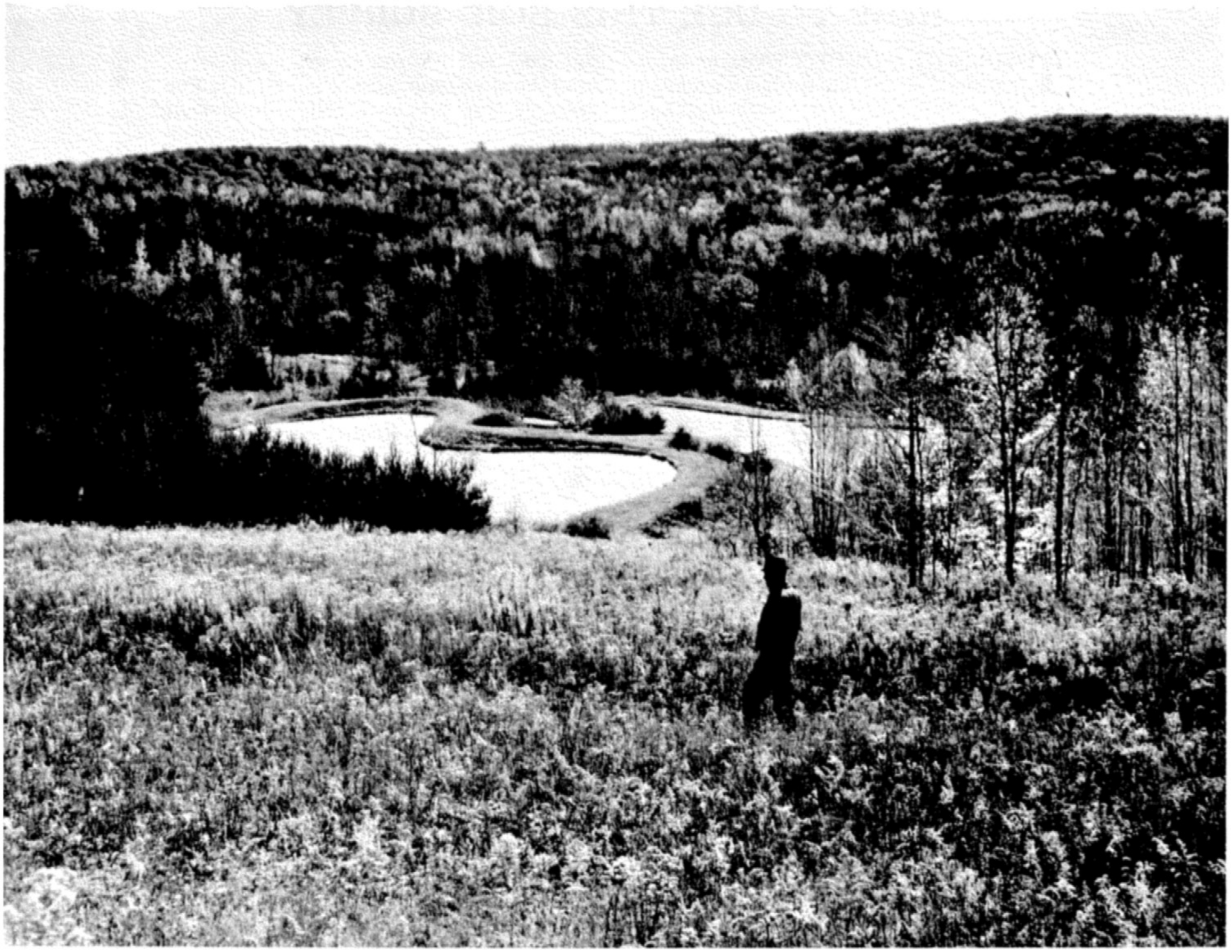
SOIL SURVEY OF

Chemung County, New York



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Cornell University Agricultural Experiment Station

Issued September 1973

Major field work for this soil survey was done in the period 1957–68. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperativey by the Soil Conservation Service and the Cornell University Agricultural Experiment Station. It is part of the technical assistance furnished to the Chemung County Soil and Water Conservation District.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

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

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

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

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

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

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

Newcomers in Chemung County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County."

Cover picture: View of a private recreational development on abandoned farmland in the Lordstown-Volusia-Mardin association. The foreground is mainly moderately well-drained Mardin soils; the twin pond area is mainly somewhat poorly drained Volusia soils; and the steeper, wooded areas in the background are mainly moderately deep, well-drained Lordstown soils.

