to 40 percent in the Bx and C horizons. In places, dominantly flat, angular fragments of slate, siltstone, or sandstone are in the Bx or C horizons. Reaction is strongly acid to

slightly acid throughout the profile except in areas where lime has been applied.

The B2 horizon is yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4). It is mainly gravelly loam but ranges to loam. Consistence is friable to firm.

The Bx horizon is commonly dark yellowish brown (10YR 4/4), but the matrix color is similar to that of the B2 horizon. In places, a few high-chroma mottles are in the Bx horizon. Texture is gravelly loam to gravelly sandy loam.

The C horizon, if present, is similar to the Bx horizon in texture and consistence but is more pale in color.

Califon series

The Califon series consists of fine-loamy, mixed, mesic Typic Fragiudults. These are deep, moderately well drained and somewhat poorly drained, loamy or stony soils that have a fragipan in the lower part of the subsoil. They formed in old gneissic glacial till or in colluvium. These soils are on uplands on concave slopes and in drainageways. Califon soils are between Annandale and Cokesbury soils. Slopes range from 3 to 15 percent.

Califon soils are adjacent to Cokesbury and Annandale soils and in places are adjacent to Edneyville and Parker soils. They have a browner A horizon and are less gray throughout the profile than Cokesbury soils. Unlike the well drained Annandale, Edneyville, and Parker soils, Califon soils have a mottled B horizon.

Typical pedon of Califon gravelly loam, 3 to 8 percent slopes, 500 feet north of intersection of Brass Castle Road and Oxford Brook, on west side of brook, near wooded area:

Ap—0 to 9 inches; dark brown (10YR 4/3) gravelly loam; medium fine granular structure; friable, slightly sticky when wet; many fine and medium roots; 15 percent fine and medium pebbles; strongly acid; clear smooth boundary.

Bt—9 to 22 inches; strong brown (7.5YR 5/6) clay loam; few fine brown (10YR 5/3) and light yellowish brown (10YR 6/4) mottles; moderate coarse subangular blocky structure; friable, slightly plastic to plastic; few fine roots; common medium and fine pores; 10 percent fine and medium pebbles; strongly acid; clear wavy boundary.

Bx—22 to 48 inches; yellowish brown (10YR 5/6) gravelly loam; many fine light yellowish brown (10YR 6/4) and dark yellowish brown (10YR 4/4) mottles; weak very coarse prismatic structure parting to platy; very firm, brittle; few very fine roots, few fine pores; 20 percent medium pebbles; thin discontinuous dull dark coatings on some ped faces; strongly acid; gradual wavy boundary.

C—48 to 66 inches; yellowish brown (10YR 5/8) gravelly sandy loam that has bands of very pale brown (10YR 7/3) and strong brown (7.5YR 5/8); massive; friable; 25 percent medium and coarse pebbles; strongly acid.

The solum is 40 to 60 inches thick. The fragipan is at a depth of 20 to 30 inches. Bedrock is at a depth of 6 to 10 feet or more. Coarse fragments, dominantly gravel, occur throughout the profile and make up 10 to 25 percent of the solum. If lime has not been applied, reaction ranges from medium acid to slightly acid in the surface layer and strongly acid to very strongly acid in the subsoil.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The Bt and Bx horizons have matrix hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. The Bx horizon has mottles in hue of 2.5Y and 10YR, value of 4 to 6, and chroma of 2 through 6. The lower part of the B horizon and the C horizon have low-chroma mottles. The B horizon is loam, clay loam, or sandy clay loam or the gravelly analogs of those textures. The Bx horizon has weak or moderate, very coarse prismatic structure.

The C horizon is sandy loam or loam or the gravelly analogs of those textures.

Carlisle series

The Carlisle series consists of euic, mesic Typic Medisaprists. These are very poorly drained organic soils that are more than 51 inches thick over mineral material. They are in low areas and in bogs and swamps formerly occupied by lakes and ponds. Over a period of thousands of years these areas have been gradually filled with an accumulation of plant remains, mineral matter, and small amounts of animal remains. Slopes range from 0 to 3 percent.

Carlisle soils are associated with Wayland, Halsey, Chippewa, Adrian, and Hazen soils. Wayland, Halsey, Chippewa, and Hazen soils do not have the organic deposits that are characteristic of Carlisle soils. Adrian soils are 18 to 50 inches deep over mineral material. In some areas the associated soils have a mucky surface layer that is less than 15 inches thick.

Typical pedon of Carlisle muck, at south end of Mountain Lake, Liberty Township, Warren County:

Oa1—0 to 6 inches; sapric material (muck), (5YR 2/1) broken face and rubbed; about 10 percent fibers, about 5 percent when rubbed; moderate coarse granular structure; friable; neutral; clear wavy boundary.

Oa2—6 to 12 inches; black sapric material (muck), black (5YR 2/1) broken face and rubbed; about 10 percent mainly woody fibers, about 5 percent when rubbed; moderate coarse granular structure; friable; neutral; abrupt wavy boundary.

Oa3—12 to 48 inches; sapric material (muck), black (5YR 2/1) broken face and rubbed; about 40 percent fibers; 5 percent when rubbed; massive; friable;

many woody fragments 1/4 inch to 6 inches in diameter within a matrix of herbaceous fibers; neutral; clear wavy boundary.

Oa4—48 to 60 inches; sapric material (muck), dark reddish brown (5YR 2/2) broken face and rubbed; 20 percent fibers, less than 10 percent when rubbed; massive; mostly woody fibers and woody fragments 1/4 inch to 6 inches in diameter; neutral.

The organic deposit is 51 inches to more than 10 feet over mineral layers (*10, 11*). The material between depths of 12 and 51 inches is dominantly sapric (muck), but in some pedons there are layers of hemic material (mucky peat) 1 inch to 6 inches thick. In most pedons woody fragments of twigs, branches, logs, or stumps are in some horizons and make up as much as 30 percent of the horizon. Bedrock is at a depth of 10 feet or more. Reaction ranges from very strongly acid to neutral.

The surface tier to a depth of 12 inches has weak or moderate, coarse to fine granular structure. The subsurface tier to a depth of 35 inches is black (5YR 2/1) to dark brown (10YR 3/3) broken face and rubbed. Value or chroma can change up to 1 unit when the soil material is rubbed, and typically it becomes darker if the material is exposed to air. The subsurface tier is massive or has weak granular or subangular blocky structure. The lowermost tier to a depth of 51 inches is similar to the subsurface layer in color, composition, structure, and consistence.

Chippewa series

The Chippewa series consists of fine-loamy, mixed, mesic Typic Fragiaquepts. These are deep, poorly drained and very poorly drained soils that have a fragipan in the lower part of the subsoil and in the substratum. They formed in glacial till that was derived predominantly from acid gray slate, yellowish brown shale, and gray calcareous sandstone. Slopes range from 0 to 8 percent.

Chippewa soils are associated with Venango, Swartswood, and Wurtsboro soils. They have grayer matrix colors than those soils.

Typical pedon of Chippewa silt loam, 0 to 3 percent slopes, in Knowlton Township, on Honeywell Road, 1 mile south of intersection with Cemetery Road, east side of road, 100 feet into pasture:

Ap—0 to 12 inches; very dark gray (10YR 3/1) silt loam; moderate medium granular structure; friable, very sticky; many medium and fine roots; slightly acid; abrupt wavy boundary.

Bg—12 to 18 inches; olive gray (5Y 5/2) silt loam; many medium faint olive (5Y 5/6) and distinct olive yellow (2.5Y 6/6 and 6/8) mottles; moderate medium subangular blocky structure, some platy structure in the lower part; firm, slightly plastic and sticky; few fine roots concentrated in upper part; slightly acid; gradual wavy boundary.

Bxg—18 to 56 inches; light olive gray (5Y 6/2) gravelly loam; many distinct medium and fine yellowish brown (10YR 5/6 and 5/8) mottles; moderate coarse prismatic structure; very firm, brittle; 25 percent pebbles and small stones; slightly acid.

Cxg—56 to 65 inches; olive gray (5Y 5/2) gravelly loam; many distinct medium and fine yellowish brown (10YR 5/6 and 5/8) mottles; massive; very firm, brittle; 25 percent pebbles; slightly acid.

The solum is 48 to 56 inches thick. The fragipan is at a depth of 10 to 20 inches. Bedrock is at a depth of more than 5 feet. The content of coarse fragments ranges from 0 to 30 percent above the fragipan and from 10 to 30 percent in the fragipan. The content of stones is 0 to 3 percent. If lime has not been applied, reaction ranges from strongly acid near the surface layer to slightly acid or neutral in the Bx and C horizons.

The A1 or Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1).

The B horizon has hue of 10YR, 2.5Y, and 5Y, value of 4 to 6, and chroma of 1 or 2. Mottles have the same hue, or they have hue that is slightly different from the matrix. They have value of 5 to 7 and chroma of 4 to 8. Texture is heavy loam through silt loam to clay loam. Consistence in the Bxg horizon is firm to very firm.

The C horizon is similar to the Bx horizon in color, texture, and firmness.

Cokesbury series

The Cokesbury series consists of fine-loamy, mixed, mesic Typic Fragiaquults. These are deep, poorly drained soils that have a moderately developed fragipan in the lower part of the subsoil. They are loamy throughout the profile. These soils formed in old glacial till that was derived predominantly from granite gneiss. They are in natural waterways, depressions, and long narrow areas along the base of steeper slopes. Slopes range from 0 to 8 percent.

Cokesbury soils are associated with Califon, Annandale, and Edneyville soils. They have a darker A horizon and a grayer B horizon than those soils.

Typical pedon of Cokesbury loam, 0 to 3 percent slopes, on Mountain Road in Harmony Township, 1/2 mile south of Montana, west side of road, 70 feet into field:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam; moderate fine granular structure; friable, sticky; many roots; medium acid; abrupt smooth boundary.

B1g—9 to 17 inches; light brownish gray (2.5Y 6/2) gravelly sandy clay loam; many coarse distinct pale yellow (2.5Y 7/4), yellow (2.5Y 7/6), and yellowish brown (10YR 5/6) mottles; weak medium subangu-

lar blocky structure; firm in place, friable when removed; roots concentrated in upper part; 20 percent pebbles; medium acid; gradual wavy boundary.

B2tg—17 to 26 inches; light brownish gray (2.5Y 6/2) clay loam; common prominent strong brown (7.5YR 5/6) and many faint pale yellow (2.5Y 7/4) mottles; strong medium and coarse subangular blocky structure; firm, plastic; 20 percent fine pebbles; distinct clay coatings on a few ped faces; medium acid; clear wavy boundary.

Bx—26 to 38 inches; strong brown (7.5YR 5/6) gravelly clay loam; common distinct light gray (N 7/0) and light brownish gray (2.5Y 6/2) mottles; moderate coarse prismatic structure; very firm; 20 percent pebbles; strongly acid; gradual wavy boundary.

C—38 to 60 inches; strong brown (7.5YR 5/6) gravelly loam; common distinct light gray (N 7/0) and light brownish gray (2.5Y 6/2) mottles; massive; very firm, dense; 30 percent pebbles; strongly acid.

The solum is 30 to 40 inches thick. The fragipan is at a depth of 20 to 30 inches. Bedrock is at a depth of 6 feet or more. Coarse fragments in the solum are 5 to 25 percent gravel and as much as 5 percent stones and cobbles. In places, the C horizon is 30 percent gravel. Reaction ranges from strongly acid to slightly acid.

The A1 or Ap horizon ranges from very dark grayish brown (2.5Y 3/2 or 10YR 3/2) to dark gray (10YR 4/1).

Matrix colors in the upper part of the B horizon range in hue from 5Y to 10YR; their value is 4 to 6 and chroma is 1 or 2. Mottles have hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 4 to 8. Texture is loam, clay loam, silt loam, silty clay loam, and sandy clay loam or the gravelly analogs of those textures. Structure is subangular blocky or prismatic. Consistence is firm to friable.

The Bx horizon has hue of 10YR and 7.5YR or the hue is neutral, value of 5 or 6, and chroma of 2 through 8, mainly 5 to 8. The texture is gravelly clay loam or gravelly loam. Consistence is firm or very firm.

The C horizon has texture similar to that of the Bx horizon. Consistence is very firm to friable.

Edneyville series

The Edneyville series consists of fine-loamy, mixed, mesic Typic Hapludults. These are deep, well drained soils that formed in residuum of granitic gneiss bedrock. These soils generally have granitic gneiss pebbles, cobbles, and stones. They are on ridgetops and side slopes of the Atlantic Highlands. Slopes range from 3 to 25 percent.

Edneyville soils are associated with Parker, Annandale, and Califon soils. They have more clay and less coarse fragments than Parker soils. Edneyville soils do not have the gray mottles that are common in Califon soils or the fragipan that is common in Annandale soils.

Typical pedon of Edneyville gravelly loam, 8 to 15 percent slopes, in Hope Township, on Hope Road, 2.5 miles west of Great Meadows, south side of road, across from Hope Township sanitary landfill:

Ap—0 to 7 inches; dark brown (10YR 3/3) gravelly loam; weak coarse granular structure; friable; many fine fibrous roots; 20 percent gneiss and quartzite pebbles; medium acid; abrupt smooth boundary.

B1—7 to 15 inches; yellowish brown (10YR 5/4) gravelly loam; weak coarse subangular blocky structure; friable, slightly sticky; common fine and medium roots; 20 percent gneiss and quartzite pebbles; medium acid; gradual wavy boundary.

B2t—15 to 36 inches; dark brown (7.5YR 4/4) gravelly heavy loam; strong medium subangular blocky and angular blocky structure; friable to firm, slightly plastic; common fine roots; faint thin patchy clay films on the faces of some peds and along some pores; 20 percent coarse weathered angular gneissic pebbles; strongly acid; clear wavy boundary.

C—36 to 72 inches; yellowish brown (10YR 5/4) gravelly sandy loam that has bands of heavy gravelly loam; massive; friable; few roots; 35 percent weathered gneissic pebbles; very strongly acid.

The solum is 30 to 40 inches thick. Granitic gneiss bedrock is at a depth of 6 to more than 10 feet. In places, it is weathered for several feet. Coarse fragments in the solum are 5 to 35 percent gravel and 0 to 5 percent cobbles. They make up 5 to 35 percent, by volume, of the C horizon. The content of stones is 0 to 15 percent. If lime has not been applied, reaction ranges from strongly acid to very strongly acid.

If not plowed, Edneyville soils have a dark A1 horizon 1 to 3 inches thick. The A horizon is dark brown (10YR 4/3 to 7.5YR 3/2).

The Bt horizon is dark brown (7.5YR 4/4) to yellowish brown (10YR 5/6). The texture is heavy sandy loam to sandy clay loam or the gravelly analogs of those textures.

The C horizon has hue of 2.5Y to 5YR, value of 4 to 7, and chroma of 4 to 8. Texture is gravelly sandy loam; in some profiles it is loamy sand below a depth of 40 inches. Thin bands of soil material that is finer textured and redder in color are common but are not present in many profiles.

Fredon series

The Fredon series consists of coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic Aeric Haplaquepts. These are deep, poorly drained soils that are underlain by stratified sandy and gravelly water-deposited material. These soils formed in glacial outwash that was derived predominantly from gray sandstone, gray shale, and limestone. They are on stream terraces that

are slightly above flood plains and in the lowest depressions. Slopes range from 0 to 3 percent.

Fredon soils are associated with Hazen, Palmyra, Hero, and Halsey soils. They have grayer matrix colors in the B horizon than Hazen, Palmyra, and Hero soils. Fredon soils have less gray colors throughout the profile than Halsey soils.

Typical pedon of Fredon loam, 0 to 3 percent slopes, in Allamuchy Township, Shades of Death Road, 1/4 mile west of intersection with Long Bridge Road, south side of road, 75 feet into field:

A1—0 to 10 inches; dark grayish brown (10YR 4/2) loam; common fine pale brown (10YR 6/3) and brownish yellow (10YR 6/8) mottles; strong coarse granular structure; friable, sticky; medium acid; abrupt clear boundary.

B1—10 to 18 inches; olive gray (5Y 5/2) loam; many fine distinct olive yellow (2.5Y 6/6 and 6/8) mottles; weak medium subangular blocky structure; slightly firm; few worm channels in upper part; medium acid; gradual wavy boundary.

B2—18 to 30 inches; gray (N 6/0) loam; many fine to coarse distinct olive yellow (2.5Y 6/6 and 6/8) mottles; weak coarse prismatic structure parting to weak subangular blocky; firm; medium acid; gradual wavy boundary.

IICg1—30 to 40 inches; gray (N 6/0) loamy sand; many fine to coarse distinct olive yellow (2.5Y 6/6 and 6/8) mottles; massive; firm; slightly acid; clear wavy boundary.

IICg2—40 to 60 inches; gray (N 6/0) gravelly loamy sand; many coarse distinct olive yellow (2.5Y 6/6 and 6/8) mottles; massive; firm, compact; 20 percent pebbles; slightly acid.

The solum is 24 to 36 inches thick. Bedrock is at a depth of more than 6 feet. The content of coarse fragments, which are dominantly pebbles, ranges from 0 to 20 percent in the solum and from 0 to 60 percent or more in the IIC horizon. If lime has not been applied, reaction ranges from medium acid to neutral. In some pedons, free lime is below a depth of 4 to 6 feet.

The A1 or Ap horizon is dark grayish brown (10YR 4/2) loam 8 to 12 inches thick.

The B horizon is neutral in color or has hue of 2.5Y and 5Y, value of 5 or 6, and chroma of 0 to 2. Mottles have hue of 10YR, 2.5Y, and 5Y, value of 5 to 7, and chroma of 0 to 8. They may vary 1 to 2 hues from matrix. Texture is fine sandy loam, loam, and silt loam or the gravelly analogs of those textures. Structure is subangular blocky or weak prismatic.

The IIC horizon is gleyed and mottled. Above a depth of 40 inches, the stratified sediment is sand and loamy sand or their gravelly or very gravelly analogs. It is dominantly the same texture below a depth of 40 inches and has thin strata as fine textured as fine sandy loam.

Halsey series

The Halsey series consists of coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic Mollic Haplaquepts. These are very poorly drained soils that are moderately deep over sand. These soils are in shallow depressions, in broad areas near streams, and in stream headwaters. They formed in glacial outwash material that has derived predominantly from gray sandstone, shale, and limestone. Slopes range from 0 to 3 percent.

Halsey soils are associated with Fredon, Hero, Wayland, and Carlisle soils. They typically have grayer matrix colors throughout the B horizon than Hero soils. Halsey soils do not have the high proportion of silt that is common to the Wayland soils on flood plains. Unlike Carlisle soils, Halsey soils do not have a thick deposit of organic material.

Typical pedon of Halsey loam, Blairstown Township, on Grunup Road, 400 feet west of intersection with Sand Hill Road and 50 feet from south side of Grunup Road:

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) loam; few fine faint dark brown (7.5YR 4/4) to distinct strong brown (7.5YR 5/6) mottles; weak medium granular structure; sticky; common fine and medium roots, few large roots; slightly acid; abrupt smooth boundary.

A2g—10 to 18 inches; olive gray (5Y 5/2) fine sandy loam; common distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak coarse granular structure; firm in place, friable when removed; slightly acid; clear wavy boundary.

B2g— 18 to 34 inches; dark gray (5Y 4/1) fine sandy loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable, slightly acid to neutral; gradual wavy boundary.

IICg—34 to 60 inches; gray (5Y 5/1) loamy sand; thin strata of silt loam below a depth of 40 inches; massive; neutral.

The solum is 24 to 34 inches thick; it varies widely in thickness within short distances. Bedrock is at a depth of 6 feet or more. The gravel content is 0 to 15 percent in the solum and 0 to 60 percent in the IIC horizon. If lime has not been applied, reaction ranges from medium acid to neutral throughout most of the solum and ranges to mildly alkaline in the IIC horizon. Free lime is at a depth of 36 to 60 inches.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 0 to 2.

The A2 horizon dominantly has hue of 10YR, 2.5Y, or 5Y. Mottles vary 1 to 2 units in hue and several units in value and chroma from the matrix.

The B horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 0 to 2. Mottles vary 1 to 2 units in hue

and several units in value and chroma from the matrix. Texture is fine sandy loam or loam. Texture generally varies within short distances.

The C horizon is dominantly gray and has variable amounts and size of mottles. Texture is loamy sand, gravelly sand, and silt loam in stratified layers.

Hazen series

The Hazen series consists of coarse-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs. These are deep, well drained soils that are underlain by stratified sand and gravel (fig. 9). These soils formed in glacial outwash deposits that were derived predominantly from slate, shale, limestone, and gneiss. They are on terraces and kames in the valleys of the Ridge and Valley section of the county. Slopes range from 0 to 40 percent but are dominantly 0 to 15 percent.

Hazen soils are associated with Hero, Fredon, and Palmyra soils. They do not have the mottles that are common to Hero soils or the low chroma matrix colors common to Fredon soils. Hazen soils have less clay in the upper part of the B horizon than Palmyra soils.

Typical pedon of Hazen loam, 3 to 8 percent slopes, in Blairstown Township, Crisman Road, 1,600 feet east of Route 94 and 250 feet south of Crisman Road in a corn field:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; friable; many fine and medium roots; many fine to large pores; 5 percent rounded pebbles; slightly acid; abrupt smooth boundary.

B1—8 to 15 inches; yellowish brown (10YR 5/4) gravelly loam; moderate medium subangular blocky structure; friable; many medium and fine roots; many fine and medium pores; 15 percent rounded pebbles; slightly acid; gradual wavy boundary.

B2t—15 to 30 inches; dark brown (7.5YR 4/4) gravelly loam; moderate medium subangular blocky structure; friable to firm; thin patchy clay films on ped faces; many medium and fine roots; many fine pores; 20 percent rounded pebbles; slightly acid; clear smooth boundary.

IIC—30 to 70 inches; dark brown (7.5YR 4/4) stratified gravelly loamy sand; massive; loose; 40 percent pebbles; neutral.

The solum is 24 to 40 inches thick. Bedrock is at a depth of more than 6 feet. The content of coarse fragments is 5 to 30 percent in the solum and 10 to 60 percent in the IIC horizon. If lime has not been applied, reaction ranges from medium acid to slightly acid in the solum and from neutral to mildly alkaline in the IIC horizon.

The Ap or A1 horizon is dominantly 10YR 3/3 to 3/2 but ranges to 7.5YR 3/2. Texture is loam, gravelly loam, or cobbly loam.

The B horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture is loam, fine sandy loam, or sandy loam or the gravelly analogs of those textures.

The C horizon has hue of 7.5YR to 10YR, value of 4 or 5, and chroma of 4. Texture in the stratified layers ranges widely within short distances. It is gravelly loamy sand, very gravelly sand, loamy sand, and cobbly sand.

Hero series

The Hero series consists of coarse-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Eutrochrepts. These are deep, moderately well drained soils that are underlain by stratified sand and gravel at a depth of 30 to 40 inches. Those soils formed in glacial outwash material that was derived predominantly from slate, shale, sandstone, and limestone. They are on broad flats or slight rises along stream terraces in central valleys and on some more sloping terraces that adjoin the valley floors. Slopes range from 0 to 8 percent.

Hero soils are associated with Hazen, Palmyra, Fredon, and Halsey soils. Unlike Hazen and Palmyra soils, they have mottles. Hero soils do not have the low chroma of matrix colors that are common in the B horizon of Fredon and Halsey soils.

Typical pedon of Hero loam, 3 to 8 percent slopes, in Allamuchy Township, Shades of Death Road, 3/4 mile southwest of intersection with Long Bridge Road and 100 feet from south side of road in brome-alfalfa field:

Ap—0 to 10 inches; dark brown (10YR 3/3) loam; weak fine granular structure; very friable; many fine and medium roots; 10 percent pebbles; medium acid; abrupt wavy boundary.

B21—10 to 17 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; many fine roots; 10 percent pebbles; medium acid; gradual wavy boundary.

B22—17 to 30 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam; common fine light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; massive; very friable; few large roots; 20 percent pebbles; medium acid; clear wavy boundary.

IIC—30 to 65 inches; dark grayish brown (10YR 4/2) stratified gravelly loamy sand; common coarse yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2) mottles; single grain; loose; 30 percent pebbles; neutral.

The solum is 24 to 32 inches thick. Bedrock is at a depth of 6 to 10 feet or more. The content of the coarse fragments, which are dominantly gravel, ranges from 5 to 20 percent in the A and B horizons and from 20 to 65 percent in the IIC horizon. If lime has not been applied reaction ranges from medium acid to neutral in the

solum and medium acid to mildly alkaline in the IIC horizon.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. Texture is loam or gravelly loam.

The B horizon has hue of 10YR or 2.5Y and value of 4 or 5. Chroma is 4 to 6 in the upper part and 3 to 4 in the lower part. Mottles are of the same hue, or they vary one hue from that of the matrix. Low-chroma mottles are between depths of 12 and 18 inches. Texture is loam to fine sandy loam or the gravelly analogs of those textures.

The C horizon is stratified sandy loam, loamy sand, or sand or the gravelly or very gravelly analogs of those textures. The soil material is dominantly loose, but in some layers below a depth of 5 or 6 feet it is weakly cemented.

Lyons series

The Lyons series consists of fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts. These soils are deep and are very poorly drained. They formed in glacial till that was derived from limestone and from varying amounts of gneiss, granite, sandstone, and shale. These soils are in depressions on uplands. Slopes range from 0 to 8 percent.

Lyons soils are associated with Washington, Wassaic, and Bartley soils. Unlike Washington, Wassaic, and Bartley soils, Lyons soils have low chroma in the B horizon.

Typical pedon of Lyons silt loam, 0 to 3 percent slopes, in Independence Township, 1/8 mile north of intersection of Ryan Road and Pyles Road and 50 feet west of Pyles Road toward the stream:

A1—0 to 12 inches; very dark brown (10YR 2/2) silt loam; weak medium granular structure; very friable; 5 percent pebbles; many fine and medium roots; neutral; abrupt smooth boundary.

B21g—12 to 18 inches; light olive gray (5Y 6/2) clay loam; many fine and medium strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very firm, plastic; 5 percent pebbles; few fine roots; neutral; clear wavy boundary.

B22g—18 to 26 inches; light olive gray (5Y 6/2) silt loam; many fine strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; very firm, plastic; 10 percent pebbles; neutral; gradual wavy boundary.

Cg—26 to 60 inches; gray (N 6/0) gravelly silt loam; many medium to coarse strong brown (7.5YR 5/6) mottles; massive to coarse prismatic structure; very firm; 20 percent pebbles; mildly alkaline.

The solum is 24 to 36 inches thick. Bedrock is at a depth of 4 to 6 feet or more. The content of coarse fragments, which are dominantly gravel, ranges from 5 to 30 percent above a depth of 40 inches and from 20 to 60 percent below a depth of 40 inches. Stones are few to common. If lime has not been applied, reaction ranges from medium acid to neutral in the solum and from medium acid to mildly alkaline in the substratum.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The B horizon has hue of 5Y to 10YR, value of 2 or 3, and chroma of 1 or 2. Mottles have hue of 7.5YR to 5Y, value of 5 or 6, and chroma of 6 to 8. Texture is sandy clay loam through clay loam to silty clay loam and silt loam or the gravelly analogs of those textures. Structure is angular blocky, subangular blocky, or prismatic. Consistence is very firm to friable.

The C horizon is similar to the B horizon in color. Texture is gravelly silt loam to very gravelly fine sandy loam. Consistence is friable to very firm.

Middlebury series

The Middlebury series consists of coarse-loamy, mixed, mesic Fluvaquentic Eutrochrepts. These are moderately well drained or somewhat poorly drained soils that are subject to occasional flooding. These soils are underlain by fine sandy loam, loamy sand, or silt loam alluvial material. They are on flood plains. Slopes range from 0 to 3 percent.

Middlebury soils are associated with Hazen and Wayland soils. Middlebury soils have mottles in the subsoil; they do not have the dominant gray colors that are common in Wayland soils.

Typical pedon of Middlebury loam, 0 to 3 percent slopes, in Frelinghuysen Township, 1/2 mile north of Marksboro, between the New York, Susquehanna, and Western Railroad and the Paulins Kill River, in a cornfield:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam; moderate fine granular structure; friable, sticky; many medium and fine roots; medium acid; clear smooth boundary.

B—10 to 20 inches; dark yellowish brown (10YR 4/4) loam; few faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; many fine roots, which diminish with depth; medium acid; clear smooth boundary.

C1—20 to 42 inches; brown (10YR 4/3) fine sandy loam; many medium and fine distinct olive yellow (2.5Y 6/6) and grayish brown (2.5Y 5/2) mottles; massive; slightly firm to friable; slightly acid; gradual diffuse boundary.

C2—42 to 62 inches; grayish brown (2.5Y 5/2) loamy sand; many olive yellow (2.5Y 6/6) and yellowish brown (10YR 5/6) mottles; massive; very friable or loose; slightly acid.

The solum is 15 to 25 inches thick. Bedrock is at a depth of 6 feet or more. The content of coarse fragments is 0 to 20 percent in the upper 40 inches. Gravel

makes up as much as 20 percent of the soil material in some strata below a depth of 40 inches. If lime has not been applied, reaction ranges from strongly acid to slightly acid.

The A horizon ranges from 10YR 3/2 to 2.5Y 4/2.

The B horizon ranges from 7.5YR to 2.5Y in hue, the value is 4 or 5, and chorma is 3 or 4. Mottles occur throughout the B horizon, and they have the same hue or no more than one unit different from that of the matrix. They have value of 5 or 6 and chroma of 2 to 8. The texture is mainly silt loam or loam, but in places there are strata of gravelly fine sandy loam.

The C horizon has the same hue and value range as that of the B horizon, but the matrix chroma is 2 or 3. Texture is mainly silt loam or loam but ranges to sandy loam or loamy sand in some strata. The organic matter content varies in successive thin strata within the C horizon.

Nassau series

The Nassau series consists of loamy-skeletal, mixed, mesic Lithic Dystrochrepts. These are shallow, somewhat excessively drained soils that are underlain by slate or shale bedrock. Most of the soils are rocky or are in areas of extensive rock outcrops. These soils formed in material that was derived from shale and slate. They are on ridgetops, side slopes, and uplands. Slopes range from 3 to 45 percent but are dominantly 8 to 25 percent.

Nassau soils are associated with Bath and Venango soils. They are shallower to bedrock than those soils.

Typical pedon of Nassau shaly silt loam, 3 to 8 percent slopes, in Blairstown Township at Paulina on Mingle Road, 1/4 mile east of State Route 94 and 100 feet north of road, in a hayfield:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) shaly silt loam; weak fine granular structure; very friable; many fine and medium roots; 20 percent shale fragments; strongly acid; clear wavy boundary.

B2—6 to 18 inches; yellowish brown (10YR 5/4) very shaly silt loam; very weak fine subangular blocky structure; friable; common fine and few medium roots; 55 percent shale fragments; strongly acid; abrupt wavy boundary.

R—18 inches; partly weathered bedded shale and slate.

The solum thickness and depth to bedrock range from 12 to 20 inches. The content of coarse fragments is 15 to 50 percent in the Ap horizon and 35 to 60 percent in the B horizon. Reaction is strongly acid if lime has not been applied.

The B horizon has hue of 10YR to 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is shaly or very shaly silt loam or loam. In some pedons, there is a C horizon that is 2 to 6 inches thick and 80 to 90 percent shale.

Oquaga series

The Oquaga series consists of loamy-skeletal, mixed, mesic Typic Dystrochrepts. These are moderately deep, well drained to excessively drained soils that are underlain by shattered sandstone or shale bedrock. These soils formed in glacial till that was derived primarily from acid red sandstone and shale. They are on the Kittatinny Mountain in the Ridge and Valley section of the county. Slopes range from 15 to 45 percent.

Oquaga soils are associated with Swartswood and Wurtsboro soils. They differ from these soils in not having a fragipan and in being shallower over bedrock.

Typical pedon of Oquaga channery loam, 15 to 25 percent slopes, in an area of the Oquaga-Swartswood-Rock outcrop association, steep, in Pahaquarry Township, 1,300 feet southeast of River Road along the stream that is southeast of Depue Island in the Delaware River:

O2—2 inches to 0; very dark brown (10YR 2/2) humus held together in a mat by fine roots; abrupt wavy boundary.

A2—0 to 4 inches; pinkish gray (7.5YR 6/2) channery loam; weak fine granular structure; friable; many fine roots; 25 percent stones and coarse fragments; strongly acid; clear wavy boundary.

B21—4 to 10 inches; brown (7.5YR 5/4) channery loam; weak fine granular structure; friable; few medium and large roots; 30 percent stones and coarse fragments; strongly acid; gradual wavy boundary.

B22—10 to 24 inches; reddish brown (5YR 5/4) channery loam; weak fine granular structure; friable; few large roots; 35 percent stones and coarse fragments; strongly acid; diffuse boundary.

C—24 to 30 inches; brown (7.5YR 5/4) very channery loam; coarse granular structure; friable; 75 percent coarse fragments and stones; very strongly acid; gradual wavy boundary.

R—30 inches; reddish brown (5YR 4/4) partly weathered and fractured shale and sandstone bedrock.

The solum is 24 to 36 inches thick. Depth to bedrock is 1-1/2 to 3-1/2 feet and is generally 2-1/2 feet. The content of rock fragments is 25 to 50 percent in the solum unless the stones have been removed and 35 to 80 percent in the C horizon. Reaction is strongly acid or very strongly acid if lime has not been applied.

The B horizon has hue of 7.5YR to 5YR and value and chroma of 4 or 5. Color varies with the amount of red sandstone material in the soil.

The C horizon is channery loam or very channery loam.

Palmyra series

The Palmyra series consists of fine-loamy over sandy or sandy-skeletal, mixed, mesic Glossoboric Hapludalfs.

These are deep, well drained soils that are underlain by stratified calcareous sand and gravel deposits. They formed in glacial outwash deposits that are dominated by limestone. The soils are in high positions on glacial outwash plains, kames, and kame terraces. Slopes range from 0 to 8 percent.

Palmyra soils are associated with Hero, Fredon, and Hazen soils. They do not have the mottles that are common to Hero soils and the low chroma matrix colors common to Fredon soils. Palmyra soils have more fine sand and clay in the upper part of the B horizon than Hazen soils.

Typical pedon of Palmyra gravelly fine sandy loam, 0 to 3 percent slopes, at the edge of a sand and gravel pit along County Route 517 at the Sussex-Warren County line:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) gravelly fine sandy loam; moderate medium granular structure; friable; many fine roots; 20 percent pebbles; slightly acid; clear smooth boundary.

A&B—8 to 12 inches; grayish brown (10YR 5/2) gravelly fine sandy loam; weak medium granular structure; friable; many fine roots; 20 percent pebbles; 15 percent dark brown (7.5YR 4/4) spots 1/4 inch to 2 inches in diameter; slightly acid; clear irregular boundary.

B2t—12 to 18 inches; dark brown (7.5YR 4/4) gravelly heavy fine sandy loam; moderate medium subangular blocky structure; friable; grayish brown (10YR 5/2) ped coatings in tongues 3 inches to 2 feet apart that branch and diminish with depth; 30 percent pebbles; slightly acid; gradual irregular boundary.

B22t—18 to 26 inches; dark brown (7.5YR 4/4) gravelly heavy fine sandy loam; moderate medium subangular blocky structure; friable; patchy clay films on ped faces; 30 percent pebbles; slightly acid; abrupt irregular boundary; cone-shaped tongues of B horizon extend 12 to 18 inches into C horizon.

IIC—26 to 60 inches; grayish brown (10YR 5/2) stratified gravelly fine sand; single grain; loose; 40 percent pebbles; mildly alkaline; calcareous.

The solum is 18 to 32 inches thick. Bedrock is at a depth of more than 6 feet. Coarse fragments, dominantly pebbles, range from 15 to 25 percent in the A and A&B horizons, from 20 to 30 percent in the Bt horizon, and from 40 to 60 percent in the IIC horizon. Reaction ranges from slightly acid in the A horizon to mildly alkaline in the C horizon if lime is not applied.

The Ap or A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2. If plowing is deep, the A&B horizon is mixed with the Ap horizon.

The B horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4. In most places, it is gravelly heavy fine sandy loam, but it ranges to sandy clay loam or loam.

The C horizon is a mixture of grayish brown unweathered sand and gravel and bright yellowish brown and strong brown strongly weathered limestone gravel. The texture is gravelly fine sand or very gravelly sand.

Parker series

The Parker series consists of loamy-skeletal, mixed, mesic Typic Dystrochrepts. These are deep, somewhat excessively drained soils that have many angular granitic stones, cobblestones, and pebbles. They are on ridgetops and side slopes in the highlands of the county. Slopes range from 15 to 40 percent but are dominantly 25 to 40 percent.

Parker soils are associated with Edneyville, Annandale, and Califon soils. They have a higher proportion of coarse fragments and a lower content of clay in the subsoil than Edneyville or Annandale soils. Parker soils do not have the mottles that are common to Califon soils.

Typical pedon of Parker gravelly sandy loam, 25 to 40 percent slopes, in an area of Rock outcrop-Parker-Edneyville association, very steep, in White Township, 1 mile north of Summerfield on Colemantown Road, crest of slope, and 1,500 feet west of Colemantown Road:

O1—10 to 7 inches; tree leaves and twigs of oak, hickory, and dogwood.

O2—7 inches to 0; black (10YR 2/1) partially decomposed organic matter between angular stones and pebbles; strongly acid.

A1—0 to 6 inches; dark brown (10YR 4/3) gravelly sandy loam; weak medium granular structure; very friable; many large and fine roots; 60 percent angular gneissic stones, cobblestones, and pebbles; strongly acid; abrupt irregular boundary.

B2—6 to 30 inches; dark brown (7.5YR 4/4) very gravelly loam; weak coarse subangular blocky structure; friable; few large roots; 60 percent large angular gneissic stones, cobblestones, and pebbles; strongly acid; diffuse irregular boundary.

C—30 to 60 inches; brown (7.5YR 5/4) very gravelly loam; massive; friable; 70 percent angular slightly weathered gneissic stones, cobblestones, and pebbles; strongly acid.

The solum is 20 to 40 inches thick; the average thickness is 30 inches. Bedrock is commonly at a depth of 4 feet, but the depth ranges to 6 feet or more. In most places the bedrock is granitic gneiss. Coarse fragments, commonly pebbles or cobblestones, range from 35 to 70 percent in the solum and 60 to 90 percent in the substratum. Stones are few to many. Reaction ranges from very strongly acid to strongly acid if lime is not applied.

The A horizon is very dark gray (10YR 3/1) to brown (7.5YR 4/4).

The B horizon is dark brown (10YR 4/3) to reddish yellow (7.5YR 6/6). It is sandy loam or loam and the gravelly or cobbly analogs.

The C horizon is brown (10YR 5/3) to strong brown (7.5YR 5/6). Color patterns appear to be related to differential weathering of the banded gneiss or related types of bedrock. The texture is gravelly sandy loam or gravelly loam or their very gravelly analogs.

Pope series

The Pope series consists of coarse-loamy, mixed, mesic Fluventic Dystrochrepts. These are well drained soils that formed in glacial and river alluvium. They are in broad areas of river terraces and on adjacent slopes. Flooding is rare. Slopes range from 0 to 8 percent.

Pope soils are associated with Steinsburg and Swartswood soils. They are deeper to bedrock than Steinsburg soils, and they do not have the fragipan that is common to Swartswood soils.

Typical pedon of Pope fine sandy loam, high bottom, 0 to 3 percent slopes, in Pahaquarry Township, in a public camping area between Depue Island and Tocks Island, 300 feet west of River Road:

Ap—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam; weak medium and weak fine granular structure; friable; many fine and medium roots; strongly acid; clear smooth boundary.

B21—9 to 16 inches; dark brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; many fine and medium roots; strongly acid; gradual wavy boundary.

B22—16 to 36 inches; dark brown (7.5YR 4/4) fine sandy loam; moderate medium subangular blocky structure; friable; common medium roots; strongly acid; gradual wavy boundary.

C—36 to 65 inches; dark reddish brown (5YR 3/4) light fine sandy loam; massive parting to single grain; very friable; few lenses of clean sand; strongly acid.

The solum is 30 to 40 inches thick. Bedrock is at a depth of more than 6 feet. Coarse fragments, dominantly fine and medium pebbles, make up 0 to 25 percent of the solum and 0 to 35 percent of the C horizon.

The A horizon is fine sandy loam and gravelly fine sandy loam.

The B horizon has hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 3 to 6. Texture is dominantly fine sandy loam, but it ranges to loam and sandy loam and the gravelly analogs.

The C horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 4 to 6. Texture is light fine sandy loam to sandy loam or their gravelly analogs. Thin lenses are in some places.

Rockaway series

The Rockaway series consists of coarse-loamy, mixed, mesic Typic Fragiudults. These are deep, well drained and moderately well drained soils that have a fragipan in the lower part of the subsoil and in the substratum. They formed in slightly weathered to moderately weathered gneissic glacial till. The soils typically are more than 15 percent pebbles and cobblestones throughout. Stones are many to common. Slopes range from 8 to 25 percent.

Rockaway soils are associated with Edneyville, Parker, Califon, and Cokesbury soils. Unlike Edneyville soils, they have a fragipan, and they have fewer coarse fragments than Parker soils. Rockaway soils are better drained than Califon soils and Cokesbury soils. They do not have the mottles of Califon soils and the light brownish gray subsoil of Cokesbury soils.

Typical pedon of Rockaway gravelly loam, in an area of Rockaway very stony loam, 8 to 25 percent slopes, 1/2 mile southeast of Allamuchy overlook (east bound lane) of U. S. Route 80 and 50 feet from north side of woods trail:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam; moderate medium granular structure; friable; many fine and medium roots; 20 percent angular partly weathered pebbles, stones, and cobbles; strongly acid; clear wavy boundary.

B1t—4 to 20 inches; yellowish brown (10YR 5/6) gravelly loam; moderate medium subangular blocky structure; friable, slightly sticky; many fine medium and coarse roots; 20 percent angular partly weathered pebbles, cobblestones, and stones; strongly acid; gradual wavy boundary.

B2t—20 to 30 inches; dark yellowish brown (10YR 4/4) gravelly loam; strong medium subangular blocky structure; slightly firm, slightly plastic; many thin films on ped faces; few coarse and medium roots; 20 percent angular pebbles, cobblestones, and stones; strongly acid; gradual wavy boundary.

Bx—30 to 48 inches; dark yellowish brown (10YR 4/4) gravelly heavy loam; few fine and medium faint pale brown (10YR 6/3), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6 and 5/8) mottles; weak coarse prismatic structure; very firm, brittle; few fine pores; many thin to thick films on ped surfaces; few thin black (10YR 2/1) stains on ped faces; 25 percent pebbles and cobblestones; strongly acid; gradual wavy boundary.

Cx—48 to 65 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; common coarse and medium faint pale brown (10YR 6/3), yellowish brown (10YR 5/6 and 5/8), and brownish yellow (10YR 6/6) mottles; massive; firm, brittle; few fine pores; 25 percent pebbles, cobblestones, and stones; strongly acid.

The solum is 30 to 50 inches thick. The fragipan is at a depth of 24 to 30 inches. Bedrock is at a depth of 4 to 6 feet or more. Angular, dominantly granitic gneissic fragments make up 10 to 35 percent of the solum and as much as 50 percent of the C horizon. Reaction is strongly acid or very strongly acid if lime is not applied.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture is loam to sandy loam or the gravelly analogs. Consistence is friable to firm and nonsticky to slightly sticky and slightly plastic.

The Bx horizon has hue of 10YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. Mottles have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 to 8. In some pedons there are no mottles. Texture is loam to sandy loam or their gravelly analogs.

The C horizon has colors similar to those of the Bx horizon, but it generally has more mottles. Texture is sandy loam to loamy sand or the gravelly analogs. Consistence is very firm and brittle to friable.

Steinsburg series

The Steinsburg series consists of coarse-loamy, mixed, mesic Typic Dystrochrepts. These are moderately deep, well drained soils. They formed in material that weathered from sandstone or shale. Slopes range from 8 to 15 percent.

Steinsburg soils are associated with Pope and Swartswood soils. They are shallower to bedrock than those soils.

Typical pedon of Steinsburg fine sandy loam, 8 to 15 percent slopes, in Pahaquarry Township, 1/4 mile west of Calno on a back road from Calno to Millbrook and 100 feet west of the road, in a hayfield:

Ap—0 to 8 inches; dark brown (7.5YR 4/2) fine sandy loam; weak medium and coarse granular structure; friable; many fine and medium roots; 5 percent angular pebbles; strongly acid; clear smooth boundary.

B2—8 to 18 inches; dark brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; 5 percent angular pebbles; strongly acid; gradual wavy boundary.

C—18 to 36 inches; dark brown (7.5YR 4/4) light sandy loam; massive; very friable; few coarse roots; 10 percent angular pebbles; strongly acid; gradual wavy boundary.

R—36 inches; weak red (10YR 4/4) easily shattered sandstone and shale bedrock.

The solum is 14 to 20 inches thick. Bedrock is at a depth of 30 to 40 inches. Pebbles and small stones range from 5 to 20 percent in the solum and 20 to 40 percent in the C horizon. Reaction is dominantly strongly acid to very strongly acid if lime is not applied.

The Ap horizon has hue of 10YR to 7.5YR, value of 4, and chroma of 2.

The B horizon has hue of 7.5YR to 10YR and value and chroma are 4 or 5. Texture is fine sandy loam to sandy loam.

The C horizon has hue of 7.5YR and 10YR and value and chroma are 4 or 5. Texture is fine sandy loam to loamy sand or their gravelly analogs.

Swartswood series

The Swartswood series consists of coarse-loamy, mixed, mesic Typic Fragiochrepts. These are deep, well drained and moderately well drained soils that have a fragipan in the lower part of the subsoil. They formed in glacial till that was derived mainly from gray and brown quartzite, conglomerate, and sandstone. Slopes range from 3 to 25 percent.

Swartswood soils are associated with Wurtsboro and Oquaga soils. Unlike Wurtsboro soils, Swartswood soils do not have low chroma mottles above the fragipan. Swartswood soils are deeper to bedrock than Oquaga soils.

Typical pedon of Swartswood gravelly loam, in an area of Swartswood very stony loam, 3 to 8 percent slopes, in Blairstown Township, 1/2 mile southwest of Spring Valley Road and 75 feet north of Maines Lane:

O1—2 inches to 0; dark brown (7.5YR 4/2) leaf litter and black (10YR 2/1) fibrous mat of decayed leaves and stems; strongly acid; abrupt smooth boundary.

A1—0 to 4 inches; dark brown (10YR 3/3) gravelly loam; weak fine granular structure; very friable; 20 percent pebbles and cobbles; common stones; very strongly acid; abrupt irregular boundary.

B1—4 to 10 inches; dark yellowish brown (10YR 4/4) gravelly loam; moderate fine subangular blocky structure; friable; 15 percent angular pebbles; common stones; strongly acid; clear wavy boundary.

B22—10 to 24 inches; light yellowish brown (10YR 6/4) gravelly loam; moderate medium subangular blocky structure; slightly firm; few thin patchy clay films on some ped faces and along channel walls; 20 percent pebbles; common stones; strongly acid; gradual wavy boundary.

Bx—24 to 70 inches; reddish brown (5YR 4/3) gravelly loam; light reddish brown (5YR 6/3) interior of prism faces and yellowish brown (10YR 5/6) exterior of prism faces; weak coarse prismatic structure; very firm, brittle; 15 percent pebbles and stones; strongly acid.

The solum is 40 to 70 or more inches thick. The fragipan is at a depth of 24 to 36 inches. Bedrock is at a depth of 5 feet or more. Coarse fragments, dominantly gravel, range from 15 to 40 percent. Reaction is very strongly acid if lime is not applied. Stones are few to many.

The O, A2, and B21ir horizons have been mixed in tilled fields to form a grayish brown (10YR 5/2) or brown (10YR 4/3) Ap horizon.

The B2 horizon has hue of 7.5YR to 10YR and value and chroma of 3 to 6. It is commonly loam but ranges to sandy loam and the gravelly analogs. Structure is subangular blocky to platy. The Bx horizon is dark grayish brown (10YR 4/2) to yellowish red (5YR 5/6) and has low to high chroma mottles. It is firm or very firm.

The C horizon, if present, is similar to the Bx horizon in color, texture, and consistence. In some pedons, the Bx and C horizons have few to many yellowish brown (10YR 5/6), brownish yellowish (10YR 6/6), and light brownish gray (10YR 6/2) mottles.

Venango series

The Venango series consists of fine-loamy, mixed, mesic Aeric Fragiaqualfs. These are deep, somewhat poorly drained soils that have a very firm fragipan in the lower part of the subsoil. They formed in glacial till material that weathered from shale, sandstone, and slate. The soils are on uplands. Slopes range from 0 to 15 percent.

Venango soils are associated with Bath, Chippewa, and Nassau soils. Unlike Bath and Nassau soils, they have mottles. They are not so gray throughout the pedon as Chippewa soils.

Typical pedon of Venango gravelly loam, 3 to 8 percent slopes, in Frelinghuysen Township, 500 feet west of Route 94 at the Sussex County Line and 50 feet south of farm lane:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) gravelly loam; moderate medium granular structure; friable; many fine and medium roots; 15 percent fine pebbles; strongly acid; clear wavy boundary.

B2—8 to 20 inches; light olive brown (2.5Y 5/4) gravelly loam; few fine dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; slightly firm; many fine and medium roots; 20 percent pebbles; strongly acid; gradual wavy boundary.

Bx—20 to 60 inches; light olive brown (2.5Y 5/4) gravelly loam; many light olive gray (5Y 6/2) and olive yellow (5Y 6/6) mottles; moderate coarse prismatic structure; very firm, brittle; few fine roots in the upper part; 30 percent pebbles; medium acid.

The solum is 40 to 72 inches thick. The fragipan is at a depth of 15 to 24 inches. Bedrock is at a depth of 6 feet or more. Coarse fragments, mostly pebbles, range from 5 to 25 percent above the fragipan and from 10 to 30 percent within the fragipan. In places, stones make up as much as 3 percent of the soil. Reaction is strongly acid to medium acid in the A and B horizons if lime is not applied. It ranges to mildly alkaline in the C horizon.

The A horizon is silt loam or gravelly loam.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 5. The Bx horizon has hue of 10YR or 5Y, value of 4 or 5, and chroma of 2 to 4. Mottles generally are of the same hue or vary 1 hue from the matrix, value is 5 to 8, and chroma is 2 to 8. Texture is loam or silt loam or their gravelly analogs. The B2 horizon is friable to firm.

The C horizon, if present, is similar in color and texture to the B horizon and is firm and brittle.

Washington series

The Washington series consists of fine-loamy, mixed, mesic Ultic Hapludalfs. These are deep, well drained soils. They formed in glacial till that has limestone or a mixture of limestone, gneiss, and chert gravel. The soils are dominantly on uplands and in valleys in the highlands of the county. Slopes range from 0 to 40 percent.

Washington soils are associated with Bartley, Wassaic, Lyons, and Annandale soils. They do not have mottles, which are common in Bartley soils. They are deeper to bedrock than Wassaic soils, have a browner solum than Lyons soils, and do not have a fragipan, which is common in Annandale soils.

Typical pedon of Washington loam, 3 to 8 percent slopes, in Pohatcong Township, 1 mile west of Alpha, in a plowed field north of the intersection of High Street and Carpentersville Road:

Ap—0 to 7 inches; brown (10YR 4/3) loam; moderate medium granular structure; friable; slightly sticky; many fine roots; slightly acid; abrupt smooth boundary.

B21—7 to 16 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable, sticky; 5 percent angular pebbles; fine and meidum roots; many large and medium pores; dark brown (10YR 4/3) material lining many pores; slightly acid; gradual wavy boundary.

B22t—16 to 50 inches; dark brown (7.5YR 4/4) loam; strong coarse subangular blocky structure; slightly firm, sticky and plastic; 5 percent angular pebbles; few coarse roots; many large pores; patchy glossy clay films on many ped faces; neutral; gradual irregular boundary.

B3—50 to 60 inches; yellowish brown (10YR 5/6) loam; moderate coarse subangular blocky structure; friable, slightly sticky; 10 percent angular pebbles; few patchy clay films on some ped faces; neutral; clear wavy boundary.

The solum is 40 to 60 or more inches thick. Bedrock is typically at a depth of more than 6 feet. Coarse fragments, angular and semiround pebbles, range from 5 to 35 percent in the solum and to as much as 55 percent in the C horizon. Some pedons are very stony. Reaction ranges from medium acid to neutral in the solum and neutral in the C horizon if lime is not applied.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 3. Texture is dominantly loam or gravelly loam.

The B horizon has hue of 7.5YR to 10YR, value of 4 or 5, and chroma of 3 to 6. Texture is sandy clay loam through heavy loam and clay loam to silt loam. Consistence is friable to firm.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4. The texture is sandy clay loam to silt loam and the gravelly analogs. In some pedons, there is no C horizon, and the B3 horizon overlies limestone bedrock.

Wassaic series

The Wassaic series consists of fine-loamy, mixed, mesic Glossoboric Hapludalfs. These soils are well drained and moderately deep. They formed in glacial till that is dominated by limestone over limestone bedrock. The soils are on uplands, in swales, and on hillsides between prominent limestone ledges and over less prominent limestone ledges in the Ridge and Valley section of the county. Slopes range from 0 to 25 percent.

Wassaic soils are associated with Washington and Lyons soils. They are shallower to bedrock than Washington soils. They do not have the grayish B horizon that is common in Lyons soils.

Typical pedon of Wassaic gravelly loam, 3 to 8 percent slopes, in Hardwick Township, east side of Primrose Road, 1/2 mile north of Spring Valley Road, in hayfield:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam; moderate medium granular structure; friable; many fine and medium roots; 15 percent angular limestone fragments; medium acid; abrupt smooth boundary.

B&A—6 to 18 inches; dark yellowish brown (10YR 4/4) gravelly silt loam; moderate fine subangular blocky structure; friable; common fine and medium roots; 15 percent angular limestone pebbles; medium acid; clear wavy boundary.

B2t—18 to 30 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm, plastic; thin and moderately thick clay films on some ped faces; many large and medium roots; 20 percent limestone pebbles; neutral; clear wavy boundary.

IIR—30 inches; hard gray limestone with pockets of fractured bedrock.

The solum is 20 to 36 inches thick. Bedrock is at a depth of 20 to 40 inches. Coarse fragments, mainly small subangular cobblestones and angular pebbles, range from 15 to 30 percent. Reaction is medium acid to neutral if lime is not applied.

The B&A horizon has hue of 10YR to 7.5YR, value of 4 or 5, and chroma of 3 to 5. It is loam to silt loam.

The B2t horizon has hue of 5YR to 7.5YR, value of 4 or 5, and chroma of 4. In many pedons, the B horizon is underlain by bedrock.

The C horizon, if present, is typically residuum of the weathered underlying rock. It is fine sandy loam, clay loam, or the gravelly analogs.

Wayland series

The Wayland series consists of fine-silty, mixed, nonacid, mesic Mollic Fluvaquents. These are deep, poorly drained and very poorly drained soils that are subject to frequent flooding. They formed in recent alluvium that was derived predominantly from limestone and some slate and shale. The soils are on flood plains. Slopes range from 0 to 3 percent.

Wayland soils are associated with Carlisle, Adrian, Fredon, and Halsey soils. They are mineral soils and have far less organic material than Carlisle or Adrian soils. Their high silt content distinguishes them from the coarser textured Fredon and Halsey soils.

Typical pedon of Wayland silt loam, 0 to 3 percent slopes, in Knowlton Township, along the west bank of the Paulins Kill River at Hainesbury:

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; friable, sticky; many fine and medium roots; neutral; gradual smooth boundary.

C1g—9 to 30 inches; dark gray (10YR 4/1) silt loam; massive; friable, sticky, neutral; gradual smooth boundary.

C2g—30 to 48 inches; gray (10YR 5/1) silt loam; massive; friable, sticky; neutral; gradual wavy boundary.

IIC3—48 to 60 inches; gray (10YR 5/1) gravelly sand; single grain; loose; 20 percent rounded pebbles; neutral.

The silty deposits are 36 inches or more thick over other deposits. Bedrock is at a depth of 5 feet or more and generally is much deeper. Coarse fragments, if present, occur only in trace amounts. Reaction ranges from neutral to mildly alkaline.

The A horizon matrix can have dark brown and dark reddish brown mottles.

The C horizon has hue of 2.5Y to 10YR, value of 4 or 5, and chroma of 1. Texture is silt loam or silty clay loam. Consistence is friable to firm and sticky to slightly plastic.

The IIC horizon is silty clay loam through fine sandy loam to gravelly sand.

Wurtsboro series

The Wurtsboro series consists of coarse-loamy, mixed, mesic Typic Fragiochrepts. These are deep, somewhat poorly drained soils that have a fragipan in the lower part of the subsoil. They formed in glacial till that was derived

predominantly from gray and brown quartzite, conglomerate, and sandstone. The soils are on uplands in the Ridge and Valley section of the county. Slopes range from 3 to 15 percent.

Wurtsboro soils are associated with Swartswood and Chippewa soils. Unlike Swartswood soils, Wurtsboro soils have mottles of low chroma above the fragipan. They do not have the gray colors that are common in Chippewa soils.

Typical pedon of Wurtsboro gravelly loam, in an area of Wurtsboro extremely stony loam, 3 to 8 percent slopes, in Blairstown Township on Maines Lane, 1/2 mile southwest of Spring Valley Road:

A1—0 to 4 inches; very dark gray (10YR 3/1) gravelly loam; weak medium granular structure; very friable; many roots; 5 percent stones; 15 percent angular and subangular pebbles; strongly acid; abrupt smooth boundary.

A2—4 to 12 inches; dark grayish brown (10YR 4/2) gravelly loam; weak coarse granular structure; friable; many roots; 3 to 5 percent stones, 15 percent angular and subangular pebbles; strongly acid; abrupt smooth boundary.

B2—12 to 18 inches; yellowish brown (10YR 5/4) gravelly fine sandy loam; many medium light yellowish brown (2.5Y 6/4) and common medium and fine light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; slightly firm; many medium and coarse roots; 20 percent angular and semi-angular cobblestones and pebbles; strongly acid; gradual wavy boundary.

Bx—18 to 70 inches; light olive brown (2.5Y 5/4) gravelly fine sandy loam; many medium light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; very firm, brittle; few fine roots in upper part; 30 percent pebbles; strongly acid.

The solum is 48 to 70 or more inches thick. The fragipan is at a depth of 17 to 24 inches. Bedrock is at a depth of 5 feet or more. Coarse fragments, dominantly cobblestones above the fragipan and gravel in the fragipan, range from 10 to 35 percent. Reaction is very strongly acid or strongly acid if lime is not applied.

In cleared fields, most surface stones and cobblestones have been removed, and the upper horizons have been mixed to form a dark grayish brown (10YR 4/2) Ap horizon 6 to 10 inches thick. The A2 horizon has value of 4 to 6 and chroma of 2 or 3.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. Mottles have chroma of 2. Texture is loam to sandy loam. The Bx horizon has hue of 2.5Y to 5YR, value of 5 or 6, and chroma of 2 to 6. It has high and low chroma mottles in most pedons.

The C horizon is very firm to friable sandy loam to fine sandy loam.

Formation of the soils

In this section the major factors of soil formation are described, and some of the processes of soil formation are explained.

Factors of soil formation

Soils form through the interaction of five major factors. These are climate, plant and animal life, parent material, topography, and time. The influence of each factor varies from place to place. Local variations in soils are due to differences in the kind of parent material and in topography and drainage. In places, one factor can dominate in the formation of a soil and determine most of its properties.

Climate

The climate of Warren County is characteristic of a humid continental type that is marked by extreme seasonal changes in temperature. The annual precipitation is about 45 inches, and the mean annual temperature is 51 degrees F. Rainfall is uniform in the growing season, April through September; it averages 24 inches. The cool temperatures have influenced the accumulation of organic matter in the surface layer of the soils. For more information on climate, see the climate section under "General nature of the county."

Plant and animal life

Living organisms are important in soil formation. Plants and animals furnish organic matter to the soil and bring nutrients from lower layers to upper layers. During decomposition, organic matter produces organic acids that accelerate leaching and mineral weathering processes. Bacteria and fungi are active in the decomposition of organic matter, the release of plant nutrients, and the formation of soil structure. When organic matter becomes a part of the soil, it plays a dominant role in determining color.

In Warren County, the native forests have had more influence on soil formation than any other living organism. Man has had great influence on the surface layer by cutting forests, removing stones and boulders, and plowing. He has added lime and fertilizer, mixed some of the soil horizons, and moved soil materials from place to place.

Parent material

Parent material is the unconsolidated mass from which soils formed. It determines the mineral and chemical

composition of soils and influences the rate of the soil-forming process.

In Warren County, soils formed in glacial till, glacial outwash, recent stream alluvium, organic material, and from rock materials weathering in place. Some of the glacial material was deposited when the glaciers melted 10,000 to 15,000 years ago (*4*), but glacial material in the southern part of the county was deposited 30,000 to 40,000 years ago. Alluvial and organic material are of more recent origin and are still accumulating today. Soils that formed in glacial till, for example, Cokesbury, Venango, Wurtsboro, and Swartswood soils, are the most extensive and have a wide range of characteristics. Firm substrata are common. Soils that formed in glacial outwash deposits, for example, Hazen, Hero, and Halsey soils, generally are loamy and commonly are underlain by stratified sand and gravel. Soils along major streams, for example, Wayland and Middlebury soils, formed in recent alluvium. They are medium textured and show little horizon development. Carlisle and Adrian muck formed in organic material.

The relation of the soils to position, parent material, and natural drainage is shown in table 21.

Topography

The shape of the land surface, the slope, and depth to the water table have had great influence on the formation of soils in the county. Soils that formed in sloping areas where runoff is moderate to rapid generally are well drained; have an unmottled, bright colored subsoil; and, in most places, are leached to greater depths than wetter soils in the same general area. In gently sloping areas where runoff is slower, more soils show some evidence of wetness, for example, mottling in the subsoil.

In level areas or in slight depressions where the water table is at or near the surface for long periods, the soils show strong evidence of wetness, for example, a thick, dark colored, organic surface layer and a strongly mottled or gray subsoil. The permeability of the soil and the length, steepness, and configuration of the slopes influence the kind of soil that forms from place to place. Local differences in soils are mainly due to differences in parent material and topography.

Time

In the process of soil formation, it generally takes thousands of years for changes to occur in the parent material. In the part of Warren County that is north of Route 46, the general area of the terminal moraine for the last glacier, the soils formed in the period since glaciation. This short time is evident in the soils, especially in such characteristics as the depth of leaching and the translocation of clay and silt. Soils in the county south of the terminal moraine formed before the last (Wisconsin) glacier. Their age is evident in more strongly developed subsoils, generally deeper weathering, and a larger percentage of gently sloping to rolling landscapes.

Soils that formed on flood plains, subject to varying degrees of overflow, can receive new sediment with each flood. They have weak structure and little variation in color between horizons.

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Glossary

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

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

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

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	Inches
Very low	less than 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	more than 5.2

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

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

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

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

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

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

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

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

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

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

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

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

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

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

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

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

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after

rainfall or commonly covering swamps and marshes is not considered flooding.

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

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction be-

cause it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Saprolite (geology). Soft, earthy, clay-rich, thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rock. In soil survey, the term saprolite is applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below.

Second bottom. The first terrace above the normal flood plain.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in a landscape where limestone has been locally dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from

4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.
Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.
Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

ILLUSTRATIONS

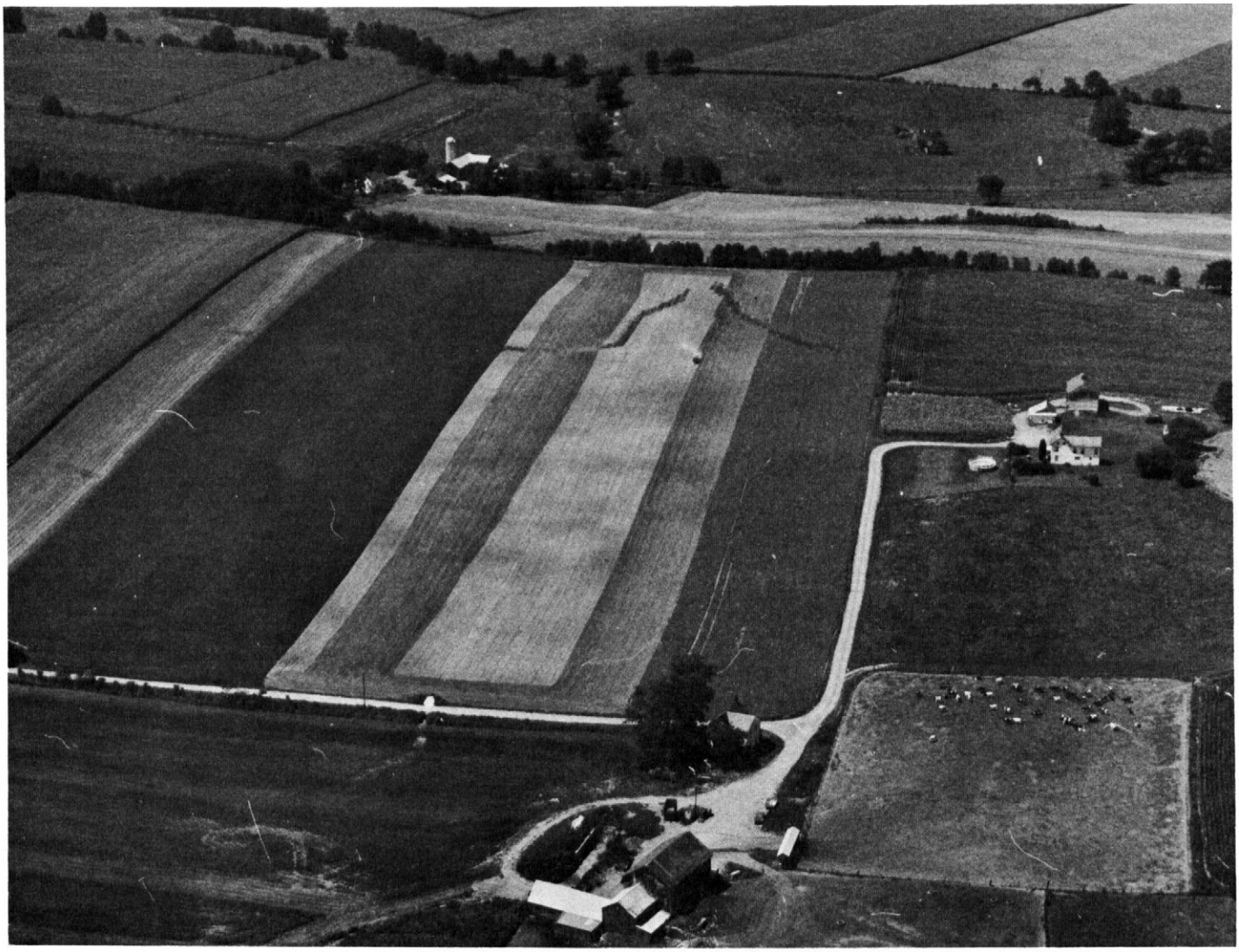

Figure 1.—Washington and Bartley soils are used as farmland.

Figure 2.—Early crop of lettuce on Carlisle muck. Onions generally follow as a late crop.

Figure 3.—Farm pond on Chippewa silt loam, 0 to 3 percent slopes, that can be used for irrigation, fire protection, stock water, swimming, fish production, and waterfowl use.

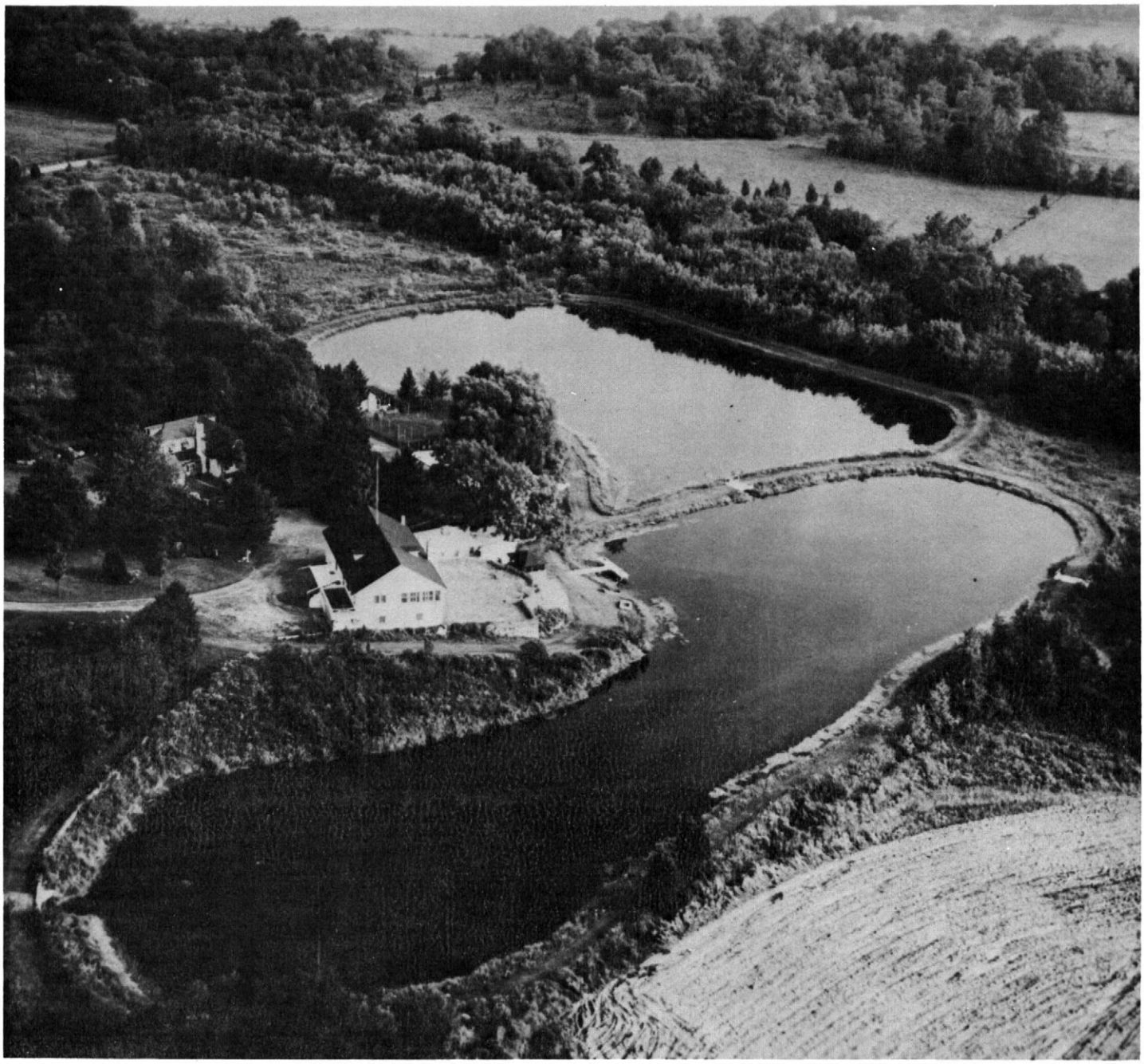

Figure 4.—Fredon soils are well suited to excavated ponds that can be used for fire protection, swimming, and fish production.

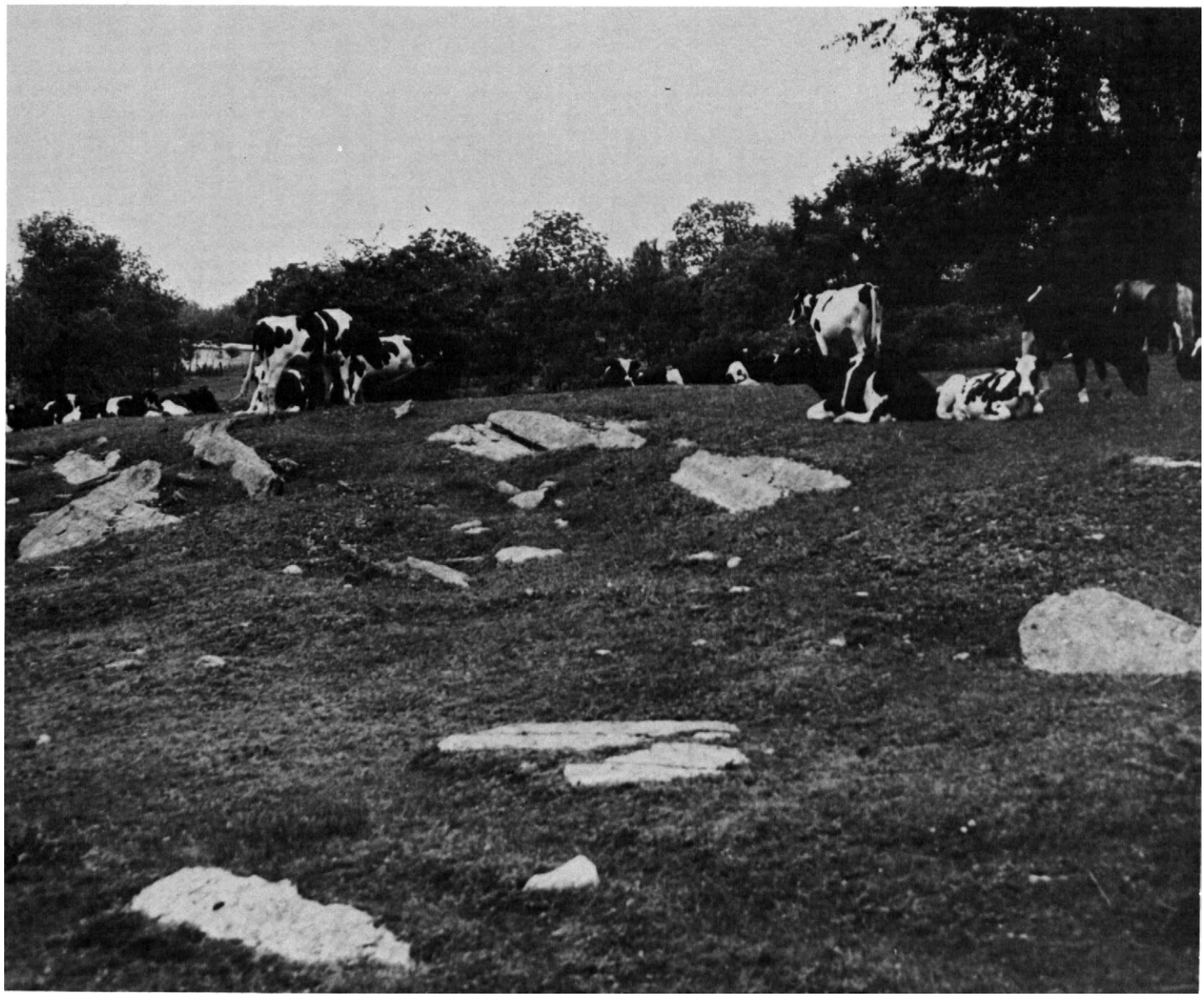

Figure 5.—Bedrock outcrops in Nassau rocky silt loam, which is suited to pasture.

Figure 6.—Sinkholes develop following heavy rains in Washington loam, 0 to 3 percent slopes. This soil, in places, overlies cavernous limestone bedrock.

Figure 7.—Contour stripcropping on Washington loam, 3 to 8 percent slopes, helps to reduce runoff and erosion and to maintain the content of organic matter. Intermediate hay strips retain most of the soil material that erodes from strips of corn.

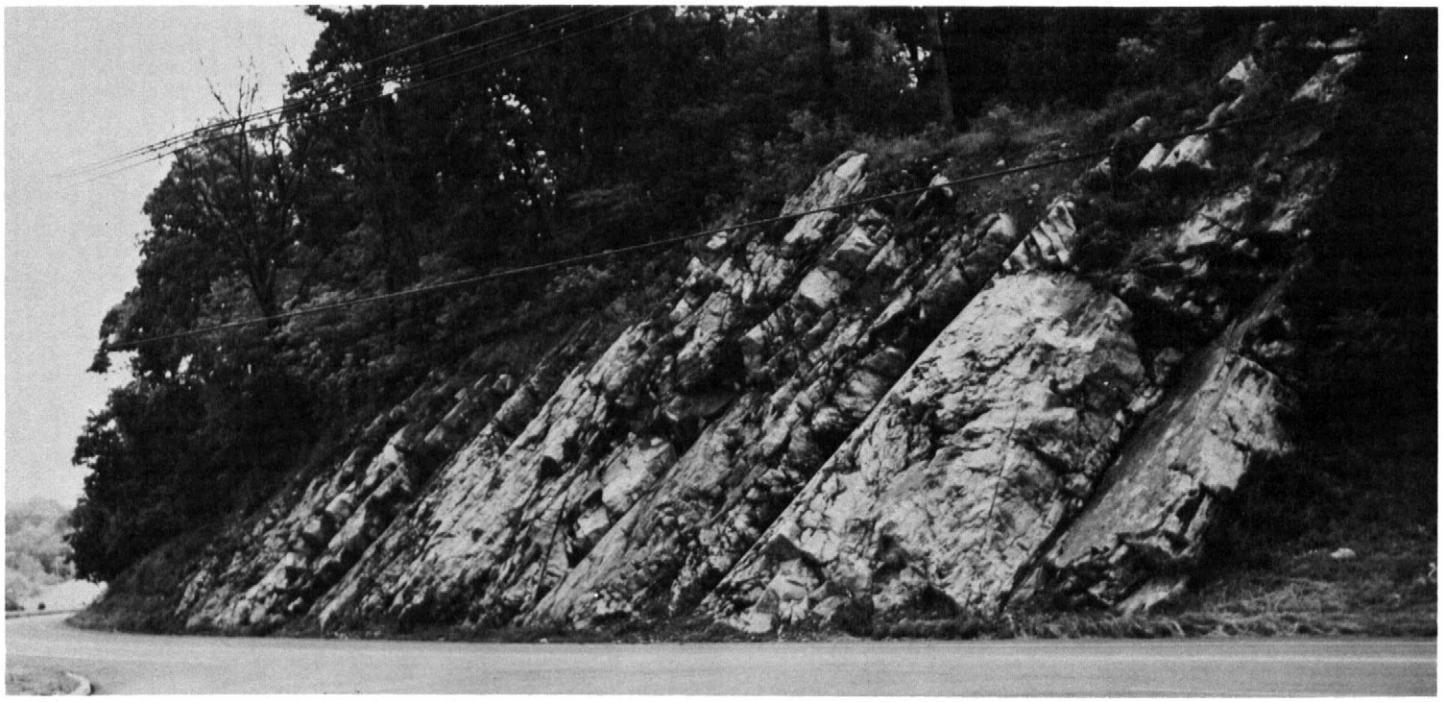

Figure 8.—Road cut in Wassaic soil showing limestone bedrock that in most places is at a depth of 20 to 40 inches.

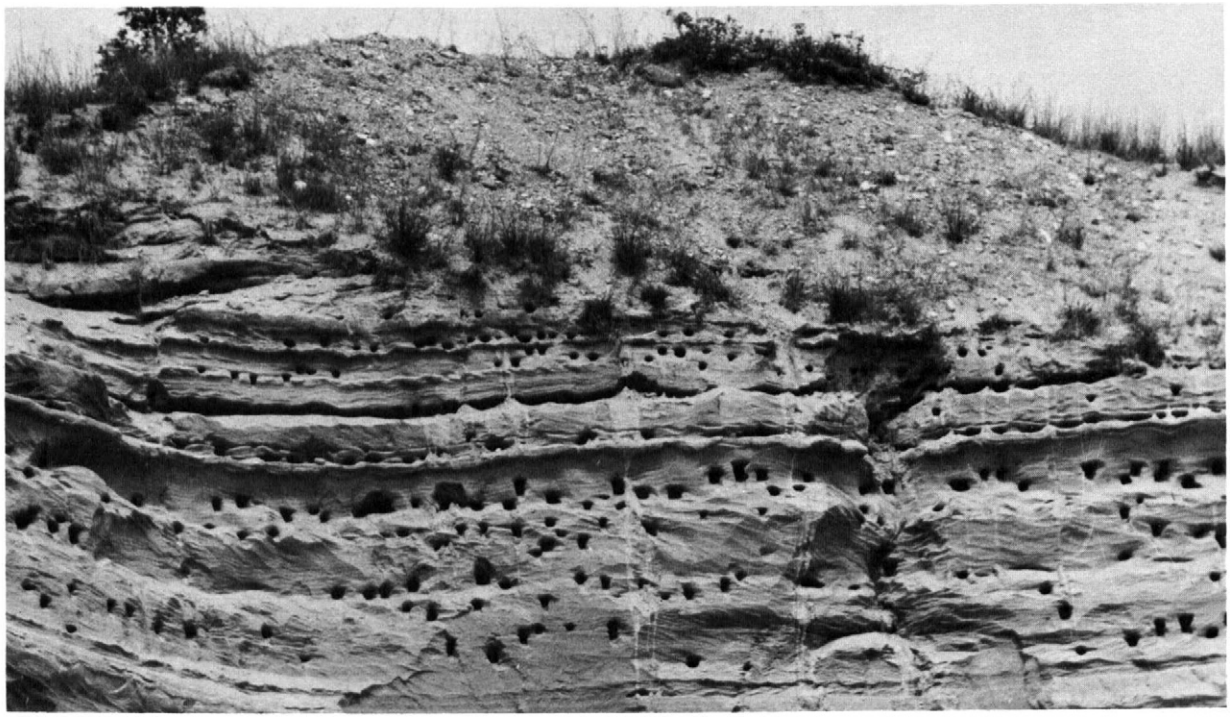

Figure 9.—The sandy substrata of Hazen soils provide ideal homes for bank swallows.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	36.4	18.6	27.5	58	-6	16	2.85	1.69	3.88	6	6.7
February---	39.7	20.2	30.0	60	-2	26	3.07	2.06	3.97	6	7.9
March------	48.9	27.7	38.3	75	9	78	3.56	2.45	4.58	7	7.1
April------	62.2	37.3	49.8	87	22	308	4.16	2.33	5.64	8	.7
May--------	72.3	46.6	59.5	93	30	605	3.54	1.71	5.04	7	.0
June-------	80.7	56.2	68.4	96	40	852	3.65	2.03	4.97	7	.0
July-------	84.9	60.4	72.7	98	47	1,014	4.36	2.01	6.27	7	.0
August-----	82.6	59.1	70.9	94	44	958	4.71	2.33	6.64	7	.0
September--	76.3	52.4	64.4	93	34	732	3.82	2.33	5.16	6	.0
October----	66.2	41.1	53.7	84	23	430	3.27	1.45	4.75	5	.1
November---	52.3	31.9	42.1	73	14	99	4.06	2.61	5.37	7	.7
December---	40.0	22.6	31.3	64	1	32	3.92	2.23	5.29	7	7.6
Year-----	61.9	39.5	50.7	99	-8	5,150	44.97	37.76	51.87	80	30.8

[1]Recorded in the period 1951-73 at Belvidere, N.J.

[2]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 13	April 27	May 17
2 years in 10 later than--	April 8	April 22	May 11
5 years in 10 later than--	March 28	April 13	April 30
First freezing temperature in fall:			
1 year in 10 earlier than--	October 25	October 8	September 29
2 years in 10 earlier than--	October 29	October 13	October 4
5 years in 10 earlier than--	November 7	October 24	October 13

[1]Recorded in the period 1951-73 at Belvidere, N.J.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
9 years in 10	199	171	142
8 years in 10	207	179	150
5 years in 10	223	194	166
2 years in 10	238	209	181
1 year in 10	246	217	189

[1]Recorded in the period 1951-73 at Belvidere, N.J.

TABLE 4.--MAP UNITS (GENERAL SOIL MAP) AND THEIR POTENTIAL AND LIMITATIONS FOR SPECIFIED USES

Map unit	Extent of area	Cultivated farm crops	Specialty crops	Woodland	Urban uses	Intensive recreation areas	Extensive recreation areas
	Pct						
1. Pope	3	Good	Very good	Good	Fair: subject to rare flooding in places.	Good	Good.
2. Hazen-Hero-Fredon	10	Good	Good	Good	Good	Good	Good.
3. Carlisle-Adrian	2	Good	Very good	Poor: wetness.	Very poor: poor stability, wetness, flooding.	Poor: stability, wetness.	Poor: wetness, flooding.
4. Wayland-Middlebury	3	Poor: wetness, flooding.	Poor: wetness, flooding.	Poor: wetness, flooding.	Very poor: floods, wetness.	Poor: wetness, flooding.	Fair: wetness, flooding.
5. Wassaic-Washington Rock outcrop	9	Fair: stones, slope, rock outcrops.	Fair: stones, slope, rock outcrops.	Good	Fair: depth to bedrock, rock outcrops, slope.	Fair: slope, rock outcrops.	Good.
6. Swartswood-Nassau-Wurtsboro	6	Poor: stones, depth to bedrock, slope.	Poor: stones, depth to bedrock, slope.	Fair: depth to bedrock, stones.	Poor: depth to bedrock, stones, slope, percs slowly.	Poor: depth to bedrock, slopes, stones, wetness.	Good.
7. Bath-Nassau	14	Fair: depth to bedrock, slopes, stones, wetness.	Poor: depth to bedrock, slopes, stones, wetness.	Fair: depth to bedrock.	Fair: depth to bedrock, slopes, wetness.	Poor: depth to bedrock, stones, slopes, wetness.	Good.
8. Oquaga-Swartswood-Rock outcrop	6	Poor: stones, rock outcrops, slopes.	Poor: stones, rock outcrops, slopes.	Fair: stones, rock outcrops.	Poor: stones, rock outcrops, slopes.	Poor: slopes, rock outcrops, stones.	Fair: slopes, rock outcrops.
9. Edneyville-Parker-Rock outcrop	14	Fair to poor: slopes, rock outcrops, stones.	Poor: slopes, rock outcrops, stones.	Fair: slopes, rock outcrops, stones.	Poor: slopes, rock outcrops, stones.	Poor: stones, slopes, rock outcrops.	Fair: slopes, rock outcrops.
10. Annandale-Washington-Califon	13	Good	Good	Good	Good	Good	Good.
11. Washington-Bartley	20	Good	Good	Good	Good	Good	Good.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Adrian muck	1,650	0.7
AnB2	Annandale gravelly loam, 3 to 8 percent slopes, eroded	2,940	1.3
AnC2	Annandale gravelly loam, 8 to 15 percent slopes, eroded	5,000	2.2
AnD2	Annandale gravelly loam, 15 to 25 percent slopes, eroded	2,660	1.2
AsB	Annandale very stony loam, 3 to 8 percent slopes	370	0.2
AsC	Annandale very stony loam, 8 to 15 percent slopes	1,060	0.5
AsD	Annandale very stony loam, 15 to 25 percent slopes	830	0.4
BaA	Bartley loam, 0 to 3 percent slopes	1,190	0.5
BaB	Bartley loam, 3 to 8 percent slopes	6,680	2.9
BbC	Bartley gravelly loam, 8 to 15 percent slopes	1,900	0.8
BdB	Bartley stony loam, 3 to 8 percent slopes	310	0.1
BfB	Bath gravelly loam, 3 to 8 percent slopes	5,641	2.4
BfC	Bath gravelly loam, 8 to 15 percent slopes	4,440	1.9
BfD	Bath gravelly loam, 15 to 25 percent slopes	1,850	0.8
BfE	Bath gravelly loam, 25 to 40 percent slopes	550	0.2
BgB	Bath very stony loam, 3 to 8 percent slopes	1,280	0.6
BgC	Bath very stony loam, 8 to 15 percent slopes	1,070	0.5
CbB	Califon gravelly loam, 3 to 8 percent slopes	3,240	1.4
CbC2	Califon gravelly loam, 8 to 15 percent slopes, eroded	1,720	0.7
CcB	Califon very stony loam, 3 to 8 percent slopes	570	0.2
CcC	Califon very stony loam, 8 to 15 percent slopes	400	0.2
Ck	Carlisle muck	3,550	1.5
CmA	Chippewa silt loam, 0 to 3 percent slopes	2,140	0.9
CmB	Chippewa silt loam, 3 to 8 percent slopes	610	0.3
CnA	Chippewa very stony silt loam, 0 to 3 percent slopes	930	0.4
CnB	Chippewa very stony silt loam, 3 to 8 percent slopes	730	0.3
CoA	Cokesbury loam, 0 to 3 percent slopes	560	0.2
CoB	Cokesbury loam, 3 to 8 percent slopes	920	0.4
CsB	Cokesbury very stony loam, 3 to 8 percent slopes	1,080	0.5
EdB	Edneyville gravelly loam, 3 to 8 percent slopes	5,160	2.2
EdC	Edneyville gravelly loam, 8 to 15 percent slopes	2,990	1.3
EeB	Edneyville extremely stony loam, 3 to 8 percent slopes	2,460	1.1
EeC	Edneyville extremely stony loam, 8 to 15 percent slopes	4,460	1.9
EPD	Edneyville-Parker-Rock outcrop association, steep	7,650	3.3
FrA	Fredon loam, 0 to 3 percent slopes	2,050	0.9
Ha	Halsey loam	1,540	0.7
HbA	Hazen loam, 0 to 3 percent slopes	1,320	0.6
HbB	Hazen loam, 3 to 8 percent slopes	270	0.1
HbC	Hazen loam, 8 to 15 percent slopes	470	0.2
HcB	Hazen cobbly loam, 3 to 8 percent slopes	870	0.4
HfA	Hazen gravelly loam, 0 to 3 percent slopes	3,970	1.7
HfB	Hazen gravelly loam, 3 to 8 percent slopes	4,310	1.9
HfC	Hazen gravelly loam, 8 to 15 percent slopes	4,040	1.7
HfD	Hazen gravelly loam, 15 to 25 percent slopes	730	0.3
HfE	Hazen gravelly loam, 25 to 40 percent slopes	360	0.2
HkA	Hero loam, 0 to 3 percent slopes	810	0.4
HkB	Hero loam, 3 to 8 percent slopes	1,000	0.4
HrA	Hero gravelly loam, 0 to 3 percent slopes	770	0.3
HrB	Hero gravelly loam, 3 to 8 percent slopes	1,300	0.6
LyA	Lyons silt loam, 0 to 4 percent slopes	1,440	0.6
LzB	Lyons very stony silt loam, 3 to 8 percent slopes	460	0.2
Md	Middlebury loam	1,580	0.7
NaC	Nassau rocky silt loam, 8 to 15 percent slopes	4,890	2.1
NbB	Nassau shaly silt loam, 3 to 8 percent slopes	2,740	1.2
NFD	Nassau-Rock outcrop complex, 15 to 25 percent slopes	5,750	2.5
NFE	Nassau-Rock outcrop complex, 25 to 45 percent slopes	3,140	1.4
ORD	Oquaga-Swartswood-Rock outcrop association, steep	720	0.3
PaA	Palmyra gravelly fine sandy loam, 0 to 3 percent slopes	420	0.2
PaB	Palmyra gravelly fine sandy loam, 3 to 8 percent slopes	530	0.2
PbD	Parker gravelly sandy loam, 15 to 25 percent slopes	1,530	0.7
PbE	Parker gravelly sandy loam, 25 to 40 percent slopes	1,090	0.5
Pc	Pits, muck	580	0.3
Pd	Pits, sand and gravel	380	0.2
PnA	Pope fine sandy loam, high bottom, 0 to 3 percent slopes	2,040	0.9
PnB	Pope fine sandy loam, high bottom, 3 to 8 percent slopes	1,060	0.5
PoA	Pope gravelly fine sandy loam, high bottom, 0 to 3 percent slopes	810	0.4
PoB	Pope gravelly fine sandy loam, high bottom, 3 to 8 percent slopes	3,050	1.3
RcD	Rockaway very stony loam, 8 to 25 percent slopes	920	0.4
ROF	Rock outcrop-Oquaga association, very steep	6,900	3.0
RPF	Rock outcrop-Parker-Edneyville association, very steep	12,800	5.5
RRE	Rock outcrop-Rockaway-Parker association, very steep	720	0.3
RWD	Rock outcrop-Wassaic complex, 15 to 25 percent slopes	2,170	0.9

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
RWF	Rock outcrop-Wassaic complex, 25 to 45 percent slopes	3,550	1.5
StC	Steinsburg fine sandy loam, 8 to 15 percent slopes	870	0.4
SuB	Swartswood gravelly loam, 3 to 8 percent slopes	480	0.2
SvB	Swartswood very stony loam, 3 to 8 percent slopes	2,620	1.1
SvC	Swartswood very stony loam, 8 to 15 percent slopes	2,220	1.0
SvD	Swartswood very stony loam, 15 to 25 percent slopes	2,230	1.0
SxC	Swartswood-Oquaga extremely stony loams, 8 to 15 percent slopes	2,470	1.1
VeA	Venango silt loam, 0 to 3 percent slopes	280	0.1
VnB	Venango gravelly loam, 3 to 8 percent slopes	1,360	0.6
VnC	Venango gravelly loam, 8 to 15 percent slopes	390	0.2
VsB	Venango very stony loam, 3 to 8 percent slopes	520	0.2
WaA	Washington loam, 0 to 3 percent slopes	2,850	1.2
WaB	Washington loam, 3 to 8 percent slopes	22,640	9.8
WaC2	Washington loam, 8 to 15 percent slopes, eroded	4,910	2.1
WaD2	Washington loam, 15 to 25 percent slopes, eroded	1,630	0.7
WgB	Washington gravelly loam, 3 to 8 percent slopes	760	0.3
WgC	Washington gravelly loam, 8 to 15 percent slopes	1,400	0.6
WgD	Washington gravelly loam, 15 to 25 percent slopes	1,260	0.5
WkB	Washington very stony loam, 3 to 8 percent slopes	490	0.2
WkC	Washington very stony loam, 8 to 15 percent slopes	950	0.4
WkD	Washington very stony loam, 15 to 25 percent slopes	500	0.2
WkE	Washington very stony loam, 25 to 40 percent slopes	920	0.4
WmA	Wassaic gravelly loam, 0 to 3 percent slopes	480	0.2
WmB	Wassaic gravelly loam, 3 to 8 percent slopes	960	0.4
WnC	Wassaic rocky gravelly loam, 8 to 15 percent slopes	1,260	0.5
WnD	Wassaic rocky gravelly loam, 15 to 25 percent slopes	470	0.2
WOB	Wassaic-Rock outcrop complex, 3 to 8 percent slopes	1,400	0.6
WOC	Wassaic-Rock outcrop complex, 8 to 15 percent slopes	3,020	1.3
WOD	Wassaic-Rock outcrop complex, 15 to 25 percent slopes	1,060	0.5
Wp	Wayland silt loam	4,100	1.8
WvB	Wurtsboro extremely stony loam, 3 to 8 percent slopes	2,560	1.1
WvC	Wurtsboro extremely stony loam, 8 to 15 percent slopes	430	0.2
	Mine dump	340	0.1
	Quarry	110	([1])
	Water	1,320	0.6
	Total	230,961	100.0

[1]Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Soybeans	Wheat	Alfalfa hay	Grass-legume hay
	Bu	Ton	Bu	Bu	Ton	Ton
Ad---------- Adrian	---	---	---	---	---	---
AnB2---------- Annandale	130	26	40	50	5.0	3.2
AnC2---------- Annandale	120	24	35	45	4.5	3.0
AnD2---------- Annandale	110	22	---	40	4.0	2.5
AsB, AsC, AsD---------- Annandale	---	---	---	---	---	---
BaA, BaB---------- Bartley	130	26	45	50	5.0	3.0
BbC, BdB---------- Bartley	120	24	40	45	4.5	3.0
BfB---------- Bath	110	22	40	45	5.0	3.5
BfC---------- Bath	100	20	35	40	5.0	3.5
BfD---------- Bath	90	18	---	40	4.5	3.0
BfE, BgB, BgC---------- Bath	---	---	---	---	---	---
CbB---------- Califon	120	24	35	45	5.0	3.5
CbC2---------- Califon	110	22	30	40	4.5	3.0
CcB, CcC---------- Califon	---	---	---	---	---	---
Ck---------- Carlisle	---	---	---	---	---	---
CmA---------- Chippewa	---	15	---	---	---	2.5
CmB---------- Chippewa	---	15	---	---	---	2.5
CnA, CnB---------- Chippewa	---	---	---	---	---	---
CoA---------- Cokesbury	80	16	---	---	---	3.0
CoB---------- Cokesbury	80	16	---	---	---	3.0
CsB---------- Cokesbury	---	---	---	---	---	---

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn	Corn silage	Soybeans	Wheat	Alfalfa hay	Grass-legume hay
	Bu	Ton	Bu	Bu	Ton	Ton
EdB---------- Edneyville	130	26	40	50	5.5	3.5
EdC---------- Edneyville	120	24	35	45	5.0	3.2
EeB, EeC---------- Edneyville	---	---	---	---	---	---
EPD[1]: Edneyville----------	---	---	---	---	---	---
Parker----------	---	---	---	---	---	---
Rock outcrop.						
FrA---------- Fredon	100	20	---	---	---	3.0
Ha---------- Halsey	90	18	20	---	---	2.5
HbA---------- Hazen	120	24	40	45	4.5	3.2
HbB---------- Hazen	120	24	40	45	4.5	3.2
HbC---------- Hazen	110	22	35	40	4.0	3.0
HcB---------- Hazen	110	22	35	40	4.0	3.0
HfA---------- Hazen	120	24	40	45	4.5	3.2
HfB---------- Hazen	120	24	40	45	4.5	3.2
HfC---------- Hazen	110	22	35	40	4.0	3.0
HfD---------- Hazen	90	18	---	35	3.5	2.5
HfE---------- Hazen	---	---	---	---	---	---
HkA, HkB, HrA, HrB-------- Hero	110	22	35	40	4.0	3.5
LyA---------- Lyons	---	18	---	---	---	3.0
LzB---------- Lyons	---	---	---	---	---	---
Md---------- Middlebury	120	24	40	40	4.5	3.5
NaC---------- Nassau	50	10	20	35	---	2.0
NbB---------- Nassau	50	10	20	35	---	2.0

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn	Corn silage	Soybeans	Wheat	Alfalfa hay	Grass-legume hay
	Bu	Ton	Bu	Bu	Ton	Ton
NFD---------- Nassau	---	---	---	30	---	1.5
NFE---------- Nassau	---	---	---	---	---	---
ORD[1]: Oquaga----------	---	---	---	---	---	---
Swartswood----------	---	---	---	---	---	---
Rock outcrop.						
PaA, PaB---------- Palmyra	110	18	40	45	4.5	3.2
PbD---------- Parker	70	14	---	35	2.5	1.8
PbE---------- Parker	---	---	---	---	---	---
Pc[1], Pd[1]---------- Pits	---	---	---	---	---	---
PnA, PnB, PoA, PoB-------- Pope	130	26	45	45	5.0	3.5
RcD---------- Rockaway	---	---	---	---	---	---
ROF[1]: Rock outcrop.						
Oquaga----------	---	---	---	---	---	---
RPF[1]: Rock outcrop.						
Parker----------	---	---	---	---	---	---
Edneyville----------	---	---	---	---	---	---
RRE[1]: Rock outcrop.						
Rockaway----------	---	---	---	---	---	---
Parker----------	---	---	---	---	---	---
RWD---------- Rock outcrop.	---	---	---	---	---	---
RWF---------- Rock outcrop.	---	---	---	---	---	---
StC---------- Steinsburg	75	15	30	35	3.0	2.5
SuB---------- Swartswood	100	20	---	45	---	3.5
SvB, SvC---------- Swartswood	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn	Corn silage	Soybeans	Wheat	Alfalfa hay	Grass-legume hay
	Bu	Ton	Bu	Bu	Ton	Ton
SvD---------- Swartswood	---	---	---	---	---	---
SxC---------- Swartswood	---	---	---	---	---	---
VeA---------- Venango	90	18	35	30	3.5	3.0
VnB---------- Venango	90	18	35	30	3.5	3.0
VnC---------- Venango	80	16	30	25	3.5	3.0
VsB---------- Venango	---	---	---	---	---	---
WaA---------- Washington	140	28	45	50	5.5	3.5
WaB---------- Washington	140	28	45	50	5.5	3.5
WaC2---------- Washington	130	26	40	40	5.0	3.2
WaD2---------- Washington	120	24	---	35	4.5	3.0
WgB---------- Washington	140	28	45	50	5.5	3.5
WgC---------- Washington	130	26	40	40	5.0	3.2
WgD---------- Washington	120	24	---	35	4.5	3.0
WkB, WkC, WkD---------- Washington	---	---	---	---	---	---
WkE---------- Washington	---	---	---	---	---	---
WmA---------- Wassaic	105	21	40	45	3.5	3.0
WmB---------- Wassaic	105	21	40	45	3.5	3.0
WnC---------- Wassaic	95	19	35	40	3.0	2.8
WnD---------- Wassaic	85	17	---	35	2.5	2.5
WOB, WOC, WOD---------- Wassaic	---	---	---	---	---	---
Wp---------- Wayland	---	---	---	---	---	---
WvB, WvC---------- Wurtsboro	---	---	---	---	---	---

[1] This map unit is made up of two or more dominant kinds of soil. See the description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas excluded. Absence of an entry means no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	11,410	---	---	---
II	65,161	58,031	6,650	480
III	41,780	32,130	8,780	870
IV	22,340	15,020	7,320	---
V	---	---	---	---
VI	33,360	2,000	4,100	27,260
VII	54,180	---	---	54,180
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that the information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
Ad Adrian	4w	Slight	Severe	Severe	Severe	Red maple White ash	46 50	
AnB2, AnC2 Annandale	2o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar White ash	80 90 70	Eastern white pine, yellow-poplar, European larch, Norway spruce, Austrian pine.
AnD2, AsD Annandale	2r	Slight	Moderate	Slight	Slight	Northern red oak Yellow-poplar White ash	80 90 70	Eastern white pine, yellow-poplar, European larch, Norway spruce, Austrian pine.
AsB, AsC Annandale	2o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar White ash	80 90 70	Eastern white pine, yellow-poplar, European larch, Norway spruce, Austrian pine.
BaA, BaB, BbC, BdB Bartley	2o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar White ash	80 90 70	Eastern white pine, European larch, black walnut, yellow-poplar.
BfB, BfC, BgB, BgC Bath	3o	Slight	Slight	Slight	Slight	Northern red oak Sugar maple White ash	61 70 60 60	Eastern white pine, red pine, Norway spruce, European larch.
BfD, BfE Bath	3r	Slight	Moderate	Slight	Slight	Northern red oak Sugar maple White ash	61 70 60 60	Eastern white pine, red pine, Norway spruce, European larch.
CbB, CbC2, CcB, CcC Califon	2o	Slight	Slight	Slight	Slight	Yellow-poplar Northern red oak White oak Black oak White ash	90 80 80 80 70	Eastern white pine, Norway spruce, yellow-poplar.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
Ck---------- Carlisle	4w	Slight	Severe	Severe	Severe	Red maple---------- White ash---------- Swamp white oak-----	46 50 60	Northern white-cedar.
CmA, CmB, CnA, CnB- Chippewa	5w	Slight	Severe	Severe	Severe	Red maple---------- Swamp white oak-----	50 50	Eastern white pine, white spruce.
CoA, CoB, CsB------ Cokesbury	3w	Slight	Severe	Severe	Moderate	Pin oak---------- Red maple---------- Swamp white oak-----	70 60 70	Eastern white pine, Norway spruce, yellow-poplar.
EdB, EdC---------- Edneyville	2o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-------	75 99	Norway spruce, eastern white pine, yellow-poplar.
EeB, EeC---------- Edneyville	3x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-------	75 99	Yellow-poplar, eastern white pine, Norway spruce.
EPD[1]: Edneyville--------	3x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-------	75 99 80	Yellow-poplar, eastern white pine, Norway spruce.
Parker----------	3x	Slight	Moderate	Moderate	Slight	Black oak---------- White oak---------- Scarlet oak--------- Chestnut oak-------- Yellow-poplar-------	70 70 70 70 75	Eastern white pine, European larch, Austrian pine, Norway spruce.
Rock outcrop.								
FrA---------- Fredon	4w	Slight	Severe	Severe	Severe	Red maple----------	60	Pin oak swamp white oak.
Ha---------- Halsey	5w	Slight	Severe	Severe	Severe	Red maple----------	55	Pin oak, swamp white oak.
HbA, HbB, HbC, HcB, HfA, HfB, HfC----- Hazen	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak---------- Black oak---------- Yellow-poplar------- White ash----------	70 70 70 80 60	Eastern white pine, yellow-poplar, northern red oak.
HfD, HfE---------- Hazen	3r	Slight	Moderate	Slight	Slight	Northern red oak---- White oak---------- Black oak---------- Yellow-poplar------- White ash----------	70 70 70 80 60	Eastern white pine, yellow-poplar, northern red oak.
HkA, HkB, HrA, HrB- Hero	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-------	65 80	Eastern white pine, European larch, white spruce.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
LyA, LzB---------- Lyons	5w	Slight	Severe	Severe	Severe	Red maple----------	60	Northern white-cedar.
Md---------- Middlebury	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Eastern white pine, yellow-poplar, Norway spruce, European larch, black walnut.
						Sugar maple---------	70	
						Yellow-poplar-------	95	
						White ash----------	75	
NaC, NbB---------- Nassau	5d	Slight	Slight	Severe	Moderate	Sugar maple---------	50	Eastern white pine, European larch, black locust.
						Black oak----------	50	
						Chestnut oak--------	50	
NFD[1]: Nassau----------	5d	Slight	Moderate	Severe	Moderate	Sugar maple---------	50	Eastern white pine, European larch, black locust.
						Black oak----------	50	
						Chestnut oak--------	50	
Rock outcrop.								
NFE[1]: Nassau----------	5d	Moderate	Moderate	Severe	Moderate	Sugar maple---------	50	Eastern white pine, European larch.
						Northern red oak----	50	
						Black oak----------	50	
						Chestnut oak--------	50	
Rock outcrop.								
ORD[1]: Oquaga----------	3x	Slight	Moderate	Slight	Slight	Sugar maple---------	73	Eastern white pine, European larch, Norway spruce.
						Northern red oak----	60	
						White ash----------	75	
						Black oak----------	60	
Swartswood--------	3x	Slight	Moderate	Slight	Slight	Northern red oak----	70	Eastern white pine, European larch, Norway spruce.
						Sugar maple---------	70	
						White ash----------	70	
Rock outcrop.								
PaA, PaB---------- Palmyra	2o	Slight	Slight	Slight	Slight	Sugar maple---------	70	Eastern white pine, European larch, black locust, Norway spruce.
						Northern red oak----	80	
PbD, PbE---------- Parker	3f	Slight	Moderate	Moderate	Slight	Black oak----------	70	Eastern white pine, European larch, Austrian pine, Norway spruce.
						White oak----------	70	
						Scarlet oak---------	70	
						Chestnut oak--------	70	
						Yellow-poplar-------	75	
PnA, PnB, PoA, PoB- Pope	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Eastern white pine, yellow-poplar, black walnut, Norway spruce, European larch.
						Yellow-poplar-------	102	
RcD---------- Rockaway	3r	Slight	Moderate	Slight	Slight	Northern red oak----	70	Eastern white pine, Austrian pine, Norway spruce.
						White oak----------	70	
						Black oak----------	70	
						Scarlet oak---------	70	
						Yellow-poplar-------	75	
						White ash----------	65	
ROF[1]: Rock outcrop.								

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
ROF[1]:								
Oquaga	3x	Slight	Moderate	Slight	Slight	Sugar maple	73	Eastern white pine,
						Northern red oak	60	European larch,
						White ash	75	Norway spruce.
						Black oak	60	
RPF[1]:								
Rock outcrop.								
Parker	3x	Slight	Moderate	Moderate	Slight	Black oak	70	Eastern white pine,
						White oak	70	European larch,
						Scarlet oak	70	Austrian pine,
						Chestnut oak	70	Norway spruce.
						Yellow-poplar	75	
Edneyville	3x	Slight	Moderate	Slight	---	Northern red oak	---	Yellow-poplar,
						Yellow-poplar	---	eastern white pine,
							---	Norway spruce.
RRE[1]:								
Rock outcrop.								
Rockaway	3x	Moderate	Severe	Slight	Slight	Northern red oak	70	Eastern white pine,
						White oak	70	Austrian pine,
						Black oak	70	Norway spruce.
						Scarlet oak	70	
						Yellow-poplar	75	
						White ash	65	
Parker	3x	Slight	Moderate	Moderate	Slight	Black oak	---	Eastern white pine,
						White oak	---	European larch,
						Scarlet oak	---	Austrian pine,
						Chestnut oak	---	Norway spruce.
						Yellow-poplar	---	
RWD[1], RWF[1]:								
Rock outcrop.								
Wassaic	3r	Slight	Moderate	Slight	Slight	Sugar maple	73	Eastern white pine,
						Northern red oak	60	European larch,
						White ash	75	Norway spruce.
StC	3f	Slight	Slight	Moderate	Slight	Yellow-poplar	75	Eastern white pine,
Steinsburg						Northern red oak	70	Norway spruce,
							---	European larch.
SuB, SvB, SvC	3o	Slight	Slight	Slight	Slight	Northern red oak	70	Eastern white pine,
Swartswood						Sugar maple	70	European larch,
						White ash	70	Norway spruce.
SvD	3r	Slight	Moderate	Slight	Slight	Northern red oak	70	Eastern white pine,
Swartswood						Sugar maple	70	European larch,
						White ash	70	Norway spruce.
SxC[1]:								
Swartswood	3x	Slight	Moderate	Slight	Slight	Northern red oak	70	Eastern white pine,
						Sugar maple	70	European larch,
						White ash	70	Norway spruce.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
SxC[1]:								
Oquaga	3x	Slight	Moderate	Slight	Slight	Sugar maple Northern red oak White ash	73 60 75	Eastern white pine, European larch, Norway spruce.
VeA, VnB, VnC, VsB-Venango	2w	Slight	Moderate	Slight	Slight	Northern red oak Yellow-poplar White ash Sugar maple	83 89 75 79	Yellow-poplar, eastern white pine.
WaA, WaB, WaC2, WgB WgC, WkB, WkC-----Washington	1o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar White ash Black walnut	85 95 75 ---	Eastern white pine, European larch, black walnut, yellow-poplar, Norway spruce.
WaD2, WgD, WkD, WkE Washington	1r	Slight	Moderate	Slight	Slight	Northern red oak Yellow-poplar White ash	85 95 75	Eastern white pine, European larch, black walnut, yellow-poplar, Norway spruce.
WmA, WmB, WnC------Wassaic	3o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak White ash Black oak	73 60 75 60	Eastern white pine, European larch, Norway spruce.
WnD----------Wassaic	3r	Moderate	Moderate	Slight	Slight	Sugar maple Northern red oak White ash Black oak	73 60 75 60	Eastern white pine, European larch, Norway spruce.
WOB[1], WOC[1]:								
Wassaic	3o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak White ash Black oak	73 60 75 60	Eastern white pine, European larch, Norway spruce.
Rock outcrop.								

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
WOD[1]:								
Wassaic	3r	Moderate	Moderate	Slight	Slight	Sugar maple	73	Eastern white pine, European larch, Norway spruce.
						Northern red oak	60	
						White ash	75	
Rock outcrop.								
Wp	4w	Slight	Severe	Severe	Severe	Red maple	65	
Wayland						Sycamore	---	
WvB, WvC	3x	Slight	Moderate	Slight	Slight	Northern red oak	70	European larch.
Wurtsboro						White ash	60	

[1] This map unit is made up of two or more dominant kinds of soil. See the description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 9.--PLANTS SUITABLE FOR SOILS OF THE AREA

[Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
Adrian: Ad	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar	Arrowwood, red-osier dogwood, winterberry, white fringe tree, chokeberry.	---
Annandale: AnB2, AnC2, AnD2, AsB, AsC, AsD	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Bartley: BaA, BaB, BbC, BdB---	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, shadbush, sweetgum.	Eastern hemlock, American holly, Austrian pine, white pine, Norway spruce, northern white-cedar.	Arrowwood, bayberry, blackhaw, red-osier dogwood, maple species, winterberry, white fringe tree, chokeberry.	Juniper species, mountain laurel, rhododendron.
Bath: BfB, BfC, BfD, BfE, BgB, BgC	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.

TABLE 9.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
Califon: CbB, CbC2, CcB, CcC--	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, shadbush, sweetgum.	Eastern hemlock, American holly, Austrian pine, white pine, Norway spruce, northern white-cedar.	Arrowwood, bayberry, blackhaw, red-osier dogwood, maple species, winterberry, white fringe tree, chokeberry.	Juniper species, mountain laurel, rhododendron.
Carlisle: Ck----------	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar	Arrowwood, red-osier dogwood, winterberry, white fringe tree, chokeberry.	---
Chippewa: CmA, CmB, CnA, CnB---	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar	Arrowwood, red-osier dogwood, winterberry, white fringe tree, chokeberry.	---
Cokesbury: CoA, CoB, CsB--------	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar	Arrowwood, red-osier dogwood, winterberry, white fringe tree, chokeberry.	--- ---
Edneyville: EdB, EdC, EeB, EeC---	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, goldenrain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumnolive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
EPD: Edneyville part-----	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, goldenrain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumnolive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.

TABLE 9.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
EPD: Parker part	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---
Rock outcrop part.				
Fredon: FrA	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar	Arrowwood, red-osier dogwood, winterberry, white fringe tree, chokeberry.	---
Halsey: Ha	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar	Arrowwood, red-osier dogwood, winterberry, white fringe tree.	---
Hazen: HbA, HbB, HbC, HcB, HfA, HfB, HfC, HfD, HfE	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellow-wood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Hero: HkA, HkB, HrA, HrB	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, shadbush, sweetgum.	Eastern hemlock, American holly, Austrian pine, white pine, Norway spruce, northern white-cedar.	Arrowwood, bayberry, blackhaw, red-osier dogwood, maple species, winterberry, white fringe tree, chokeberry.	Juniper species, mountain laurel, rhododendron.
Lyons: LyA, LzB	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar	Arrowwood, red-osier dogwood, winterberry, white fringe tree, chokeberry.	---
Middlebury: Md	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, shadbush, sweetgum.	Eastern hemlock, American holly, Austrian pine, white pine, Norway spruce, northern white-cedar.	Arrowwood, bayberry, blackhaw, red-osier dogwood, maple species, winterberry, white fringe tree, chokeberry.	Juniper species, mountain laurel, rhododendron.

TABLE 9.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
Nassau:				
NaC, NbB	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---
NFD, NFE:				
Nassau part	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---
Rock outcrop part.				
ORD:				
Oquaga part	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn olive.	---
Swartswood part	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Rock outcrop part.				
Palmyra:				
PaA, PaB	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species mountain laurel, Mugo pine, rhododendron, Japanese yew.
Parker:				
PbB, PbE	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---
Pits:				
Pc, Pd	---	---	---	---

TABLE 9.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
Pope: PnA, PnB, PoA, PoB	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Rockaway: RcD	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
ROF: Rock outcrop part.				
Oquaga part	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---
RPF: Rock outcrop part.				
Parker part	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---
Edneyville part	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.

TABLE 9. --PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
RRE: Rock outcrop part.				
Rockaway part	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Parker part	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---
RWD, RWF: Rock outcrop part.				
Wassaic part	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.

TABLE 9.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
Steinsburg:				
StC	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, goldenrain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Swartswood:				
SuB, SvB, SvC, SvD	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, goldenrain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
SxC:				
Swartswood part	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, goldenrain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Oquaga part	American hornbeam, ironwood, zelkova.	Austrian pine, white pine.	Bayberry, amur honeysuckle, autumn-olive.	---

TABLE 9.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
Venango: VeA, VnB, VnC, VsB	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, shadbush, sweetgum.	Eastern hemlock, American holly, Austrian pine, white pine, Norway spruce, northern white-cedar.	Arrowwood, bayberry, blackhaw, red-osier dogwood, maple species, winterberry, white fringe tree, chokeberry.	Juniper species, mountain laurel, rhododendron.
Washington: WaA, WaB, WaC2, WaD2, WgB, WgC, WgD, WkB, WkC, WkD, WkE	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
Wassaic: WmA, WmB, WnC, WnD	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.
WOB, WOC, WOD: Wassaic part	White ash, European beech, gray birch, flowering crabapple, flowering dogwood, ginkgo, American hornbeam, ironwood, littleleaf linden, sugar maple, northern red oak, pin oak, scarlet oak, willow oak, white oak, Japanese pagoda tree, Bradford pear, plums and cherries, golden-rain-tree, shadbush, sweetgum, yellowwood, zelkova.	Atlas cedar, cryptomeria, white fir, eastern hemlock, American holly, Austrian pine, white pine, Colorado blue spruce, Norway spruce, northern white-cedar.	Arrowwood, flame azalea, bayberry, blackhaw, red-osier dogwood, Laland firethorn, forsythia, Franklinia tree, hawthorns, amur honeysuckle, maple species, autumn-olive, winterberry, white fringe tree, chokeberry.	Azalea, Japanese holly, juniper species, mountain laurel, Mugo pine, rhododendron, Japanese yew.

TABLE 9. --PLANTS SUITABLE FOR SOILS OF THE AREA--Continuted

Soil name and map symbol	Deciduous trees	Evergreen trees	Deciduous shrubs	Evergreen shrubs
WOB, WOC, WOD: Rock outcrop part.				
Wayland: Wp	Pin oak, willow oak, white oak, sweetgum.	Atlantic white-cedar.	Arrowwood, red-osier, dogwood, winterberry, white fringe tree, chokeberry.	---
Wurtsboro: WvB, WvC	---	---	---	---

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some of the terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ad Adrian	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods, frost action.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.	Severe: excess humus, wetness.
AnB2 Annandale	Slight	Moderate: frost action.	Slight	Moderate: slope, frost action.	Moderate: frost action.	Moderate: small stones.
AnC2 Annandale	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
AnD2, AsD Annandale	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AsB Annandale	Moderate: large stones.	Moderate: large stones, frost action.	Moderate: large stones.	Moderate: slope, large stones, frost action.	Moderate: frost action.	Moderate: large stones.
AsC Annandale	Moderate: slope, large stones.	Moderate: slope, large stones, frost action.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, large stones.
BaA Bartley	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: frost action.	Slight.
BaB Bartley	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness.	Moderate: slope, frost action.	Moderate: frost action.	Slight.
BbC Bartley	Moderate: slope, wetness.	Moderate: slope, wetness, frost action.	Moderate: slope, wetness.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
BdB Bartley	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness.	Moderate: slope, wetness, frost action.	Moderate: frost action.	Slight.
BfB Bath	Slight	Moderate: frost action.	Slight	Moderate: slope, frost action.	Moderate: frost action.	Moderate: small stones.
BfC Bath	Moderate: slope, small stones.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
BfD, BfE Bath	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BgB Bath	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: frost action.	Moderate: large stones.
BgC Bath	Moderate: slope, large stones.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, large stones.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CbB, CcB---------- Califon	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: frost action.	Moderate: wetness, small stones.
CbC2, CcC---------- Califon	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: slope, wetness, frost action.	Severe: frost action.	Moderate: slope, wetness, small stones.
Ck---------- Carlisle	Severe: floods, wetness, cutbanks cave.	Severe: wetness, low strength, floods.	Severe: wetness, low strength, floods.	Severe: wetness, low strength, floods.	Severe: excess humus, wetness, floods.	Severe: excess humus, wetness, floods.
CmA, CmB, CnA, CnB---------- Chippewa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
CoA, CoB---------- Cokesbury	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.
CsB---------- Cokesbury	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
EdB---------- Edneyville	Slight---------	Moderate: frost action.	Slight---------	Moderate: frost action.	Moderate: frost action.	Moderate: small stones.
EdC---------- Edneyville	Moderate: depth to rock, slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
EeB---------- Edneyville	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Moderate: large stones.	Severe: large stones.
EeC---------- Edneyville	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Moderate: large stones, slope.	Severe: large stones.
EPD[1]: Edneyville-------	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.	Severe: large stones, slope.
Parker----------	Severe: slope, large stones, small stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
Rock outcrop.						
FrA---------- Fredon	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.
Ha---------- Halsey	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
HbA, HfA---------- Hazen	Severe: cutbanks cave.	Moderate: frost action.	Slight---------	Moderate: frost action.	Moderate: frost action.	Slight.
HbB, HcB, HfB----- Hazen	Severe: cutbanks cave.	Moderate: frost action, slope.	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
HbC, HfC---------- Hazen	Severe: cutbanks cave.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
HfD, HfE---------- Hazen	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HkA, HkB---------- Hero	Severe: wetness, small stones, cutbanks cave.	Severe: frost action.	Severe: wetness.	Severe: frost action.	Severe: frost action.	Slight.
HrA, HrB---------- Hero	Severe: wetness, small stones, cutbanks cave.	Severe: frost action.	Severe: wetness.	Severe: frost action.	Severe: frost action.	Moderate: small stones.
LyA, LzB---------- Lyons	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.
Md---------- Middlebury	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.	Severe: floods, frost action.	Severe: frost action.	Slight.
NaC---------- Nassau	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.
NbB---------- Nassau	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
NFD[1], NFE[1]: Nassau---------- Rock outcrop.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
ORD[1]: Oquaga---------- Swartswood------- 	Severe: slope, large stones, depth to rock. Severe: slope, large stones.	Severe: slope, large stones. Severe: slope, large stones.	Severe: slope, large stones, depth to rock. Severe: slope, wetness, large stones.	Severe: slope, large stones. Severe: slope, large stones.	Severe: slope. Severe: slope.	Severe: slope, large stones. Severe: slope, large stones.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ORD[1]: Rock outcrop.						
PaA---- Palmyra	Slight----	Moderate: frost action.	Slight----	Moderate: frost action.	Moderate: frost action.	Moderate: small stones.
PaB---- Palmyra	Slight----	Moderate: frost action.	Slight----	Moderate: slope, frost action.	Moderate: frost action.	Moderate: small stones.
PbD, PbE---- Parker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pc[1], Pd[1]. Pits						
PnA, PnB, PoA, PoB---- Pope	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Slight.
RcD---- Rockaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ROF[1]: Rock outcrop.						
Oquaga----	Severe: slope, large stones, depth to rock.	Severe: slope, large stones.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
RPF[1]: Rock outcrop.						
Parker----	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
Edneyville----	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.	Severe: large stones, slope.
RRE[1]: Rock outcrop.						
Rockaway----	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
Parker----	Severe: slope, large stones, small stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
RWD[1], RWF[1]: Rock outcrop.						
Wassaic----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
StC---- Steinsburg	Moderate: depth to rock.	Moderate: slope, frost action.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
SuB---- Swartswood	Slight----	Moderate: frost action.	Moderate: wetness.	Moderate: slope, frost action.	Moderate: frost action.	Moderate: small stones.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SvB---------- Swartswood	Moderate: wetness, large stones.	Moderate: frost action.	Moderate: wetness, large stones.	Moderate: slope, frost action.	Moderate: frost action.	Moderate: large stones.
SvC---------- Swartswood	Moderate: slope, wetness.	Moderate: slope, frost action.	Moderate: slope, wetness.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, large stones.
SvD---------- Swartswood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SxC[1]: Swartswood-------	Severe: large stones.	Severe: large stones.	Severe: wetness, large stones.	Severe: slope, large stones.	Moderate: large stones, frost action.	Severe: large stones.
Oquaga----------	Severe: large stones, depth to rock.	Severe: large stones.	Severe: large stones, depth to rock.	Severe: slope, large stones.	Moderate: slope, large stones.	Severe: large stones.
VeA, VnB, VsB----- Venango	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: frost action.	Moderate: wetness.
VnC---------- Venango	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: slope, wetness, frost action.	Severe: frost action.	Moderate: small stones, wetness, slope.
WaA---------- Washington	Moderate: too clayey.	Moderate: frost action, shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
WaB---------- Washington	Moderate: too clayey.	Moderate: frost action, shrink-swell.	Moderate: shrink-swell.	Moderate: slope, frost action, shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
WaC2---------- Washington	Moderate: slope, too clayey.	Moderate: slope, frost action, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
WaD2---------- Washington	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WgB---------- Washington	Moderate: too clayey, small stones.	Moderate: frost action, shrink-swell.	Moderate: shrink-swell.	Moderate: slope, frost action, shrink-swell.	Moderate: frost action, shrink-swell.	Moderate: small stones.
WgC---------- Washington	Moderate: slope, too clayey, small stones.	Moderate: slope, frost action, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope, small stones.
WgD---------- Washington	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: too clayey.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WkB---------- Washington	Moderate: large stones, too clayey.	Moderate: frost action, shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: slope, shrink-swell, frost action.	Moderate: frost action, shrink-swell.	Moderate: large stones.
WkC---------- Washington	Moderate: slope, large stones, too clayey.	Moderate: slope, frost action, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope, large stones.
WkD, WkE---------- Washington	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WmA---------- Wassaic	Severe: depth to rock.	Moderate: depth to rock, frost action.	Severe: depth to rock.	Moderate: depth to rock, frost action.	Moderate: depth to rock, frost action.	Moderate: small stones, depth to rock.
WmB---------- Wassaic	Severe: depth to rock.	Moderate: depth to rock, frost action.	Severe: depth to rock.	Moderate: slope, depth to rock, frost action.	Moderate: depth to rock, frost action.	Moderate: small stones, depth to rock.
WnC---------- Wassaic	Severe: depth to rock.	Moderate: slope, depth to rock, frost action.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, frost action.	Moderate: slope, depth to rock.
WnD---------- Wassaic	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
WOB[1]: Wassaic----------	Severe: depth to rock.	Moderate: depth to rock, large stones, frost action.	Severe: depth to rock.	Moderate: slope, depth to rock, frost action.	Moderate: depth to rock, frost action.	Moderate: depth to rock, large stones.
Rock outcrop.						
WOC[1]: Wassaic----------	Severe: depth to rock.	Moderate: slope, depth to rock, frost action.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, frost action.	Moderate: depth to rock, large stones.
Rock outcrop.						
WOD[1]: Wassaic----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
Wp---------- Wayland	Severe: wetness, floods.	Severe: floods, wetness, frost action.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
WvB---------- Wurtsboro	Severe: wetness.	Severe: frost action.	Severe: wetness.	Severe: frost action.	Severe: frost action.	Severe: large stones.
WvC---------- Wurtsboro	Severe: wetness.	Severe: frost action.	Severe: wetness.	Severe: slope, frost action.	Severe: frost action.	Severe: large stones.

[1] This map unit is made up of two or more dominant kinds of soil. See the description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ad Adrian	Severe: wetness, floods.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: excess humus, hard to pack.
AnB2 Annandale	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Fair: small stones.
AnC2 Annandale	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, small stones.
AnD2 Annandale	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
AsB Annandale	Severe: percs slowly.	Moderate: slope, small stones, seepage.	Moderate: large stones.	Slight	Fair: large stones, small stones.
AsC Annandale	Severe: percs slowly.	Severe: slope.	Moderate: large stones.	Moderate: slope.	Fair: slope, large stones, small stones.
AsD Annandale	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, large stones.	Severe: slope.	Poor: slope.
BaA, BaB Bartley	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Good.
BbC Bartley	Severe: percs slowly, wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.	Fair: slope.
BdB Bartley	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Good.
BfB Bath	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Fair: small stones.
BfC Bath	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, small stones.
BfD Bath	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
BfE Bath	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
BgB Bath	Severe: percs slowly.	Moderate: slope.	Moderate: large stones.	Slight	Fair: large stones.
BgC Bath	Severe: percs slowly.	Severe: slope.	Moderate: large stones.	Moderate: slope.	Fair: slope, large stones.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CbB---------- Califon	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: small stones.
CbC2---------- Califon	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: slope, small stones.
CcB---------- Califon	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: large stones, small stones.
CcC---------- Califon	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: slope, large stones, small stones.
Ck---------- Carlisle	Severe: floods, wetness.	Severe: wetness, excess humus, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness, hard to pack.
CmA, CmB, CnA, CnB-- Chippewa	Severe: wetness, percs slowly.	Moderate: small stones.	Severe: wetness.	Severe: wetness.	Poor: wetness.
CoA, CoB---------- Cokesbury	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
CsB---------- Cokesbury	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
EdB---------- Edneyville	Slight----------	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Good.
EdC---------- Edneyville	Moderate: slope.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Good.
EeB---------- Edneyville	Severe: large stones.	Severe: seepage.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
EeC---------- Edneyville	Severe: large stones.	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
EPD[1]: Edneyville---------	Severe: large stones, slope.	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: seepage.	Poor: slope, large stones.
Parker----------	Severe: slope, large stones.	Severe: slope, seepage, small stones.	Severe: seepage, large stones, depth to rock.	Severe: slope, seepage.	Poor: slope, large stones, small stones.
Rock outcrop.					

See footnotes at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FrA---------- Fredon	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
Ha---------- Halsey	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
HbA[2], HbB[2]: Hazen----------	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
HbC[2]: Hazen----------	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope.
HcB[2]: Hazen----------	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
HfA[2], HfB[2]: Hazen----------	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
HfC[2]: Hazen----------	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope, small stones.
HfD[2]: Hazen----------	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
HfE[2]: Hazen----------	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
HkA, HkB, HrA, HrB-- Hero	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Fair: thin layer, area reclaim.
LyA, LzB---------- Lyons	Severe: wetness, percs slowly.	Slight----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
Md---------- Middlebury	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.	Good.
NaC---------- Nassau	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
NbB---------- Nassau	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Poor: thin layer, area reclaim.
NFD[1]: Nassau----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
Rock outcrop.					

See footnotes at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
NFE[1]:					
Nassau	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
Rock outcrop.					
ORD[1]:					
Oquaga	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock.	Severe: large stones, depth to rock.	Severe: slope.	Poor: slope, large stones.
Swartswood	Severe: slope, percs slowly.	Severe: slope.	Severe: wetness, large stones.	Severe: slope, wetness.	Poor: slope, large stones.
Rock outcrop.					
PaA[2], PaB[2]:					
Palmyra	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
PbD Parker	Severe: slope.	Severe: slope, seepage.	Severe: seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones.
PbE Parker	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones.
Pc[1], Pd[1]. Pits					
PnA, PnB, PoA, PoB Pope	Moderate: floods.	Severe: floods, seepage.	Severe: seepage.	Moderate: floods.	Good.
RcD Rockaway	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, large stones.	Severe: slope.	Poor: slope.
ROF[1]:					
Rock outcrop.					
Oquaga	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: slope.	Poor: slope, large stones.
RPF[1]:					
Rock outcrop.					
Parker	Severe: slope, large stones.	Severe: slope, seepage, small stones.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, large stones, small stones.
Edneyville	Severe: large stones, slope.	Severe: seepage, slope.	Severe: seepage, large stones, slope.	Severe: seepage.	Severe: slope, large stones.

See footnotes at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RRE[1]: Rock outcrop.					
Rockaway	Severe: slope, large stones, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, large stones.
Parker	Severe: slope, large stones.	Severe: slope, seepage, small stones.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, large stones, small stones.
RWD[1]: Rock outcrop.					
Wassaic	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope.
RWF[1]: Rock outcrop.					
Wassaic	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.
StC Steinsburg	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: slope, thin layer, small stones.
SuB Swartswood	Severe: percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: small stones.
SvB Swartswood	Severe: percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: large stones.
SvC Swartswood	Severe: percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: slope, large stones.
SvD Swartswood	Severe: slope, percs slowly.	Severe: slope.	Severe: wetness.	Severe: slope, wetness.	Poor: slope.
SxC[1]: Swartswood	Severe: percs slowly.	Severe: slope.	Severe: wetness, large stones.	Severe: wetness.	Poor: large stones.
Oquaga	Severe: large stones, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, depth to rock.	Moderate: slope.	Poor: large stones.
VeA Venango	Severe: percs slowly, wetness.	Slight	Moderate: wetness.	Severe: wetness.	Good.
VnB Venango	Severe: percs slowly, wetness.	Moderate: slope.	Moderate: wetness.	Severe: wetness.	Fair: small stones.
VnC Venango	Severe: percs slowly, wetness.	Severe: slope.	Moderate: wetness.	Severe: wetness.	Fair: small stones, slope.
VsB Venango	Severe: percs slowly, wetness.	Moderate: slope.	Moderate: wetness.	Severe: wetness.	Fair: large stones.

See footnotes at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
WaA---------- Washington	Slight----------	Moderate: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
WaB---------- Washington	Slight----------	Moderate: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
WaC2---------- Washington	Moderate: slope.	Severe: slope.	Severe: seepage.	Severe: seepage.	Fair: slope, too clayey.
WaD2, WsD, WkD------ Washington	Severe: slope.	Severe: slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
WgB---------- Washington	Slight----------	Moderate: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones.
WgC---------- Washington	Moderate: slope.	Severe: slope.	Severe: seepage.	Severe: seepage.	Fair: slope, too clayey, small stones.
WkB---------- Washington	Moderate: large stones.	Moderate: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: large stones, too clayey.
WkC---------- Washington	Moderate: slope, large stones.	Severe: slope.	Severe: seepage.	Severe: seepage.	Fair: slope, large stones, too clayey.
WkE---------- Washington	Severe: slope.	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
WmA, WmB---------- Wassaic	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Fair: thin layer.
WnC---------- Wassaic	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Fair: slope, thin layer.
WnD---------- Wassaic	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope.
WOB[1]: Wassaic----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Fair: large stones, thin layer.
Rock outcrop.					
WOC[1]: Wassaic----------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Fair: slope, thin layer.
Rock outcrop.					
WOD[1]: Wassaic----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope.
Rock outcrop.					

See footnotes at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Wp---------- Wayland	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
WvB---------- Wurtsboro	Severe: percs slowly.	Severe: large stones.	Severe: wetness.	Severe: wetness.	Poor: large stones.
WvC---------- Wurtsboro	Severe: percs slowly.	Severe: slope, large stones.	Severe: wetness.	Severe: wetness.	Poor: large stones.

[1] This map unit is made up of two or more dominant kinds of soil. See the description of the map unit for the composition and behavior characteristics of the map unit.

[2] Permeability of the C horizon can cause ground-water pollution.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ad Adrian	Poor: excess humus, wetness.	Poor: excess fines.	Unsuited: excess humus.	Poor: wetness.
AnB2, AnC2 Annandale	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
AnD2 Annandale	Fair: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
AsB, AsC Annandale	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones, small stones.
AsD Annandale	Fair: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones, small stones.
BaA, BaB Bartley	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
BbC Bartley	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
BdB Bartley	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
BfB, BfC Bath	Fair: frost action.	Poor: excess fines.	Poor: excess fines.	Poor: small stones.
BfD Bath	Fair: slope, frost action.	Poor: excess fines.	Poor: excess fines.	Poor: slope, small stones.
BfE Bath	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: slope, small stones.
BgB, BgC Bath	Fair: frost action.	Unsuited: excess fines.	Poor: excess fines.	Poor: large stones.
CbB Califon	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, thin layer.
CbC2 Califon	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones, thin layer.
CcB, CcC Califon	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Ck Carlisle	Poor: frost action, low strength.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
CmA, CmB, CnA, CnB Chippewa	Poor: wetness, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CoA, CoB---------- Cokesbury	Poor: wetness, frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
CsB---------- Cokesbury	Poor: wetness, frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, large stones.
EdB---------- Edneyville	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
EdC---------- Edneyville	Fair: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
EeB, EeC---------- Edneyville	Fair: large stones, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
EPD[1]: Edneyville----------	Fair: large stones, slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
Parker----------	Fair: slope, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones, small stones.
Rock outcrop.				
FrA---------- Fredon	Poor: wetness, frost action.	Poor: excess fines.	Poor: excess fines.	Poor: wetness.
Ha---------- Halsey	Poor: wetness, frost action.	Poor: excess fines.	Poor: excess fines.	Poor: wetness.
HbA, HbB---------- Hazen	Fair: frost action.	Fair: excess fines.	Fair: excess fines.	Good.
HbC---------- Hazen	Fair: frost action.	Fair: excess fines.	Fair: excess fines.	Fair: slope.
HcB---------- Hazen	Fair: frost action.	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
HfA, HfB, HfC--------- Hazen	Fair: frost action.	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
HfD---------- Hazen	Fair: slope, frost action.	Fair: excess fines.	Fair: excess fines.	Poor: slope, small stones.
HfE---------- Hazen	Poor: slope.	Fair: excess fines.	Fair: excess fines.	Poor: slope, small stones.
HkA, HkB---------- Hero	Poor: frost action.	Good----------	Good----------	Fair: area reclaim.
HrA, HrB---------- Hero	Poor: frost action.	Good----------	Good----------	Poor: small stones.
LyA---------- Lyons	Poor: wetness, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LzB Lyons	Poor: wetness, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, large stones.
Md Middlebury	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
NaC, NbB Nassau	Poor: thin layer, area reclaim.	Unsuited: thin layer, excess fines.	Unsuited: thin layer.	Poor: area reclaim, small stones.
NFD[1]: Nassau	Poor: thin layer, area reclaim.	Unsuited: thin layer, excess fines.	Unsuited: thin layer.	Poor: slope, area reclaim, small stones.
Rock outcrop.				
NFE[1]: Nassau	Poor: slope, thin layer, area reclaim.	Unsuited: thin layer, excess fines.	Unsuited: thin layer.	Poor: slope, area reclaim, small stones.
Rock outcrop.				
ORD[1]: Oquaga	Poor: thin layer.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: slope, large stones.
Swartswood	Fair: large stones, frost action.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones.
Rock outcrop.				
PaA, PaB Palmyra	Fair: frost action.	Good	Good	Poor: small stones.
PbD Parker	Fair: slope, frost action.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.
PbE Parker	Poor: slope.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.
Pc[1], Pd[1]. Pits				
PnA, PnB, PoA, PoB Pope	Fair: low strength, frost action.	Poor: excess fines.	Unsuited: excess fines.	Good.
RcD Rockaway	Fair: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
ROF[1]: Rock outcrop.				
Oquaga	Poor: slope, thin layer.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: slope, large stones.
RPF[1]: Rock outcrop.				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RPF[1]:				
Parker	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones, small stones.
Edneyville	Poor: slope.	Unsuited	Unsuited	Poor: slope, large stones.
RRE[1]:				
Rock outcrop.				
Rockaway		Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
Parker	Poor: slope.	Unsuited	Unsuited	Poor: slope, large stones, small stones.
RWD[1]:				
Rock outcrop.				
Wassaic	Poor: thin layer.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones.
RWF[1]:				
Rock outcrop.				
Wassaic	Poor: slope, thin layer.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones.
StC Steinsburg	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
SuB Swartswood	Fair: frost action.	Poor: excess fines.	Poor: excess fines.	Poor: small stones.
SvB, SvC Swartswood	Fair: frost action.	Poor: excess fines.	Poor: excess fines.	Poor: large stones.
SvD Swartswood	Fair: slope, frost action.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones.
SxC[1]:				
Swartswood	Fair: frost action, large stones.	Poor: excess fines.	Poor: excess fines.	Poor: large stones.
Oquaga	Poor: thin layer.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: large stones.
VeA Venango	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
VnB, VnC Venango	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
VsB Venango	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
WaA, WaB---------- Washington	Fair: frost action, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
WaC2---------- Washington	Fair: frost action, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
WaD2, WkD---------- Washington	Fair: slope, frost action, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
WgB, WgC---------- Washington	Fair: frost action, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
WgD---------- Washington	Fair: slope, frost action, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
WkB, WkC---------- Washington	Fair: frost action, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
WkE---------- Washington	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
WmA, WmB, WnC--------- Wassaic	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones.
WnD---------- Wassaic	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.
WOB[1], WOC[1]: Wassaic----------	Poor: thin layer.	Poor: excess fines.	Poor: excess fines.	Poor: large stones.
Rock outcrop.				
WOD[1]: Wassaic----------	Poor: thin layer.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones.
Rock outcrop.				
Wp---------- Wayland	Poor: wetness, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
WvB, WvC---------- Wurtsboro	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.

[1] This map unit is made up of two or more dominant kinds of soil. See the description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Ad---- Adrian	Seepage	Compressible, seepage, hard to pack.	Favorable	Floods, wetness, cutbanks cave.	Not needed	Not needed.
AnB2, AnC2, AnD2-- Annandale	Slope	Compressible, low strength, piping.	No water	Not needed	Slope, rooting depth.	Rooting depth, slope.
AsB, AsC, AsD---- Annandale	Slope	Large stones	No water	Not needed	Large stones, percs slowly, slope.	Large stones, percs slowly, slope.
BaA, BaB, BbC---- Bartley	Slope	Piping, low strength.	Slope, slow refill.	Percs slowly, wetness.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
BdB---- Bartley	Slope	Piping, low strength.	Slow refill, slope.	Percs slowly, wetness.	Percs slowly, large stones.	Percs slowly, erodes easily, large stones.
BfB, BfC, BfD, BfE---- Bath	Favorable, slope.	Favorable	No water	Not needed	Percs slowly, erodes easily.	Percs slowly, slope, erodes easily.
BgB, BgC---- Bath	Slope	Large stones	Large stones, no water.	Not needed	Large stones, slope.	Large stones, slope.
CbB, CbC2---- Califon	Slope	Low strength, piping.	Slow refill	Percs slowly, wetness.	Percs slowly, wetness, rooting depth.	Percs slowly, wetness, rooting depth.
CcB, CcC---- Califon	Slope	Large stones	Slow refill, large stones.	Large stones, percs slowly, wetness.	Large stones, percs slowly, rooting depth.	Large stones, percs slowly, rooting depth.
Ck---- Carlisle	Seepage	Low strength	Favorable	Wetness, cutbanks cave.	Not needed	Not needed.
CmA, CmB---- Chippewa	Slope	Favorable	Slow refill	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
CnA, CnB---- Chippewa	Slope	Large stones	Large stones, slow refill.	Wetness, percs slowly.	Large stones, wetness, percs slowly.	Large stones, wetness, percs slowly.
CoA, CoB---- Cokesbury	Favorable	Piping, low strength.	Favorable	Wetness, percs slowly, erodes easily.	Percs slowly, erodes easily, wetness.	Percs slowly, wetness, erodes easily.
CsB---- Cokesbury	Favorable	Piping, low strength, large stones.	Large stones	Wetness, percs slowly.	Percs slowly, erodes easily, wetness.	Large stones, wetness, erodes easily.
EdB, EdC---- Edneyville	Seepage	Piping	No water	Not needed	Erodes easily	Slope.
EeB, EeC---- Edneyville	Seepage	Thin layer, piping.	No water	Not needed	Large stones	Large stones.
EPD[1]: Edneyville----	Seepage	Thin layer, piping.	No water	Not needed	Large stones	Large stones.
Parker----	Seepage	Hard to pack, large stones.	No water	Not needed	Large stones, erodes easily.	Large stones, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
EPD[1]: Rock outcrop.						
FrA---------- Fredon	Seepage--------	Seepage, low strength.	Favorable------	Wetness, poor outlets.	Wetness--------	Wetness.
Ha---------- Halsey	Seepage--------	Seepage, low strength.	Favorable------	Wetness, poor outlets.	Not needed-----	Not needed.
HbA, HbB, HbC, HcB, HfA, HfB, HfC, HfD, HfE---- Hazen	Seepage, slope.	Piping, seepage.	No water-------	Not needed-----	Slope----------	Slope.
HkA, HkB, HrA, HrB---------- Hero	Slope, seepage.	Seepage, piping.	Deep to water	Wetness, cutbanks cave.	Slope, wetness, piping.	Slope, wetness, erodes easily.
LyA---------- Lyons	Favorable------	Favorable------	Favorable------	Wetness, percs slowly, poor outlets.	Not needed-----	Not needed.
LzB---------- Lyons	Favorable------	Large stones---	Large stones---	Wetness, percs slowly, poor outlets.	Not needed-----	Not needed.
Md---------- Middlebury	Favorable------	Piping, low strength.	Deep to water	Floods, wetness.	Not needed-----	Not needed.
NaC, NbB---------- Nassau	Slope, depth to rock.	Depth to rock	Depth to rock, no water.	Not needed-----	Slope, depth to rock, droughty.	Slope, rooting depth, droughty.
NFD[1], NFE[1]: Nassau----------	Slope, depth to rock.	Depth to rock	Depth to rock, no water.	Not needed-----	Slope, depth to rock, droughty.	Slope, rooting depth, droughty.
Rock outcrop.						
ORD[1]: Oquaga----------	Slope, depth to rock.	Depth to rock, large stones.	Depth to rock, large stones, no water.	Not needed-----	Slope, depth to rock, large stones.	Slope, rooting depth, large stones.
Swartswood-------	Slope----------	Large stones---	No water-------	Not needed-----	Large stones, percs slowly.	Large stones, percs slowly.
Rock outcrop.						
PaA, PaB---------- Palmyra	Seepage, slope.	Piping, seepage.	No water-------	Not needed-----	Favorable------	Favorable.
PbD, PbE---------- Parker	Seepage, slope.	Seepage--------	No water-------	Not needed-----	Slope----------	Slope.
Pc[1], Pd[1]. Pits						
PnA, PnB, PoA, PoB---------- Pope	Seepage--------	Piping---------	No water-------	Not needed-----	Not needed-----	Not needed.
RcD---------- Rockaway	Slope----------	Large stones---	Deep to water	Not needed-----	Percs slowly, rooting depth, large stones.	Percs slowly, rooting depth, large stones.
ROF[1] Rock outcrop.						

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
ROF[1]: Oquaga	Slope, depth to rock.	Depth to rock, large stones.	Depth to rock, large stones.	Not needed	Slope, depth to rock, large stones.	Slope, rooting depth, large stones.
RPF[1]: Rock outcrop.						
Parker	Seepage	Hard to pack, large stones.	No water	Not needed	Large stones, erodes easily.	Large stones, erodes easily.
Edneyville	Seepage	Thin layer, piping.	No water	Not needed	Large stones	Large stones.
RRE[1]: Rock outcrop.						
Rockaway	Slope	Large stones	Deep to water	Not needed	Percs slowly, rooting depth, large stones.	Percs slowly, rooting depth, large stones.
Parker	Seepage	Hard to pack, large stones.	No water	Not needed	Large stones, erodes easily.	Large stones, erodes easily.
RWD[1], RWF[1]: Rock outcrop.						
Wassaic	Slope, depth to rock.	Thin layer, large stones.	Depth to rock, large stones.	Not needed	Slope, depth to rock, large stones.	Slope, rooting depth, large stones.
StC Steinsburg	Depth to rock, slope, seepage.	Piping, low strength.	No water	Not needed	Slope, depth to rock, rooting depth.	Droughty, slope, rooting depth.
SuB Swartswood	Slope	Favorable	No water	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.
SvB, SvC, SvD Swartswood	Slope	Large stones	No water	Not needed	Large stones, percs slowly.	Large stones, percs slowly.
SxC[1]: Swartswood	Slope	Large stones	No water	Not needed	Large stones, percs slowly.	Large stones, percs slowly.
Oquaga	Slope, depth to rock.	Depth to rock, large stones.	Depth to rock, large stones, no water.	Not needed	Slope, depth to rock, large stones.	Slope, rooting depth, large stones.
VeA, VnB, VnC Venango	Slope	Low strength, compressible, piping.	Slow refill	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness, erodes easily.
VsB Venango	Slope	Low strength, piping, large stones.	Slow refill, large stones.	Percs slowly, wetness.	Percs slowly, large stones, wetness.	Percs slowly, large stones, wetness.
WaA, WaB, WaC2, WaD2, WgB, WgC, WgD Washington	Slope, seepage.	Low strength, piping.	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
WkB, WkC, WkD, WkE Washington	Seepage, slope.	Low strength, piping, large stones.	No water	Not needed	Large stones, slope.	Large stones, slope.
WmA, WmB, WnC, WnD Wassaic	Slope, depth to rock.	Thin layer	Depth to rock, no water.	Not needed	Slope, depth to rock.	Slope, rooting depth.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
WOB[1], WOC[1], WOD[1]: Wassaic	Slope, depth to rock.	Thin layer, large stones.	Depth to rock, large stones, no water.	Not needed	Slope, depth to rock, large stones.	Slope, rooting depth, large stones.
Rock outcrop.						
Wp Wayland	Favorable	Piping	Favorable	Wetness, floods, poor outlets.	Not needed	Wetness.
WvB, WvC Wurtsboro	Slope, large stones.	Large stones	Deep to water, large stones.	Percs slowly, slope, large stones.	Percs slowly, slope, large stones.	Percs slowly, slope, large stones.

[1] This map unit is made up of two or more dominant kinds of soil. See the description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 14.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ad Adrian	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: excess humus, wetness.
AnB2 Annandale	Moderate: small stones, percs slowly.	Moderate: small stones.	Severe: small stones.	Moderate: small stones, slope.	Moderate: small stones.
AnC2 Annandale	Moderate: slope, small stones, percs slowly.	Moderate: slope, small stones.	Severe: slope.	Moderate: small stones, slope.	Moderate: slope, small stones.
AnD2 Annandale	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: small stones, slope.	Severe: slope.
AsB Annandale	Moderate: large stones, small stones.	Moderate: small stones.	Severe: small stones.	Moderate: large stones, small stones.	Moderate: large stones.
AsC Annandale	Moderate: slope, large stones, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: large stones, small stones.	Moderate: slope, large stones.
AsD Annandale	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, large stones, small stones.	Severe: slope.
BaA Bartley	Moderate: percs slowly, wetness.	Slight	Moderate: percs slowly, wetness.	Slight	Slight.
BaB Bartley	Moderate: percs slowly, wetness.	Slight	Moderate: slope, percs slowly, wetness.	Slight	Slight.
BbC Bartley	Moderate: slope, wetness, percs slowly.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: slope.
BdB Bartley	Moderate: percs slowly, wetness.	Moderate: small stones.	Moderate: slope, wetness, small stones.	Slight	Slight.
BfB Bath	Moderate: small stones, percs slowly.	Moderate: small stones.	Moderate: small stones, percs slowly.	Moderate: small stones.	Moderate: small stones.
BfC Bath	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: slope, small stones.
BfD Bath	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BfE---- Bath	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
BgB---- Bath	Moderate: large stones.	Moderate: small stones.	Severe: small stones.	Moderate: large stones.	Moderate: large stones.
BgC---- Bath	Moderate: slope, large stones.	Moderate: slope.	Severe: slope, small stones.	Moderate: large stones.	Moderate: slope, large stones.
CbB---- Califon	Moderate: wetness, small stones.	Moderate: small stones.	Severe: small stones, wetness.	Moderate: wetness, small stones.	Moderate: wetness.
CbC2---- Califon	Moderate: slope, wetness, small stones.	Moderate: slope, small stones.	Severe: slope, small stones, wetness.	Moderate: wetness, small stones.	Moderate: slope, wetness.
CcB---- Califon	Moderate: wetness, large stones.	Moderate: small stones.	Severe: wetness.	Moderate: wetness, large stones.	Moderate: wetness, large stones.
CcC---- Califon	Moderate: slope, wetness, large stones.	Moderate: slope.	Severe: slope, wetness.	Moderate: wetness, large stones.	Moderate: slope, wetness, large stones.
Ck---- Carlisle	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus.	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus.	Severe: excess humus, wetness, floods.
CmA, CmB, CnA, CnB---- Chippewa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
CoA, CoB, CsB---- Cokesbury	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
EdB---- Edneyville	Moderate: small stones.	Moderate: small stones.	Severe: slope.	Slight----	Slight.
EdC---- Edneyville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----	Moderate: slope.
EeB---- Edneyville	Severe: large stones.	Moderate: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
EeC---- Edneyville	Severe: large stones.	Moderate: slope, large stones.	Severe: large stones, slope.	Severe: large stones.	Severe: large stones.
EPD[1]: Edneyville----	Severe: slope, large stones.	Severe: slope.	Severe: large stones, slope.	Severe: large stones.	Severe: large stones, slope.
Parker----	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones, small stones.	Severe: large stones.	Severe: slope, large stones.
Rock outcrop.					

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FrA---------- Fredon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ha---------- Halsey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
HbA---------- Hazen	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
HbB---------- Hazen	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
HbC---------- Hazen	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
HcB---------- Hazen	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
HfA, HfB---------- Hazen	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
HfC---------- Hazen	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: slope, small stones.
HfD---------- Hazen	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.
HfE---------- Hazen	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
HkA---------- Hero	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
HkB---------- Hero	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
HrA---------- Hero	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: small stones.
HrB---------- Hero	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: small stones.
LyA, LzB---------- Lyons	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Md---------- Middlebury	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight----------	Slight.
NaC---------- Nassau	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock.	Slight----------	Severe: depth to rock.
NbB---------- Nassau	Moderate: small stones.	Moderate: small stones.	Severe: depth to rock.	Slight----------	Severe: depth to rock.
NFD[1]: Nassau----------	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, depth to rock.
Rock outcrop.					

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
NFE[1]:					
Nassau	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe	Severe: slope, depth to rock.
Rock outcrop.					
ORD[1]:					
Oquaga	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: slope, large stones.
Swartswood	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones, small stones.	Severe: large stones.	Severe: slope, large stones.
Rock outcrop.					
PaA, PaB Palmyra	Slight	Slight	Severe: small stones.	Slight	Moderate: small stones.
PbD Parker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.
PbE Parker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Pc[1], Pd[1]. Pits					
PnA, PnB, PoA, PoB Pope	Severe: floods.	Slight	Slight	Slight	Slight.
RcD Rockaway	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, large stones.	Severe: slope.
ROF[1]:					
Rock outcrop.					
Oquaga	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
RPF[1]:					
Rock outcrop.					
Parker	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones, small stones.	Severe: slope, large stones.	Severe: slope, large stones.
Edneyville	Severe: slope, large stones.	Severe: slope.	Severe: large stones, slope.	Severe: slope, large stones.	Severe: large stones, slope.
RRE[1]:					
Rock outcrop.					
Rockaway	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RRE[1]:					
Parker	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones, small stones.	Severe: slope, large stones.	Severe: slope, large stones.
RWD[1]:					
Rock outcrop.					
Wassaic	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, large stones.	Severe: slope.
RWF[1]:					
Rock outcrop.					
Wassaic	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
StC Steinsburg	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
SuB Swartswood	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
SvB Swartswood	Moderate: percs slowly.	Moderate: small stones.	Severe: small stones.	Moderate: large stones.	Moderate: large stones.
SvC Swartswood	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope, small stones.	Moderate: large stones.	Moderate: slope, large stones.
SvD Swartswood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, large stones.	Severe: slope.
SxC[1]:					
Swartswood	Severe: large stones.	Moderate: large stones, slope.	Severe: slope, large stones, small stones.	Severe: large stones.	Severe: large stones.
Oquaga	Severe: large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: large stones.
VeA Venango	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
VnB Venango	Severe: wetness.	Moderate: small stones, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: small stones, wetness.
VnC Venango	Severe: wetness.	Moderate: small stones, slope, wetness.	Severe: slope.	Moderate: wetness.	Moderate: small stones, wetness, slope.
VsB Venango	Severe: wetness, large stones.	Severe: large stones.	Severe: wetness, large stones.	Severe: large stones.	Moderate: large stones, wetness.
WaA Washington	Slight	Slight	Moderate: small stones.	Slight	Slight.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
WaB---------- Washington	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
WaC2---------- Washington	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
WaD2---------- Washington	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
WgB---------- Washington	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
WgC---------- Washington	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: slope, small stones.
WgD---------- Washington	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: too clayey.
WkB---------- Washington	Moderate: large stones, small stones.	Moderate: small stones.	Severe: small stones.	Moderate: large stones, small stones.	Moderate: large stones.
WkC---------- Washington	Moderate: slope, large stones, small stones.	Moderate: slope, small stones.	Severe: slope.	Moderate: large stones, small stones.	Moderate: slope, large stones.
WkD, WkE---------- Washington	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WmA, WmB---------- Wassaic	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones, depth to rock.
WnC---------- Wassaic	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: slope, depth to rock.
WnD---------- Wassaic	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.
WOB[1]: Wassaic----------	Moderate: large stones.	Slight----------	Moderate: slope, depth to rock.	Moderate: large stones.	Moderate: depth to rock, large stones.
Rock outcrop.					
WOC[1]: Wassaic----------	Moderate: slope, large stones.	Moderate: slope.	Severe: slope.	Moderate: large stones.	Moderate: depth to rock, large stones.
Rock outcrop.					
WOD[1]: Wassaic----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, large stones.	Severe: slope.
Rock outcrop.					

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Wp Wayland	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
WvB Wurtsboro	Severe: large stones.	Moderate: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
WvC Wurtsboro	Severe: large stones.	Severe: slope.	Severe: slope, large stones.	Severe: large stones.	Severe: large stones.

[1] This map unit is made up of two or more dominant kinds of soil. See the description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 15.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ad---- Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
AnB2---- Annandale	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AnC2---- Annandale	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AnD2---- Annandale	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
AsB---- Annandale	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
AsC---- Annandale	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
AsD---- Annandale	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
BaA---- Bartley	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
BaB---- Bartley	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BbC---- Bartley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BdB---- Bartley	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BfB---- Bath	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BfC---- Bath	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BfD---- Bath	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BfE---- Bath	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BgB---- Bath	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
BgC---- Bath	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
CbB---- Califon	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CbC2---- Califon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CcB---- Califon	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
CcC---- Califon	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ck---------- Carlisle	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
CmA---------- Chippewa	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
CmB---------- Chippewa	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
CnA---------- Chippewa	Very poor.	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
CnB---------- Chippewa	Very poor.	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
CoA---------- Cokesbury	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
CoB---------- Cokesbury	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
CsB---------- Cokesbury	Very poor.	Poor	Good	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
EdB---------- Edneyville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EdC---------- Edneyville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
EeB, EeC---------- Edneyville	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
EPD[1]:										
Edneyville--------	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Parker----------	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
FrA---------- Fredon	Poor	Fair	Fair	Fair	Fair	Poor	Good	Fair	Fair	Good.
Ha---------- Halsey	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
HbA, HfA---------- Hazen	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HbB, HcB, HfB------ Hazen	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HbC, HfC---------- Hazen	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HcB, HfC---------- Hazen	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
HfD---- Hazen	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HfE---- Hazen	Very poor.	Poor	Good	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
HkA, HrA---- Hero	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
HkB, HrB---- Hero	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LyA, LzB---- Lyons	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Md---- Middlebury	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
NaC, NbB---- Nassau	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
NFD[1]: Nassau----	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
NFE[1]: Nassau----	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
ORD[1]: Oquaga----	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Swartswood----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
PaA, PaB---- Palmyra	Fair	Good	Good	Fair	---	Poor	Very poor.	Good	Good	Very poor.
PbD---- Parker	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
PbE---- Parker	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Pc[1], Pd[1]. Pits										
PnA, PnB, PoA, PoB- Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
RcD---- Rockaway	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
ROF[1]: Rock outcrop.										
Oquaga----	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
RPF[1]: Rock outcrop.										
Parker----	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Edneyville----	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
RRE[1]: Rock outcrop.										
Rockaway----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Parker----	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
RWD[1]: Rock outcrop.										
Wassaic----	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
RWF[1]: Rock outcrop.										
Wassaic:	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
StC---- Steinsburg	Fair	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
SuB---- Swartswood	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SvB---- Swartswood	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
SvC, SvD---- Swartswood	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
SxC[1]: Swartswood----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Oquaga----	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
VeA---- Venango	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
VnB---- Venango	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
VnC---- Venango	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
VsB---------- Venango	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
WaA---------- Washington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WaB, WsB---------- Washington	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WaC2, WsC---------- Washington	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WaD2, WsD---------- Washington	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
WkB---------- Washington	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
WkC, WkD, WkE------ Washington	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
WmA, WmB---------- Wassaic	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
WnC---------- Wassaic	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
WnD---------- Wassaic	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
WOB[1]: Wassaic----------	Very poor.	Very poor.	Good	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
WOC[1], WOD[1]: Wassaic----------	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
Wp---------- Wayland	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
WvB---------- Wurtsboro	Very poor.	Very poor.	Good	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
WvC---------- Wurtsboro	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

[1] This map unit is made up of two or more dominant kinds of soil. See the map unit description for the composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ad	0-24	Sapric material	Pt	A-8	---	---	---	---	---	---	---
Adrian	24-60	Sand, loamy fine sand, gravelly loamy sand.	SP, SM	A-2, A-3, A-1	0	100	70-100	40-75	0-30	---	NP
AnB2, AnC2, AnD2 Annandale	0-8	Gravelly loam	ML, CL, SM	A-4, A-6	0-5	80-90	70-75	60-70	40-55	20-40	NP-15
	8-24	Gravelly loam, gravelly clay loam, clay loam.	ML, CL, SM, SC	A-4, A-6	0-5	85-100	75-100	65-100	45-75	20-40	NP-15
	24-52	Gravelly loam, loam, gravelly clay loam, gravelly sandy clay loam.	ML, CL, SM, SC	A-4, A-6	0-5	60-85	50-75	45-70	35-65	15-40	NP-15
	52-60	Clay loam, gravelly sandy loam, gravelly loam.	ML, CL, SM	A-4, A-6, A-2, A-1	0-10	70-80	55-70	35-70	20-55	15-30	NP-15
AsB Annandale	0-8	Very stony loam	ML, CL, GM, SM	A-4, A-6	3-15	60-85	50-75	45-70	35-65	20-40	NP-15
	8-24	Gravelly loam, gravelly clay loam, clay loam.	ML, CL, SM, GM	A-4, A-6	0-10	70-80	60-70	50-65	40-55	20-40	NP-15
	24-52	Gravelly loam, gravelly clay loam, gravelly sandy clay loam.	ML, CL, SM, GM	A-4, A-6	0-10	60-85	50-75	45-70	35-65	15-40	NP-15
	52-60	Gravelly sandy loam, gravelly loam, clay loam.	ML, CL, SM, GC	A-4, A-6, A-2, A-1	0-10	70-80	55-70	35-70	20-55	15-30	NP-15
AsC, AsD Annandale	0-8	Very stony loam	ML, CL, GM, SM	A-4, A-6	3-15	60-85	50-75	45-70	35-65	20-40	NP-15
	8-24	Gravelly loam, gravelly clay loam, clay loam.	ML, CL, SM, GM	A-4, A-6	0-10	70-80	60-70	50-65	40-55	20-40	NP-15
	24-52	Gravelly loam, gravelly clay loam, gravelly sandy clay loam.	ML, CL, SM, GM	A-4, A-6	0-10	60-85	50-75	45-70	35-65	15-40	NP-15
	52-60	Gravelly sandy loam, gravelly loam, clay loam.	ML, CL, SM, GC	A-4, A-6, A-2, A-1	0-10	70-80	55-70	35-70	20-55	15-30	NP-15
BaA, BaB Bartley	0-12	Loam	ML, CL, SM, SC	A-4, A-6, A-2	0-5	85-100	75-95	40-85	25-70	20-40	3-15
	12-30	Loam, clay loam, gravelly loam.	ML, CL, SM, SC	A-4, A-6, A-2	0-5	85-100	65-95	40-90	25-75	20-40	2-20
	30-52	Sandy clay loam, gravelly loam, clay loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-90	60-85	45-70	20-40	2-20
	52-65	Sandy loam, loam, gravelly sandy loam.	SM, SC, ML, CL	A-2, A-4	0-5	90-100	70-95	45-85	30-60	20-30	NP-10

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BbC---------- Bartley	0-12	Gravelly loam---	ML, SM, SC	A-4, A-6	0-5	75-85	60-80	55-70	40-55	20-40	3-15
	12-30	Loam, clay loam, gravelly loam.	ML, CL, SM, SC	A-4, A-6, A-2	0-5	85-100	65-95	40-90	25-75	20-40	2-20
	30-52	Sandy clay loam, gravelly loam, clay loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-90	60-85	45-70	20-40	2-20
	52-65	Sandy loam, loam, gravelly sandy loam.	SM, SC, ML, CL	A-2, A-4	0-5	90-100	70-95	45-85	30-60	20-30	NP-10
BdB---------- Bartley	0-12	Stony loam------	ML, CL, SM	A-4, A-6	0-5	75-85	60-75	55-70	40-55	30-40	5-10
	12-30	Loam, clay loam, gravelly loam.	SM, ML, CL	A-2, A-4	0-5	75-100	65-95	55-90	40-70	20-40	5-10
	30-52	Sandy clay loam, gravelly loam, clay loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-90	60-85	45-70	20-40	5-20
	52-65	Sandy loam, loam, gravelly sandy loam.	SM, SC, ML, CL	A-2, A-4	0-5	90-100	70-95	45-85	30-60	20-30	NP-10
BfB, BfC, BfD, BfE- Bath	0-8	Gravelly loam---	ML, GM, GC, SM	A-4	0-5	70-95	60-75	55-70	40-55	30-40	6-10
	8-34	Loam, gravelly loam.	SM, GM, CL-ML	A-4	0-5	70-95	60-85	55-75	40-55	20-34	NP-7
	34-72	Gravelly loam, gravelly sandy loam.	SM-SC, GM-GC, CL-ML	A-1, A-2, A-4	0-5	70-90	50-75	35-65	20-55	20-24	4-6
BgB, BgC---------- Bath	0-8	Very stony loam	ML, GM, GC	A-4	10-15	65-95	60-75	45-70	40-55	30-35	6-10
	8-34	Loam, gravelly loam.	SM-SC, CL-ML, GM-GC	A-4	5-10	70-95	65-85	55-75	40-55	20-24	NP-7
	34-72	Gravelly loam, gravelly sandy loam.	SM-SC, GM-GC, CL-ML	A-1, A-2, A-4	0-5	70-90	50-75	35-65	20-55	20-24	4-6
CbB, CbC2---------- Califon	0-9	Gravelly loam---	CL	A-4, A-6	0-3	80-100	65-95	55-80	50-70	20-30	7-12
	9-22	Loam, clay loam, gravelly loam.	ML, SM-SC, CL	A-4, A-6	0-3	85-100	65-95	55-90	45-70	23-40	3-15
	22-48	Loam, clay loam, gravelly loam.	SM, ML, CL, SC	A-4, A-6	0-3	85-100	65-95	55-90	45-70	23-40	3-15
	48-60	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL, SC	A-2, A-4, A-1, A-6	0-3	75-95	65-95	35-90	15-75	15-30	3-15
CcB, CcC---------- Califon	0-9	Very stony loam	CL	A-4, A-6	3-10	80-100	60-95	55-80	50-70	20-30	7-12
	9-22	Loam, clay loam, gravelly loam.	ML, SM-SC, CL	A-4, A-6	3-10	85-100	60-95	55-90	45-70	23-40	3-15
	22-48	Loam, clay loam, gravelly loam.	SM, ML, CL, SC	A-4, A-6	3-10	85-100	65-95	55-90	45-70	23-40	3-15
	48-60	Sandy loam, clay loam, gravelly sandy loam.	SM, ML, CL, SC	A-2, A-4, A-1, A-6	3-10	75-95	65-95	35-90	15-75	15-30	3-15

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ck Carlisle	0-60	Sapric material	Pt	A-8	---	---	---	---	---	---	---
CmA, CmB Chippewa	0-12	Silt loam	ML, OL	A-7, A-5	0-5	80-100	75-100	65-95	55-85	40-50	5-15
	12-18	Silt loam, loam, channery clay loam.	GM, ML, CL, GC	A-4	5-10	65-85	60-85	45-85	35-75	25-35	5-10
	18-65	Silt loam, channery clay loam, gravelly loam.	CL, GC, SC, CL-ML	A-2, A-4	10-25	60-80	55-70	45-70	30-65	15-25	5-10
CnA, CnB Chippewa	0-12	Very stony silt loam.	GM, ML, SM	A-7, A-5	3-10	65-90	60-85	50-80	35-75	40-50	5-15
	12-18	Silt loam, gravelly loam, channery clay loam.	GM, ML, CL, GC	A-4	5-10	65-85	60-85	45-85	35-65	25-35	5-10
	18-65	Silt loam, channery clay loam, gravelly loam.	CL, GC, SC, CL-ML	A-2, A-4	10-25	60-80	55-70	45-70	30-65	15-25	5-10
CoA, CoB Cokesbury	0-9	Loam	ML	A-4, A-6	0-5	85-95	85-90	65-85	50-80	30-40	6-12
	9-26	Sandy clay loam, silty clay loam, gravelly loam.	CL, CL-ML	A-4, A-6	0-5	80-95	70-90	65-85	50-80	25-35	5-12
	26-60	Gravelly loam, gravelly clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-5	80-95	60-75	60-75	40-60	20-35	4-12
CsB Cokesbury	0-9	Very stony loam	ML, SM	A-4, A-6	5-10	70-90	70-85	60-75	35-60	30-40	6-12
	9-26	Sandy clay loam, silty clay loam, gravelly loam.	CL, CL-ML	A-4, A-6	0-10	80-95	70-90	65-85	50-80	25-35	5-12
	26-60	Gravelly loam, gravelly clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-10	80-95	60-75	60-75	40-60	20-35	4-12
EdB, EdC Edneyville	0-7	Gravelly loam	SM, ML, CL, SC	A-2, A-4	0-5	70-85	55-75	50-70	30-55	<30	NP-10
	7-36	Sandy clay loam, loam, gravelly sandy loam.	SM, ML, CL, SC	A-4, A-6, A-1, A-2	0-10	70-95	60-90	35-90	20-60	25-35	6-15
	36-72	Sandy loam, gravelly loamy sand.	SM, SM-SC	A-1, A-2	0-15	80-95	60-90	30-65	10-35	<30	NP-7
EeB, EeC Edneyville	0-7	Extremely stony loam.	CL, SM, CL-ML, SM-SC	A-2, A-4	2-30	70-85	55-75	50-70	30-55	<30	NP-10
	7-36	Sandy clay loam, gravelly sandy loam.	SM, CL, SC, ML	A-1, A-2, A-4	0-20	70-85	60-90	35-90	20-60	25-35	6-15
	36-72	Sandy loam, gravelly sandy loam.	SM, SM-SC	A-1, A-2	0-15	80-95	60-90	30-65	10-35	<30	NP-7

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EPD[1]:											
Edneyville--------	0-7	Extremely stony loam.	CL, SM, CL-ML, SM-SC	A-2, A-4	2-30	70-85	55-75	50-70	30-55	<30	NP-10
	7-36	Sandy clay loam, gravelly sandy loam.	SM, CL, SC, ML	A-1, A-2, A-4	0-20	70-95	60-90	35-90	20-60	25-35	6-15
	36-72	Sandy loam, gravelly sandy loam.	SM, SM-SC	A-1, A-2	0-15	80-95	60-90	30-65	10-35	<30	NP-7
Parker----------	0-6	Extremely stony sandy loam.	GM, GP-GM	A-1	10-25	40-60	25-50	15-35	10-20	10-20	2-4
	6-30	Very gravelly loam, cobbly sandy loam, very gravelly sandy loam.	GM, GP-GM, GC	A-1, A-2	5-25	40-60	30-55	20-35	10-25	15-25	2-10
	30-60	Very gravelly sandy loam, very gravelly loam.	GM, GP, GC	A-1, A-2	5-30	20-40	5-30	3-25	2-20	15-25	2-10
Rock outcrop.											
FrA---------- Fredon	0-10	Loam----------	ML, CL, SC, SM	A-2, A-4	0	90-95	85-95	65-90	30-70	20-30	NP-10
	10-30	Gravelly fine sandy loam, loam, silt loam.	SM, SC, ML, CL	A-2, A-4	0	90-100	75-95	65-90	30-85	20-30	NP-10
	30-60	Very gravelly sand, loamy sand.	GP, GM, SP, SM	A-1, A-2	0-5	40-95	30-85	20-65	0-35	---	NP
Ha---------- Halsey	0-10	Loam----------	ML, CL, SM, SC	A-2, A-4	0-2	95-100	75-100	60-90	30-70	20-30	5-10
	10-34	Loam, fine sandy loam.	SM, SC, ML, CL	A-2, A-4	0-2	90-100	75-100	55-75	30-60	20-30	5-10
	34-60	Gravelly sand, very gravelly sand, silt loam.	SP, GM, SM, ML	A-1, A-2, A-3, A-4	5-10	45-100	25-100	10-95	0-90	10-30	NP-10
HbA, HbB, HbC------ Hazen	0-8	Loam----------	ML, SM, CL-ML, SM-SC	A-2, A-4	0-5	90-100	80-95	60-85	30-55	25-35	4-8
	8-30	Gravelly sandy loam, gravelly loam, loam.	SM, SC, GM, CL, CL-ML	A-1, A-2, A-4	10-20	65-100	55-90	20-75	15-60	20-30	5-10
	30-70	Stratified very gravelly sand to loamy sand.	SM, GM, SP-SM, GP-GM, SM-SC	A-1, A-2	10-20	50-90	30-85	10-60	5-25	<25	NP-5
HcB---------- Hazen	0-8	Cobbly loam-----	SM, GM, ML	A-1, A-2, A-4	10-20	70-95	50-75	35-65	20-55	25-35	4-9
	8-30	Gravelly sandy loam, gravelly loam, loam.	SM, SC, GM, ML, CL, CL-ML	A-1, A-2, A-4	10-20	65-100	55-90	20-75	15-60	20-30	5-10
	30-70	Stratified very gravelly sand to loamy sand, and cobbly sand.	SM, GM, SP-SM, GP-GM, SM-SC	A-1, A-2	10-20	50-90	30-85	10-60	5-25	<25	NP-5

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HfA, HfB, HfC, HfD-- Hazen	0-8	Gravelly loam---	SM, GM	A-1, A-2, A-4	0-5	70-95	50-75	35-65	20-45	25-35	4-8
	8-30	Gravelly sandy loam, gravelly loam, loam.	SM, SC, GM, ML, CL, CL-ML	A-1, A-2, A-4	10-20	65-100	55-90	20-75	15-60	20-30	5-10
	30-70	Stratified very gravelly sand to loamy sand.	SM, GM, SP-SM, GP-GM, SM-SC	A-1, A-2	10-20	50-90	30-85	10-60	5-25	<25	NP-5
HfE---------- Hazen	0-8	Gravelly loam---	SM, GM	A-1, A-2, A-4	0-5	70-95	50-75	35-65	20-45	25-35	4-8
	8-34	Gravelly sandy loam, gravelly loam, loam.	SM, SC, GM, ML, CL, CL-ML	A-1, A-2, A-4	10-20	65-100	55-90	20-75	15-60	20-30	5-10
	34-70	Stratified very gravelly sand to loamy sand.	SM, GM, SP-SM, GP-GM, SM-SC	A-1, A-2	10-20	50-90	30-85	10-60	5-25	<25	NP-5
HkA, HkB---------- Hero	0-10	Loam----------	SM, ML	A-4	0-10	85-100	70-80	60-75	40-65	<25	NP-4
	10-30	Loam, fine sandy loam, gravelly fine sandy loam.	SM, ML	A-4, A-2	0-10	75-95	70-85	60-80	30-60	<20	NP-4
	30-65	Stratified sandy loam to very gravelly sand.	SM, GM, SP, GP	A-1	0-10	45-80	25-70	10-50	0-20	---	NP
HrA, HrB---------- Hero	0-10	Gravelly loam---	SM, ML	A-4	0-10	85-100	70-80	60-75	40-65	<25	NP-4
	10-30	Loam, fine sandy loam, gravelly fine sandy loam.	SM, ML	A-4, A-2	0-10	75-95	70-85	60-80	30-60	<20	NP-4
	30-65	Stratified sandy loam to very gravelly sand.	SM, GM, SP, GP	A-1	0-10	45-80	25-70	10-50	0-20	---	NP
LyA---------- Lyons	0-12	Silt loam-------	ML, OL	A-5, A-7	0	80-95	75-90	65-85	55-80	42-50	5-15
	12-26	Silt loam, gravelly sandy clay loam, clay loam.	CL-ML, CL, GC, SC	A-4, A-6, A-1, A-2	0-5	60-95	55-90	45-85	25-80	20-35	5-15
	26-48	Gravelly loam, gravelly silt loam, very gravelly fine sandy loam.	CL-ML, CL, GC, SC	A-1, A-2, A-4, A-6	5-10	35-95	30-90	25-85	15-80	20-35	5-15
LzB---------- Lyons	0-12	Very stony silt loam.	ML, OL	A-5, A-7	2-10	80-95	75-90	65-85	55-80	42-50	5-15
	12-26	Silt loam, gravelly sandy clay loam, clay loam.	CL-ML, GC, SC, CL	A-4, A-6, A-2, A-1	0-15	60-95	55-90	45-85	25-80	20-35	5-15
	26-60	Gravelly loam, gravelly silt loam, very gravelly fine sandy loam.	CL-ML, CL, GC, SC	A-1, A-2, A-4 A-6	5-10	35-95	30-90	25-85	15-80	20-35	5-15
Md---------- Middlebury	0-10	Loam----------	ML, SM	A-4	0	85-100	75-100	65-100	45-85	<20	NP-4
	10-42	Silt loam, loam, gravelly fine sandy loam.	ML, SM	A-4, A-2	0	75-100	70-100	50-100	30-85	<20	NP-4
	42-62	Stratified gravelly sandy loam to sand.	GW, GM, SW, SM	A-1, A-2	0-5	45-95	40-85	15-50	0-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NaC, NbB---------- Nassau	0-6	Shaly silt loam	ML, GM	A-2, A-4	5-20	50-85	35-80	30-75	25-70	20-30	NP-4
	6-18	Very shaly silt loam, very shaly loam.	GM	A-1, A-2, A-4	10-25	45-70	25-55	20-55	15-50	20-30	NP-4
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
NFD[1], NFE[1]: Nassau-----------	0-6	Shaly silt loam	ML, GM	A-2, A-4	5-20	50-85	35-80	30-75	25-70	20-30	NP-4
	6-18	Very shaly silt loam, very shaly loam.	GM	A-1, A-2, A-4	10-25	45-70	25-55	20-55	15-50	20-30	NP-4
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
ORD[1]: Oquaga-----------	0-4	Extremely stony loam.	GM-GC, GM	A-4, A-2	3-20	50-85	45-55	40-50	30-40	<25	NP-5
	4-30	Channery, channery loam.	GM, GM-GC, GP-GM	A-1, A-2, A-4	3-25	35-70	15-60	15-55	10-45	<25	NP-5
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Swartswood--------	0-4	Extremely stony loam.	SM, ML, GM	A-2, A-4, A-1	5-15	65-90	50-85	30-80	25-65	---	---
	4-24	Gravelly loam, gravelly sandy loam, gravelly fine sandy loam.	GM, SM, ML	A-1, A-2, A-4	0-25	65-90	50-85	30-85	15-65	<25	NP-3
	24-70	Gravelly fine sandy loam, flaggy sandy loam, channery loam.	GM, SM, ML	A-2, A-1, A-4	5-25	50-80	35-80	20-70	10-60	<20	NP-3
Rock outcrop.											
PaA, PaB---------- Palmyra	0-8	Gravelly fine sandy loam.	SM	A-2, A-4, A-1	0-5	60-80	55-75	40-70	20-40	25-35	NP-4
	8-26	Gravelly loam, gravelly sandy clay loam, gravelly fine sandy loam.	SM, SC, ML, CL-ML	A-2, A-4	0-5	60-90	55-70	40-65	25-55	25-35	5-10
	26-60	Very gravelly sand, gravelly fine sand.	GP, GW, GP-GM	A-1	5-10	35-60	30-55	15-40	0-10	<5	NP
PbD, PbE---------- Parker	0-6	Gravelly sandy loam.	GM, GP-GM, GC	A-1, A-2	0-5	40-60	25-50	15-45	10-30	15-25	3-10
	6-30	Gravelly loam, cobbly sandy loam, very gravelly sandy loam.	GM, GP-GM, GC	A-1, A-2	5-10	40-60	30-55	20-50	10-35	15-25	3-10
	30-60	Very gravelly sandy loam, very gravelly loam.	GP, GM, GC	A-1, A-2	5-15	20-40	5-30	3-25	2-20	15-25	3-10
Pc[1], Pd[1]---------- Pits	0-60		---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PnA, PnB---------- Pope	0-9	Fine sandy loam	SM, ML	A-2, A-4	0-5	85-100	75-100	55-85	25-55	<20	NP-5
	9-65	Fine sandy loam, sandy loam, gravelly loam.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-5	55-100	50-100	35-95	15-70	<30	NP-7
PoA, PoB---------- Pope	0-9	Gravelly fine sandy loam.	SM, GM	A-2, A-4	0-5	75-100	65-75	45-70	25-45	<20	NP-5
	9-65	Fine sandy loam, sandy loam, gravelly fine sandy loam.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-5	55-100	50-100	35-95	15-70	<30	NP-7
RcD---------- Rockaway	0-4	Very stony loam	ML, CL, SM, SC	A-2, A-4	5-25	70-85	50-80	50-70	30-60	10-20	5-10
	4-30	Gravelly sandy loam, gravelly loam.	ML, CL, SM, SC	A-2, A-4	0-5	70-95	50-90	40-75	20-65	10-20	5-10
	30-48	Gravelly sandy loam.	SM, SC	A-2, A-4	0-5	70-95	50-90	40-65	20-40	10-20	5-10
	48-65	Gravelly loamy sand, gravelly sandy loam.	SM, GM	A-2	0-5	65-90	35-80	25-65	12-35	5-15	NP-5
ROF[1]: Rock outcrop.											
Oquaga---------- Oquaga	0-4	Extremely stony loam.	GM, GM-GC	A-4, A-2	3-20	50-85	45-55	40-50	30-40	<25	NP-5
	4-30	Very channery loam, channery loam.	GM, GM-GC, GP-GM	A-1, A-2, A-4	3-25	35-70	15-60	15-55	10-45	<25	NP-5
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RPF[1]: Rock outcrop.											
Parker---------- Parker	0-6	Extremely stony sandy loam.	GM, GP-GM	A-1, A-2	10-25	40-60	25-50	15-35	10-20	10-20	2-14
	6-30	Gravelly loam, loam, cobbly sandy loam, very gravelly sandy loam.	GM, GP-GM, GC	A-1, A-2	5-25	40-60	30-55	20-35	10-25	15-25	2-10
	30-60	Very gravelly sandy loam, very gravelly loam.	GM, GP, GC	A-1, A-2	5-30	20-40	5-30	3-25	2-20	15-25	2-10
Edneyville-------- Edneyville	0-7	Extremely stony loam.	CL, SM, CL-ML, SM-SC	A-4, A-2	2-30	70-85	55-75	50-70	30-55	<30	NP-10
	7-36	Sandy clay loam, gravelly sandy loam.	SM, CL, SC, ML	A-4, A-1, A-2	0-20	70-95	60-90	35-90	20-60	25-35	6-15
	36-72	Sandy loam, gravelly sandy loam.	SM	A-1, A-2	0-15	80-95	60-90	30-65	10-35	<30	NP-7
RRE[1]: Rock outcrop.											

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RRE[1]:											
Rockaway	0-4	Extremely stony sandy loam.	ML, CL, SM, SC	A-2, A-4	5-25	70-85	50-80	50-70	30-60	10-20	5-10
	4-30	Gravelly sandy loam, gravelly loam.	ML, CL, SM, SC	A-2, A-4	0-5	70-95	50-90	40-75	20-65	10-20	5-10
	30-48	Gravelly sandy loam.	SM, SC	A-2, A-4	0-5	70-95	50-90	40-65	20-40	10-20	5-10
	48-65	Gravelly loamy sand, gravelly sandy loam.	SM, GM	A-2	0-5	65-90	35-80	25-65	12-35	5-15	NP-5
Parker	0-6	Extremely stony sandy loam.	GM, GP-GM	A-1, A-2	10-15	40-60	25-50	15-45	10-30	10-20	2-7
	6-30	Very gravelly loam, cobbly sandy loam, very gravelly sandy loam.	GM, GP-GM, GC	A-1, A-2	5-10	40-60	30-55	20-50	10-35	15-25	2-10
	30-60	Very gravelly sandy loam, very gravelly loam.	GM, GP, GC	A-1, A-2	5-15	20-40	5-30	3-25	2-20	15-25	2-10
RWD[1], RWF[1]:											
Rock outcrop.											
Wassaic	0-6	Very stony silt loam.	ML	A-2, A-4	5-15	85-95	70-85	60-85	50-75	25-35	2-10
	6-30	Loam, gravelly fine sandy loam, silty clay loam.	SC, ML, SM, CL	A-2, A-4	5-15	85-95	70-85	45-80	25-70	15-25	2-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
StC	0-8	Fine sandy loam	SM	A-4	0-5	95-100	85-100	65-90	35-50	---	---
Steinsburg	8-18	Gravelly sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4, A-1	0-10	90-100	80-95	35-80	15-40	<25	NP-5
	18-36	Gravelly sandy loam, gravelly loamy sand.	SM, GM	A-2, A-1	5-15	70-85	55-75	35-60	15-35	<25	NP-3
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SuB	0-4	Gravelly loam	GM, SM, ML	A-2, A-4	0-5	60-90	50-85	40-70	30-55	---	---
Swartswood	4-24	Gravelly fine sandy loam, gravelly sandy loam, gravelly loam.	GM, SM,	A-1, A-2, A-4	0-25	65-90	50-85	30-85	15-65	<25	NP-3
	24-70	Gravelly fine sandy loam, flaggy sandy loam, channery loam.	GM, SM, ML	A-1, A-2, A-4	5-25	80-95	35-85	20-80	10-65	<20	NP-3

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SvB, SvC, SvD------ Swartswood	0-4	Very stony loam	SM, ML	A-2, A-4, A-1	3-15	65-90	50-85	30-80	25-65	---	---
	4-24	Gravelly loam, gravelly sandy loam, gravelly fine sandy loam.	GM, SM, ML	A-2, A-4, A-1	0-25	65-90	50-85	30-85	15-65	<25	NP-3
	24-70	Gravelly fine sandy loam, gravelly sandy loam, gravelly loam.	GM, SM, ML	A-2, A-1, A-4	5-25	80-95	35-85	20-80	10-60	<20	NP-3
SxC[1]: Swartswood--------	0-4	Extremely stony loam.	SM, ML	A-2, A-4, A-1	5-20	65-90	50-85	40-80	30-55	---	---
	4-24	Gravelly loam, gravelly sandy loam, gravelly fine sandy loam.	GM, SM, ML	A-2, A-4, A-1	0-25	65-90	50-85	30-85	15-65	<25	NP-3
	24-70	Gravelly fine sandy loam, gravelly sandy loam, gravelly loam.	GM, SM, ML	A-2, A-1, A-4	5-25	80-95	35-85	20-80	10-65	<20	NP-3
Oquaga------------	0-4	Extremely stony loam.	GM-GC, GM	A-4, A-2	3-20	50-85	45-55	40-50	30-40	<25	NP-5
	4-30	Very channery loam, channery loam.	GM, GM-GC, GP-GM	A-1, A-2, A-4	3-25	35-70	15-60	15-55	10-45	<25	NP-5
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
VeA---------------- Venango	0-8	Silt loam-------	ML, CL-ML	A-4	0	90-100	80-100	75-95	65-85	22-35	4-10
	8-20	Silt loam, loam, gravelly loam.	CL, SC, CL-ML, GC	A-4, A-6, A-7	0-5	80-100	65-95	55-95	40-85	25-45	5-15
	20-60	Loam, silt loam, gravelly loam.	CL, ML, SC, GM	A-4, A-6	0-10	75-95	65-95	60-90	40-80	20-35	3-14
VnB, VnC---------- Venango	0-8	Gravelly loam---	ML, CL, GC, SC	A-4	0-5	70-90	60-75	50-70	35-55	20-35	3-10
	8-20	Silt loam, gravelly loam, loam.	CL, GC, CL-ML, SC	A-4, A-6, A-7	0-5	80-100	65-95	55-95	40-85	25-45	5-15
	20-60	Loam, silt loam, gravelly loam.	CL, ML, SC, GM	A-4, A-6	0-10	75-95	65-95	60-90	40-80	20-35	3-14
VsB---------------- Venango	0-8	Very stony loam	ML, CL-ML, SM, SM-SC	A-4	5-10	80-100	70-90	60-90	45-80	22-35	4-10
	8-20	Silt loam, loam, gravelly loam.	CL, SC, CL-ML, GC	A-4, A-6, A-7	5-10	90-100	70-95	55-95	40-85	25-45	5-15
	20-60	Loam, silt loam, gravelly loam.	CL, ML, SC, GM	A-4, A-6	5-10	75-95	65-95	60-90	40-80	20-35	3-14

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WaA, WaB, WaC2, WaD2---------- Washington	0-7	Loam----------	CL, ML	A-4, A-6	0-10	85-100	85-95	65-90	55-75	30-40	6-15
	7-50	Loam, silt loam, gravelly loam.	CL, SC, GC, ML	A-4, A-6	0-15	75-100	60-95	55-90	40-85	30-40	6-15
	50-60	Clay loam, silt loam, gravelly sandy clay loam.	CL, SC, GC	A-4, A-6, A-2	0-15	75-95	35-95	30-85	15-75	25-35	8-15
WgB, WgC, WgD------ Washington	0-7	Gravelly loam---	CL, SC	A-4, A-6	0-10	70-90	55-75	60-70	40-60	30-40	8-15
	7-50	Loam, silt loam, gravelly loam.	CL, SC, GC, ML	A-4, A-6	0-15	75-100	60-95	55-90	40-85	30-40	8-15
	50-60	Clay loam, silt loam, gravelly sandy clay loam.	CL, SC, GC	A-4, A-6, A-2	0-15	70-95	40-95	30-85	15-75	25-35	8-15
WkB, WkC, WkD, WkE- Washington	0-7	Very stony loam	CL, SC, SM-SC	A-4, A-6	2-15	80-90	65-75	60-70	40-60	30-40	6-15
	7-50	Loam, gravelly loam, silt loam.	CL, SC, GC, ML	A-4, A-6	0-15	80-100	60-95	55-90	40-85	30-40	6-15
	50-60	Clay loam, silt loam, gravelly sandy clay loam.	CL, SC, GC	A-4, A-6, A-2	5-15	70-95	40-95	30-85	15-75	25-35	8-15
WmA, WmB, WnC, WnD- Wassaic	0-6	Gravelly loam---	GM, ML, SM	A-2, A-4	0-10	60-85	50-75	35-70	25-65	25-35	2-10
	6-30	Loam, gravelly fine sandy loam, clay loam.	GM, GC, SM, CL	A-2, A-4	0-5	60-100	55-95	45-95	25-75	15-25	2-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WOB[1], WOC[1], WOD[1]: Wassaic----------	0-6	Very stony silt loam.	ML, SC	A-4	5-15	85-95	70-85	60-85	50-75	25-35	2-10
	6-30	Loam, gravelly fine sandy loam, clay loam.	SC, ML, SM, CL	A-2, A-4	5-15	85-95	70-85	45-85	25-75	15-25	2-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Wp---------- Wayland	0-9	Silt loam-------	ML, CL, OL	A-7, A-5	0	100	95-100	90-100	70-95	40-50	5-15
	9-48	Silt loam, silty clay loam.	ML, CL	A-6, A-4	0	100	95-100	90-100	70-95	25-40	5-15
	48-60	Stratified silt loam, fine sandy loam, gravelly sand.	ML, CL, SM, SP	A-4, A-2, A-6, A-1	0	90-100	70-100	10-95	0-90	<25	NP-10
WvB, WvC---------- Wurtsboro	0-4	Extremely stony loam.	SM, ML	A-2, A-4	5-15	70-100	65-95	55-95	30-80	---	---
	4-18	Fine sandy loam, gravelly sandy loam, loam.	SM, ML	A-2, A-4, A-1	0-15	70-95	50-90	35-85	15-70	<30	NP-4
	18-70	Gravelly fine sandy loam, gravelly sandy loam.	SM, GM	A-1, A-2, A-4	0-20	80-95	65-90	40-80	30-50	<25	NP-4

[1] This map unit is made up of two or more dominant kinds of soil. See the map unit description for the composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Ad	0-24	0.6-6.0	0.35-0.45	5.1-7.3		High	Moderate	---	---
Adrian	24-60	6.0-20	0.03-0.08	6.1-8.4	Low	High	Moderate	---	
AnB2, AnC2, AnD2	0-8	0.6-2.0	0.14-0.18	5.6-6.0	Low	Low	Moderate	3	---
Annandale	8-24	0.6-2.0	0.09-0.21	6.1-6.5	Low	Low	Low	0.37	
	24-52	0.06-0.6	0.10-0.14	6.1-6.5	Moderate	Moderate	Low	0.49	
	52-60	0.6-2.0	0.12-0.18	5.1-6.5	Low	Low	Moderate	0.28	
AsB, AsC, AsD	0-8	0.6-2.0	0.18-0.22	5.6-6.0	Low	Low	Moderate	0.24	3
Annandale	8-24	0.6-2.0	0.14-0.18	6.1-6.5	Low	Low	Low	0.37	
	24-52	0.06-0.6	0.10-0.14	6.1-6.5	Low	Moderate	Low	0.49	
	52-60	0.6-2.0	0.12-0.18	5.1-6.5	Low	Low	Moderate	0.28	
BaA, BaB, BbC	0-12	0.6-2.0	0.16-0.20	5.1-6.5	Low	Moderate	Low	0.32	4
Bartley	12-30	0.6-2.0	0.12-0.18	5.1-6.5	Moderate	Moderate	Low	0.32	
	30-52	0.06-0.6	0.08-0.12	6.6-7.3	Low	Moderate	Low	0.24	
	52-65	0.6-2.0	0.14-0.20	6.6-7.3	Low	Moderate	Low	0.28	
BdB	0-12	0.6-2.0	0.16-0.20	5.1-6.5	Moderate	Moderate	Low	0.32	4
Bartley	12-30	0.6-2.0	0.12-0.18	5.1-6.5	Moderate	Moderate	Low	---	
	30-52	0.06-0.6	0.08-0.12	6.6-7.3	Low	Moderate	Low	---	
	52-65	0.6-2.0	0.14-0.20	6.6-7.3	Low	Moderate	Low	---	
BfB, BfC, BfD, BfE	0-8	0.6-2.0	0.10-0.20	4.5-6.0	Low	Moderate	Moderate	0.17	3
Bath	8-34	0.6-2.0	0.08-0.18	4.5-6.0	Low	Moderate	Moderate	0.28	
	34-72	<0.2	0.-0.06	4.5-6.5	Low	Moderate	Moderate	0.28	
BgB, BgC	0-8	0.6-2.0	0.10-0.20	4.5-6.0	Low	Moderate	Moderate	0.24	3
Bath	8-34	0.6-2.0	0.08-0.18	4.5-6.0	Low	Moderate	Moderate	0.28	
	34-72	0.06-0.2	0.01-0.06	4.5-6.5	Low	Moderate	Moderate	0.28	
CbB, CbC2	0-9	0.6-2.0	0.18-0.25	5.6-6.5	Low	High	High	0.24	3
Califon	9-22	0.6-2.0	0.16-0.21	5.6-6.5	Low	High	High	0.32	
	22-48	0.06-0.2	0.06-0.10	4.5-5.5	Low	High	High	0.28	
	48-60	2.0-6.0	0.14-0.20	4.5-5.5	Low	High	High	0.37	
CcB, CcC	0-9	0.6-2.0	0.16-0.20	4.5-5.5	Low	High	High	0.17	3
Califon	9-22	0.6-2.0	0.10-0.20	4.5-5.5	Low	High	High	0.24	
	22-48	0.06-0.2	0.06-0.10	4.5-5.5	Low	High	High	0.28	
	48-60	0.6-2.0	0.14-0.18	4.5-5.5	Low	High	High	0.37	
Ck	0-60	2.0-6.0	0.35-0.45	5.6-7.3		High	Low	---	---
Carlisle									
CmA, CmB	0-12	0.6-2.0	0.14-0.21	4.5-5.5	Low	High	Moderate	0.32	3
Chippewa	12-18	0.6-2.0	0.10-0.17	4.5-5.5	Low	High	Moderate	0.43	
	18-65	<0.2	0.01-0.02	5.1-6.5	Low	High	Moderate	0.28	
CnA, CnB	0-12	0.6-2.0	0.11-0.18	4.5-5.5	Low	High	Moderate	0.24	3
Chippewa	12-18	0.6-2.0	0.10-0.17	4.5-5.5	Low	High	Moderate	0.43	
	18-65	<0.2	0.01-0.02	5.1-6.5	Low	High	Moderate	0.28	
CoA, CoB	0-9	0.6-2.0	0.20-0.25	5.1-5.5	Low	High	High	0.32	2
Cokesbury	9-26	0.2-0.6	0.16-0.20	5.1-5.5	Moderate	High	High	---	
	26-60	0.06-0.2	0.08-0.12	4.5-5.5	Low	High	High	---	
CsB	0-9	0.6-2.0	0.20-0.25	5.1-5.5	Low	High	High	0.24	2
Cokesbury	9-26	0.2-0.6	0.16-0.20	5.1-5.5	Moderate	High	High	---	
	26-60	>0.2	0.08-0.12	4.5-5.5	Low	High	High	---	

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
EdB, EdC	0-7	2.0-6.0	0.11-0.17	4.5-5.5	Low	Low	High	0.17	3
Edneyville	7-36	0.6-2.0	0.14-0.16	4.5-5.0	Low	Low	High	0.20	
	36-72	2.0-6.0	0.08-0.12	4.5-5.0	Low	Low	High	0.20	
EeB, EeC	0-7	2.0-6.0	0.10-0.15	4.5-5.5	Low	Low	High	0.17	3
Edneyville	7-36	0.6-2.0	0.12-0.16	4.5-5.5	Low	Low	High	0.20	
	36-72	2.0-6.0	0.08-0.12	4.5-5.0	Low	Low	High	---	
EPD[1]:									
Edneyville	0-7	2.0-6.0	0.10-0.15	4.5-5.5	Low	Low	High	0.17	3
	7-36	0.6-2.0	0.12-0.16	4.5-5.5	Low	Low	High	0.20	
	36-72	2.0--6.0	0.08-0.12	4.5-5.0	Low	Low	High	0.20	
Parker	0-6	2.0-6.0	0.06-0.14	4.5-5.5	Low	Low	High	0.17	5
	6-30	2.0-6.0	0.10-0.14	4.5-5.5	Low	Low	High	0.20	
	30-60	6.0-20	0.04-0.08	4.5-5.5	Low	Low	High	0.20	
Rock outcrop.									
FrA	0-10	0.6-2.0	0.12-0.20	5.6-6.0	Low	High	Moderate	0.24	3
Fredon	10-30	0.2-2.0	0.12-0.20	5.6-6.0	Low	High	Moderate	---	
	30-60	2.0-20	0.02-0.06	6.6-7.3	Low	High	Moderate	---	
Ha	0-10	0.6-6.0	0.14-0.24	5.6-6.5	Low	High	Moderate	---	---
Halsey	10-34	0.6-6.0	0.12-0.18	5.6-6.5	Low	High	Moderate	---	
	34-60	6.0-20	0.02-0.07	6.6-7.8	Low	High	Moderate	---	
HbA, HbB, HbC	0-8	0.6-2.0	0.12-0.18	5.6-6.5	Low	Low	Low	0.17	3
Hazen	8-30	0.6-2.0	0.10-0.14	5.6-6.5	Low	Low	Low	0.20	
	30-70	6.0-20	0.02-0.08	6.6-7.8	Low	Low	Low	0.20	
HcB, HfA, HfB, HfC, HfD, HfE	0-8	0.6-2.0	0.14-0.20	5.6-6.5	Low	Low	Low	0.17	3
Hazen	8-30	0.6-2.0	0.10-0.14	5.6-6.5	Low	Low	Low	0.20	
	30-70	6.0-20	0.02-0.08	6.6-7.8	Low	Low	Low	0.20	
HkA, HkB, HrA, HrB	0-10	2.0-6.0	0.10-0.24	5.6-7.3	Low	Moderate	Low	0.24	3
Hero	10-30	2.0-6.0	0.08-0.19	5.6-7.3	Low	Moderate	Low	0.43	
	30-65	>6.0	0.04-0.13	5.6-7.3	Low	Moderate	Low	0.17	
LyA	0-12	0.6-2.0	0.15-0.20	5.6-7.3	Low	High	Low	---	---
Lyons	12-26	0.2-2.0	0.08-0.18	6.1-7.3	Low	High	Low	---	
	26-48	0.06-0.2	0.06-0.15	7.4-8.4	Low	High	Low	---	
LzB	0-12	0.6-2.0	0.11-0.16	5.6-7.3	Low	High	Low	---	---
Lyons	12-26	0.2-2.0	0.08-0.18	6.1-7.3	Low	High	Low	---	
	26-48	0.06-0.2	0.06-0.15	7.4-8.4	Low	High	Low	---	
Md	0-10	0.6-2.0	0.14-0.21	5.1-6.5	Low	Moderate	Moderate	---	---
Middlebury	10-42	0.6-2.0	0.10-0.20	5.6-7.3	Low	Moderate	Low	---	
	42-60	0.6-6.0	0.06-0.20	5.6-6.5	Low	Moderate	Low	---	
NaC, NbB	0-6	0.6-2.0	0.08-0.16	4.5-5.5	Low	Low	High	0.20	2
Nassau	6-18	0.6-2.0	0.07-0.12	4.5-5.5	Low	Low	High	0.20	
	18	---	---	---	---	---	---	---	
NFD[1], NFE[1]:									
Nassau	0-6	0.6-2.0	0.08-0.16	4.5-5.5	Low	Low	High	0.20	2
	6-18	0.6-2.0	0.07-0.12	4.5-5.5	Low	Low	High	0.20	
	18	---	---	---	---	---	---	---	
Rock outcrop.									

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
ORD[1]:									
Oquaga	0-4	0.6-2.0	0.08-0.17	4.5-5.5	Low	Low	Moderate	0.24	3
	4-30	0.6-2.0	0.04-0.12	4.5-5.5	Low	Low	Moderate	0.28	
	30	---	---	---	---	---	---	---	
Swartswood	0-4	0.6-2.0	0.08-0.12	3.6-5.5	Low	Low	High	0.17	3-2
	4-24	0.6-2.0	0.08-0.12	3.6-5.5	Low	Low	High	0.28	
	24-70	0.06-0.6	0.06-0.10	3.6-5.5	Low	Low	High	0.28	
Rock outcrop.									
PaA, PaB	0-8	0.6-2.0	0.10-0.16	5.6-7.3	Low	Low	Low	0.17	3
Palmyra	8-26	0.6-2.0	0.07-0.15	6.1-7.8	Low	Low	Low	0.28	
	26-60	6.0-20	0.01-0.02	7.4-7.8	Low	Low	Low	0.17	
PbD, PbE	0-6	2.0-6.0	0.10-0.14	4.5-5.5	Low	Low	High	0.17	5
Parker	6-30	2.0-6.0	0.10-0.14	4.5-5.5	Low	Low	High	0.20	
	30-60	6.0-20	0.04-0.08	4.5-5.5	Low	Low	High	0.20	
Pc[1], Pd[1]	0-60	---	---	---	---	---	---	---	---
Pits									
PnA, PnB, PoA, PoB	0-9	2.0-6.0	0.07-0.14	3.6-5.5	Low	Low	High	0.28	---
Pope	9-65	0.6-6.0	0.07-0.15	3.6-5.5	Low	Low	High	0.28	
RcD	0-4	0.6-2.0	0.10-0.16	4.5-5.5	Low	Low	High	0.17	3
Rockaway	4-30	0.6-2.0	0.10-0.17	4.5-5.5	Low	Low	High	0.24	
	30-48	<0.2	0.06-0.10	4.5-5.5	Low	Low	High	0.24	
	48-65	0.6-6.0	0.06-0.10	4.5-5.5	Low	Low	High	0.17	
ROF[1]:									
Rock outcrop.									
Oquaga	0-4	0.6-2.0	0.08-0.17	4.5-5.5	Low	Low	Moderate	0.24	3
	4-30	0.6-2.0	0.04-0.12	4.5-5.5	Low	Low	Moderate	0.28	
	30	---	---	---	---	---	---	---	
RPF[1]:									
Rock outcrop.									
Parker	0-6	2.0-6.0	0.06-0.14	4.5-5.5	Low	Low	High	0.17	5
	6-30	2.0-6.0	0.10-0.14	4.5-5.5	Low	Low	High	0.20	
	30-60	6.0-20	0.04-0.08	4.5-5.5	Low	Low	High	0.20	
Edneyville	0-7	2.0-6.0	0.10-0.15	4.5-5.5	Low	Low	High	0.17	3
	7-36	0.6-2.0	0.12-0.16	4.5-5.5	Low	Low	High	0.20	
	36-72	2.0-6.0	0.08-0.12	4.5-5.0	Low	Low	High	0.20	
RRE[1]:									
Rock outcrop.									
Rockaway	0-4	0.6-2.0	0.10-0.16	4.5-5.5	Low	Low	High	0.17	3
	4-30	0.6-2.0	0.10-0.17	4.5-5.5	Low	Low	High	0.24	
	30-48	<0.2	0.06-0.10	4.5-5.5	Low	Low	High	0.24	
	48-65	0.6-6.0	0.06-0.10	4.5-5.5	Low	Low	High	0.17	
Parker	0-6	2.0-6.0	0.06-0.14	4.5-5.5	Low	Low	High	0.17	5
	6-30	2.0-6.0	0.10-0.14	4.5-5.5	Low	Low	High	0.20	
	30-60	6.0-20	0.04-0.08	4.5-5.5	Low	Low	High	0.20	
RWD[1], RWF[1]:									
Rock outcrop.									
Wassaic	0-6	0.6-2.0	0.08-0.17	5.6-7.3	Low	Moderate	Low	0.24	3
	6-30	0.2-2.0	0.09-0.19	5.6-7.8	Low	Moderate	Low	0.37	
	30	---	---	---	---	---	---	---	

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
StC----------	0-8	2.0-6.0	0.10-0.14	4.5-6.5	Low-------	Low----------	High----------	0.28	2
Steinsburg	8-18	2.0-6.0	0.10-0.14	4.5-6.5	Low-------	Low----------	High----------	---	
	18-36	2.0-6.0	0.04-0.08	4.5-6.5	Low-------	Low----------	High----------	---	
	36	---	---	---	---	---	---	---	
SuB, SvB, SvC, SvD-	0-4	0.6-2.0	0.08-0.12	3.6-5.5	Low-------	Low----------	High----------	0.17	3-2
Swartswood	4-24	0.6-2.0	0.08-0.12	3.6-5.5	Low-------	Low----------	High----------	0.28	
	24-70	0.06-0.6	0.06-0.10	3.6-5.5	Low-------	Low----------	High----------	0.28	
SxC[1]:									
Swartswood--------	0-4	0.6-2.0	0.08-0.12	3.6-5.5	Low-------	Low----------	High----------	0.17	3-2
	4-24	0.6-2.0	0.08-0.12	3.6-5.5	Low-------	Low----------	High----------	0.28	
	24-70	0.06-0.6	0.06-0.10	3.6-5.5	Low-------	Low----------	High----------	0.28	
Oquaga------------	0-4	0.6-2.0	0.08-0.17	4.5-5.5	Low-------	Low----------	Moderate-------	0.24	3
	4-30	0.6-2.0	0.04-0.12	4.5-5.5	Low-------	Low----------	Moderate-------	0.28	
	30	---	---	---	---	---	---	---	
VeA----------	0-8	0.6-2.0	0.17-0.20	3.6-6.0	Low-------	High----------	High----------	0.37	4-3
Venango	8-20	0.6-2.0	0.16-0.18	3.6-6.0	Low-------	High----------	High----------	0.37	
	20-60	<0.06	0.06-0.09	4.5-7.3	Low-------	High----------	Low----------	0.37	
VnB, VnC----------	0-8	0.6-2.0	0.15-0.18	3.6-6.0	Low-------	High----------	High----------	0.28	4-3
Venango	8-20	0.6-2.0	0.16-0.18	3.6-6.0	Low-------	High----------	High----------	0.37	
	20-60	<0.06	0.06-0.09	4.5-7.3	Low-------	High----------	Low----------	0.37	
VsB----------	0-8	0.6-2.0	0.17-0.20	4.5-5.5	Low-------	High----------	High----------	0.28	4
Venango	8-20	0.6-2.0	0.16-0.18	4.5-5.5	Low-------	High----------	High----------	0.37	
	20-60	<0.06	0.06-0.09	4.5-7.3	Low-------	High----------	High----------	0.37	
WaA, WaB, WaC2,									
WaD2----------	0-7	0.6-2.0	0.18-0.22	5.6-7.3	Low-------	Moderate------	Low----------	0.32	4
Washington	7-50	0.6-2.0	0.16-0.20	5.6-7.3	Moderate	Moderate------	Low----------	0.28	
	50-60	0.6-6.0	0.12-0.16	5.6-7.3	Moderate	Moderate------	Low----------	0.32	
WgB, WgC, WgD------	0-7	0.6-2.0	0.15-0.20	5.6-7.3	Low-------	Moderate------	Low----------	0.28	4
Washington	7-50	0.6-2.0	0.16-0.20	5.6-7.3	Moderate	Moderate------	Low----------	0.28	
	50-60	0.6-6.0	0.12-0.16	5.6-7.3	Moderate	Moderate------	Low----------	0.32	
WkB, WkC, WkD, WkE-	0-7	0.6-2.0	0.18-0.22	5.6-7.3	Low-------	Moderate------	Low----------	0.28	4
Washington	7-50	0.6-2.0	0.16-0.20	5.6-7.3	Moderate	Moderate------	Low----------	---	
	50-60	0.6-6.0	0.12-0.16	5.6-7.3	Moderate	Moderate------	Low----------	---	
WmA, WmB, WnC, WnD-	0-6	0.6-2.0	0.08-0.17	5.6-7.3	Low-------	Moderate------	Low----------	0.24	3
Wassaic	6-30	0.2-2.0	0.09-0.19	5.6-7.8	Low-------	Moderate------	Low----------	0.37	
	30	---	---	---	---	---	---	---	
WOB[1], WOC[1], WOD[1]:									
Wassaic-----------	0-6	0.6-2.0	0.08-0.17	5.6-7.3	Low-------	Moderate------	Low----------	0.24	3
	6-30	0.2-2.0	0.09-0.19	5.6-7.8	Low-------	Moderate------	Low----------	0.37	
	30	---	---	---	---	---	---	---	
Rock outcrop.									
Wp----------	0-9	0.2-2.0	0.17-0.22	6.6-7.8	Low-------	High----------	Low----------	---	---
Wayland	9-48	0.06-0.2	0.16-0.20	6.6-7.8	Low-------	High----------	Low----------	---	
	48-60	0.06-0.2	0.11-0.19	7.4-8.4	Low-------	High----------	Low----------	---	
WvB, WvC----------	0-4	0.6-2.0	0.10-0.16	3.6-5.5	Low-------	High----------	High----------	0.24	3-2
Wurtsboro	4-18	0.6-2.0	0.10-0.14	3.6-5.5	Low-------	High----------	High----------	0.28	
	18-70	0.06-0.2	0.08-0.12	3.6-5.5	Low-------	High----------	High----------	---	

[1] This map unit consists of two or more dominant kinds of soil. See the map unit description for the composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "frequent," "brief," "apparent," and "perched." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Ad---------- Adrian	A/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Nov-May	>60	---
AnB2, AnC2, AnD2, AsB, AsC, AsD---- Annandale	C	None--------	---	---	>6.0	---	---	>60	---
BaA, BaB, BbC, BdB Bartley	C	None--------	---	---	2.0-3.0	Perched	Dec-May	>60	---
BfB, BfC, BfD, BfE---------- Bath	C	None--------	---	---	>6.0	---	---	>60	---
BgB, BgC---------- Bath	C	None--------	---	---	---	---	---	>60	---
CbB, CbC2, CcB, CcC---------- Califon	C	None--------	---	---	0.5-2.5	Perched	Dec-May	>60	---
Ck---------- Carlisle	A/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Sep-Jun	>60	---
CmA, CmB, CnA, CnB---------- Chippewa	D	None--------	---	---	0.0-0.5	Perched	Nov-May	>60	---
CoA, CoB---------- Cokesbury	D	None--------	---	---	0-1.0	Perched	Sep-Jun	>60	---
CsB---------- Cokesbury	D	None--------	---	---	0-1.0	Perched	---	>60	---
EdB, EdC---------- Edneyville	B	None--------	---	---	>6.0	---	---	>40	---
EeB, EeC---------- Edneyville	B	None--------	---	---	>6.0	---	---	>60	---
EPD[1]: Edneyville-------	B	None--------	---	---	>6.0	---	---	>60	---
Parker----------	B	None--------	---	---	>6.0	---	---	>48	Hard
Rock outcrop.									
FrA---------- Fredon	C	None to common	Brief-----	Nov-May	0-1.5	Apparent	Oct-Jun	>60	---
Ha---------- Halsey	D	None to frequent	Brief-----	Nov-May	0-0.5	Apparent	Sep-Jun	>60	---
HbA, HbB, HbC, HcB, HfA, HfB, HfC, HfD, HfE---- Hazen	B	None to rare	---	---	>6.0	---	---	>60	---

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
HkA, HkB, HrA, HrB---------- Hero	B	None to occasional	Brief-----	Nov-May	1.5-3.5	Apparent	Nov-Apr	>60	---
LyA, LzB---------- Lyons	D	None to common	Brief-----	Nov-May	0-0.5	Perched	Nov-Jun	>60	---
Md---------- Middlebury	B	Common------	Brief-----	Nov-May	0.5-2.0	Apparent	Feb-Apr	>60	---
NaC, NbB---------- Nassau	C	None--------	---	---	>6.0	---	---	10-20	Hard
NFD[1], NFE[1]: Nassau----------	C	None--------	---	---	>6.0	---	---	10-20	Hard
Rock outcrop.									
ORD[1]: Oquaga----------	C	None--------	---	---	>6.0	---	---	20-40	Hard
Swartswood-------	C	None--------	---	---	2.0-4.0	Perched	Nov-Mar	>60	---
Rock outcrop.									
PaA, PaB---------- Palmyra	B	None--------	---	---	>6.0	---	---	>60	---
PbD, PbE---------- Parker	B	None--------	---	---	>6.0	---	---	>48	Hard
Pc[1]:---------- Pits	---	----------	---	---	---	---	---	---	---
Pd[1]:---------- Pits	---	----------	---	---	---	---	---	---	---
PnA, PnB, PoA, PoB---------- Pope	B	Rare--------	Very brief	Nov-Apr	>4.0	Apparent	Feb-Mar	>60	---
RcD---------- Rockaway	C	None--------	---	---	>6.0	---	---	>60	---
ROF[1]: Rock outcrop.									
Oquaga----------	C	None--------	---	---	>6.0	---	---	20-40	Hard
RPF[1]: Rock outcrop.									
Parker----------	B	None--------	---	---	>6.0	---	---	>48	Hard
Edneyville-------	B	None--------	---	---	>6.0	---	---	>60	---
RRE[1]: Rock outcrop.									
Rockaway---------	C	None--------	---	---	>6.0	---	---	>60	---
Parker----------	B	None--------	---	---	>6.0	---	---	>48	Hard
RWD[1], RWF[1]: Rock outcrop.									
Wassaic----------	B	None--------	---	---	>6.0	---	---	20-40	Hard

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
StC---------- Steinsburg	C	None--------	---	---	>6.0	---	---	30-40	Rippable
SuB, SvB, SvC, SvD---------- Swartswood	C	None--------	---	---	2.0-4.0	Perched	Nov-Mar	>60	---
SxC[1]: Swartswood-------	C	None--------	---	---	2.0-4.0	Perched	Nov-Mar	>60	---
Oquaga----------	C	None--------	---	---	>6.0	---	---	20-40	Hard
VeA, VnB, VnC, VsB---------- Venango	C	None--------	---	---	0.5-1.5	Perched	Jan-Apr	>60	---
WaA, WaB, WaC2, WaD2, WgB, WgC, WgD, WkB, WkC, WkD, WkE--------- Washington	B	None--------	---	---	>6.0	---	---	>60	---
WmA, WmB, WnC, WnD---------- Wassaic	B	None--------	---	---	>6.0	---	---	20-40	Hard
WOB[1], WOC[1], WOD[1]: Wassaic----------	B	None--------	---	---	>6.0	---	---	20-40	Hard
Rock outcrop.									
Wp---------- Wayland	D	Frequent----	Long------	---	0.0-0.5	Apparent	Nov-Jun	>60	---
WvB, WvC---------- Wurtsboro	C	None--------	---	---	1.5-3.0	Perched	Nov-Mar	>60	---

[1] This map unit is made up of two or more dominant kinds of soil. See the map unit description for the composition and behavior characteristics of the map unit.

TABLE 19.-- ENGINEERING TEST DATA

[Tests performed by the College of Engineering, Rutgers University (5, 6) according to standard procedures of the American Association of State Highway and Transportation Officials (AASHTO). Absence of an entry indicates that no determination was made]

Soil name and location	Parent material	Site No.	Depth	Moisture density [1]		Percentage passing sieve-- [2]				Percentage smaller than-- [2]				Liquid limit	Plasticity index	Classification	
				Maximum dry density	Optimum moisture	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO[3]	Unified[4]
			In	Lb/cu ft	Pct									Pct			
Annandale gravelly loam:																	
Nonmodal, lower subsoil finer textured than normal. Latitude 40°36'54", longitude 75°10'53".	Compact glacial till derived from granitic gneiss.	66	0-11	--	--	97	97	84	67	--	--	--	--	41	11	A-7-6(7)	ML
			11-24	102	21	94	92	80	67	63	--	32	--	36	12	A-6(7)	CL-ML
			24-36	101	22	98	92	81	67	64	--	39	--	43	20	A-7-6(12)	CL
Bartley gravelly loam:																	
Modal. Latitude 40°52'04", longitude 74°52'50".	Compact glacial till derived from limestone and gneiss.	38	0-8	--	--	81	78	70	48	--	--	--	--	32	NP[5]	A-4(3)	SM
			8-25	116	14	66	64	53	41	--	--	--	--	26	8	A-4(1)	SC
			25-42	118	13	78	68	54	38	--	--	--	--	28	11	A-6(1)	SC
Bath gravelly loam:																	
Modal. Latitude 40°56'28", longtitude 75°05'30".	Glacial till derived from slate, sandstone, and shale.	10	0-14	--	--	87	85	77	56	--	--	--	--	29	7	A-4(4)	CL-ML
			14-33	121	10	90	85	74	50	--	--	--	--	22	5	A-4(3)	CL-ML
			33-48	125	9	90	74	59	42	--	--	--	--	17	4	A-4(1)	SM-SC
Hazen gravelly loam:																	
Nonmodal, surface horizon coarser than normal. Latitude 40°56'35", longitude 74°51'50".	Stratified sand and gravel, gravelly loam material.	3	0-8	--	--	71	59	38	20	--	--	--	--	26	5	A-1-b(0)	SM-SC
			8-16	--	--	67	58	41	16	--	--	--	--	NL[6]	NP	A-1-b(0)	SM
			16-22	--	--	91	86	69	21	--	--	--	--	NL	NP	A-2-4(0)	SM
			22-30	--	--	91	82	53	27	--	--	--	--	NL	NP	A-2-4(0)	SM
			30-36	--	--	67	52	26	12	--	--	--	--	NL	NP	A-1-b(0)	SP- SM
Hazen loam:																	
Modal. Latitude 40°48'42", longitude 75°03'57".	Stratified sand and gravel, gravelly loam material.	46	0-11	--	--	96	94	81	55	--	--	--	--	21	7	A-4(4)	CL-ML
			11-34	--	--	93	89	76	62	53	--	11	--	25	7	A-4(5)	CL-ML
			34-56	--	--	84	75	40	25	--	--	--	--	24	5	A-1-b(0)	SM-SC
Lyons silt loam:																	
Nonmodal, surface horizon coarser than normal. Latitude 40°51'55", longitude 74°58'04".	Compact glacial till derived from limestone and gneiss.	7	0-8	--	--	88	88	68	48	--	--	--	--	61	17	A-7-5(6)	SM
			8-34	--	--	93	93	78	53	--	--	--	--	88	29	A-7-5(13)	MH
			34-46	113	15	94	92	82	60	--	--	--	--	23	7	A-4(5)	CL-ML

See footnotes at end of table.

TABLE 19.-- ENGINEERING TEST DATA--Continued

Soil name and location	Parent material	Site No.	Depth	Moisture density [1]		Percentage passing sieve-- [2]				Percentage smaller than-- [2]				Liquid limit	Plasticity index	Classification	
				Maximum dry density	Optimum moisture	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO[3]	Unified[4]
			In	Lb/cu ft	Pct									Pct			
Nassau shaly silt loam:																	
Nonmodal, surface horizon coarser than normal. Latitude 40°56'33", longitude 75°02'31".	Glacial till derived from slate, sandstone, and shale.	72	0-4	--	--	59	49	32	17	--	--	--	--	42	10	A-2-5(0)	GM, SM
			4-18	--	--	50	41	32	24	20	--	6	--	31	8	A-2-4(0)	GM-GC
Parker gravelly sandy loam:																	
Nonmodal, finer textured throughout than normal. Latitude 40°48'23", longitude 74°54'12".	Glacial till derived from granitic gneiss.	57	0-13	--	--	66	58	43	30	--	--	--	--	26	6	A-2-4(0)	SM-SC
			13-34	120	13	67	60	34	19	--	--	--	--	24	6	A-1-b(0)	SM-SC
			34-49	119	13	91	85	38	11	--	--	--	--	27	NP	A-1-b(0)	SP-SM
Parker gravelly sandy loam:																	
Nonmodal, finer textured substratum than normal. Latitude 40°48'46", longitude 75°02'43".	Glacial till derived from granitic gneiss.	59	0-6	--	--	56	51	37	21	--	--	--	--	22	4	A-1-b(0)	SM
			6-30	116	15	60	52	31	11	--	--	--	--	23	4	A-1-b(0)	SP-SM
			30-66	114	15	94	89	52	12	--	--	--	--	25	5	A-2-4(0)	SP-SM
Pope fine sandy loam, high bottom:																	
Modal. Latitude 40°53'36", longitude 75°04'05".	Alluvial sediments.	52	0-9	--	--	100	100	88	49	--	--	--	--	NL	NP	A-4(3)	SM
			9-33	115	13	99	99	98	56	--	--	--	--	21	NP	A-4(4)	ML
			33-48	119	10	100	99	86	41	--	--	--	--	NL	NP	A-4(1)	SM
Pope fine sandy loam, high bottom:																	
Nonmodal, surface horizon coarser than normal. Latitude 40°56'28", longitude 75°06'10".	Alluvial sediments.	55	0-24	--	--	100	99	93	30	--	--	--	--	NL	NP	A-2-4(0)	SM
			24-48	--	--	100	99	97	44	--	--	--	--	NL	NP	A-4(2)	SM
			48-60	--	--	100	99	98	66	--	--	--	--	NL	NP	A-4(6)	ML
			60-84	--	--	91	86	64	44	--	--	--	--	NL	NP	A-4(2)	SM
Washington gravelly loam:																	
Nonmodal, surface horizon coarser than normal. Latitude 40°46'30", longitude 74°54'35".	Glacial till derived from limestone, shale, and granitic material.	35	0-4	--	--	64	59	38	23	--	--	--	--	36	12	A-2-6(0)	SM
			4-20	--	--	93	78	64	55	52	--	15	--	32	9	A-4(4)	CL-ML
			20-48	--	--	91	77	65	54	53	--	12	--	37	15	A-6(6)	CL-ML

See footnotes at end of table.

TABLE 19.--ENGINEERING TEST DATA--Continued

Soil name and location	Parent material	Site No.	Depth	Moisture density [1]		Percentage passing sieve-- [2]				Percentage smaller than-- [2]				Liquid limit	Plasticity index	Classification	
				Maximum dry density	Optimum moisture	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO[3]	Unified[4]
			In	Lb/cu ft	Pct									Pct			
Washington gravelly loam:																	
Nonmodal, surface layer and subsoil coarser than normal. Latitude 40°47'25", longitude 74°58'14".	Glacial till derived from limestone, shale, and granitic material.	36	0-10	--	--	94	78	50	32	--	--	--	--	36	12	A-2-6(0)	SM-SC
			10-36	--	--	95	92	79	61	43	--	9	--	29	8	A-4(5)	CL-ML
			36-60	--	--	87	79	60	30	--	--	--	--	24	5	A-2-4(0)	SM-SC
Washington loam:																	
Modal. Latitude 40°43'55", longitude 74°57'50".	Glacial till derived from limestone, shale, and granitic material.	77	0-16	--	--	95	91	85	74	--	--	--	--	33	9	A-4(8)	CL-ML
			16-48	--	--	88	81	77	64	59	--	16	--	34	11	A-6(6)	CL-ML
			48-60	--	--	92	86	79	67	64	--	22	--	29	8	A-4(7)	CL-ML
			60-68	--	--	95	93	87	73	66	--	18	--	28	6	A-4(8)	CL-ML

[1]Maximum dry density and optimum moisture based on AASHTO Designation T 99-49.

[2]Mechanical analyses according to the AASHTO Designation T 88. Results by this procedure frequently differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses in this table are not suitable for use in naming textural classes for soil.

[3]Based on AASHTO Designation M 145-49.

[4]Based on the Unified Soil Classification System ASTM Designation D2487. Soil Conservation Service and Federal Highway Administration have agreed to consider that all soils having a plasticity index within 2 points of the A line are to be given a borderline classification, for example, CL-ML.

[5]Nonplastic.

[6]Nonliquid.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Annandale	Fine-loamy, mixed, mesic Typic Fragiudults
Bartley	Fine-loamy, mixed, mesic Typic Fragiudalfs
Bath	Coarse-loamy, mixed, mesic Typic Fragiochrepts
Califon	Fine-loamy, mixed, mesic Typic Fragiudults
Carlisle	Euic, mesic Typic Medisaprists
Chippewa	Fine-loamy, mixed, mesic Typic Fragiaquepts
Cokesbury	Fine-loamy, mixed, mesic Typic Fragiaquults
Edneyville	Fine-loamy, mixed, mesic Typic Hapludults
Fredon	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic Aeric Haplaquepts
Halsey	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic Mollic Haplaquepts
Hazen	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Hero	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Eutrochrepts
Lyons	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Middlebury	Coarse-loamy, mixed, mesic Fluvaquentic Eutrochrepts
Nassau	Loamy-skeletal, mixed, mesic Lithic Dystrochrepts
Oquaga	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Palmyra	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Glossoboric Hapludalfs
Parker	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Pits.	
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Rockaway	Coarse-loamy, mixed, mesic Typic Fragiudults
Steinsburg	Coarse-loamy, mixed, mesic Typic Dystrochrepts
Swartswood	Coarse-loamy, mixed, mesic Typic Fragiochrepts
Venango	Fine-loamy, mixed, mesic Aeric Fragiaqualfs
Washington	Fine-loamy, mixed, mesic Ultic Hapludalfs
Wassaic	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Wayland	Fine-silty, mixed, nonacid, mesic Mollic Fluvaquents
Wurtsboro	Coarse-loamy, mixed, mesic Typic Fragiochrepts

TABLE 21.--Relation of the soils to position, parent material, and drainage

Parent Material	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
	SOILS ON UPLANDS					
Shallow glacial till derived mainly from slate, sandstone, and shale.	Nassau					
Deep, medium textured glacial till derived mainly from sandstone, quartzite, and shale.		Swartswood	Swartswood	Wurtsboro	Chippewa	Chippewa
Moderately deep, glacial till derived mainly from sandstone and shale.	Oquaga[1]	Oquaga[1]				
Moderately deep, moderately coarse textured material weathered from sandstone.		Steinsburg				
Moderately deep, glacial till derived mainly from limestone, shale, and granitic material.		Wassaic				
Deep, glacial till derived mainly from limestone, shale, and granitic material.		Washington				
Deep, medium textured, compact glacial till derived mainly from limestone and gneiss.			Bartley		Lyons	Lyons
Deep, moderately coarse textured, compact glacial till derived mainly from gneiss.		Rockaway	Rockaway			
Deep, moderately fine textured, compact glacial till derived mainly from granitic gneiss.		Annandale	Califon	Califon	Cokesbury	
Deep, medium and moderately coarse textured, glacial till derived mainly from granitic gneiss.	Parker	Edneyville				
Deep, glacial till derived mainly from slate, sandstone, and shale.		Bath		Venango	Chippewa	Chippewa
	SOILS ON OUTWASH TERRACES AND KAMES					
Stratified sand and gravel, gravelly loam material.		Hazen				
Stratified sand and gravel, gravelly fine sandy loam or loamy material.		Palmyra	Hero		Fredon	Halsey
	SOILS ON FLOOD PLAINS AND RIVER TERRACES					
Medium textured to moderately coarse textured alluvial sediments.		Pope	Middlebury	Middlebury	Wayland	Wayland
	SOILS IN SWAMPS AND BOGS					
Deep organic material.						Carlisle
Organic material 18 to 50 inches thick over sand.						Adrian

[1] Oquaga soils are excessively drained in some areas.

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