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Contents

Issued September 1973

SOIL SURVEY OF CHEMUNG COUNTY, NEW YORK

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

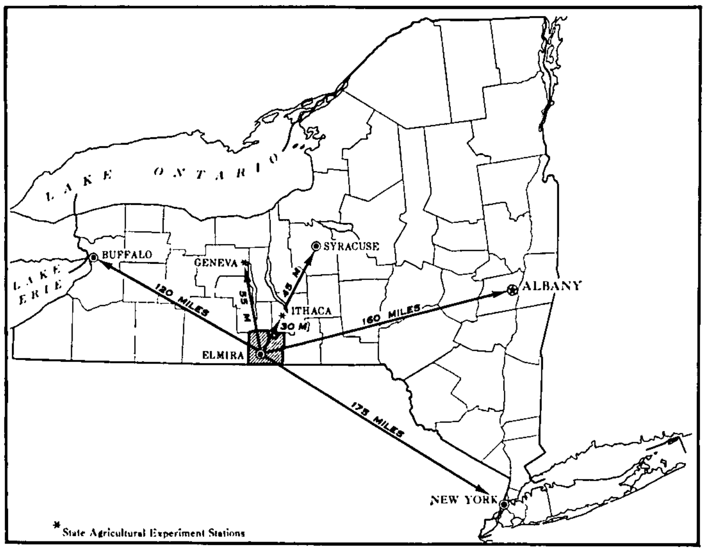

Figure 1.—**Location of Chemung County in New York.**

CHEMUNG COUNTY is in the south-central part of New York State and is one of the southern tier counties that adjoin the New York-Pennsylvania State line (fig. 1). It is bounded on the east by Tioga County, on the north by Tompkins and Schuyler Counties, and on the west by Steuben County.

The county is almost square in shape, and has a north-south dimension of 20 miles and an east-west dimesion of 21 miles. It has a total area of 412 square miles or 263,680 acres. Elmira is the county seat.

According to the 1964 Census of Agriculture, about 40 percent of the land area of the county is in farms. About 50 percent of this area is in crops, 13 percent is pasture, and 29 percent is woodland. There was a considerable change in the farming status of the county during the period 1965 to 1970. A large acreage that was farmed in 1964 is now out of production. Much of it is idle, but a considerable acreage, particularly in the central valley, has been taken over for industrial and urban development. In Chemung County farming on a commercial basis is limited to 3 or 4 restricted areas, notably along County Roads 5 and 6 north of Horseheads, along the Chemung River west and south of Elmira, and in a small section of the town of Southport along the Steuben County line. A poultry industry of considerable magnitude is located along Cayuta Creek in the vicinity of Van Etten. Aside from this poultry farming, the principal enterprise in the areas mentioned is the production of fluid milk, mostly for the local markets of Elmira and Horseheads. Most cropland is used for growing hay, oats, and corn to feed dairy cows. A small acreage has specialized uses, such as growing vegetables for roadside markets and producing sod for landscaping.

Woodlands occupy about 53 percent of the land in Chemung County (*9*).[1] These wooded areas are scattered throughout the farming area, but more of them are in the southern part of the county where the topography is somewhat rougher. Most areas have been cut over 3 or 4 times, but the woodland is an important source of timber, fuel wood, and fence posts for the landowners.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Chemung County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, 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 that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures (*11*). The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or

[1] Italic numbers in parentheses refer to Literature Cited, p. 98.

other geographic feature near the place where a soil of that series was first observed and mapped. Howard and Lordstown, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Chippewa silt loam, 0 to 3 percent slopes, is one of several phases within the Chippewa series.

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

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

Some mapping units are made up of soils of different series or of different phases within one series. One such unit shown on the soil map of Chemung County is the undifferentiated group.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Lordstown and Arnot very rocky soils, 25 to 35 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Alluvial land is a land type in Chemung County.

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

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

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

General Soil Map

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

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

The soil associations in Chemung County are discussed in the following pages.

1. Lordstown-Volusia-Mardin Association

Gently sloping to steep, moderately deep, well-drained soils and deep, somewhat poorly drained and moderately well drained soils that have a fragipan; on uplands

This association is mainly on uplands. It occupies long, smooth slopes just above the valley floors, steep upper slopes, and nearly level hilltops and ridgetops. It is the largest of the associations shown on the map and includes much of the southern and western parts of the county. The total area makes up about 41 percent of the county.

Lordstown soils make up about 34 percent of the association; Volusia soils, about 33 percent; Mardin soils, about 18 percent; and minor soils, the remaining 15 percent.

Lordstown soils are moderately deep, well drained, medium textured, and gently sloping to steep. They contain many channery rock fragments and are underlain by siltstone, sandstone, or shale bedrock at a depth of 20 to 40 inches. Outcrops of rock are common on the steeper slopes.

The deeper, somewhat poorly drained Volusia soils and the moderately well drained Mardin soils are interspersed among the Lordstown soils. These soils formed in compact glacial till derived mainly from local shale, siltstone, and sandstone rocks. A very dense, slowly permeable fragipan occurs at a depth of about 12 to 18 inches in the Volusia soils and at a depth of about 15 to 25 inches in the Mardin soils. Both soils are gently sloping to moderately steep. Volusia soils occur mainly in concave areas where runoff is slow or on foot slopes that receive runoff from adjacent areas. Mardin soils occur mainly on convex areas or on the upper part of slopes where little water accumulates.

The minor soils are of the Arnot, Chippewa, Middlebury, Tioga, and Tuller series and Alluvial land. Shallow, well-drained to poorly drained Arnot and Tuller soils and deep, poorly drained Chippewa soils are interspersed with the major soils on uplands. Traces of Alluvial land and Middlebury and Tioga soils are on the flood plains of small streams that are scattered throughout the association.

Not much of this association is farmed, except for an area in Southport near Steuben County where a few dairy farms are still operating (fig. 2). A large percentage of this association is in native forest. Most of the steeper soils, particularly of the Lordstown series, were never cleared of their original forest cover. A large acreage in these upland sections that was once farmed is now idle or abandoned. Some of this association has been reforested, mostly by the State Conservation Department but some by private landowners (fig. 3). A considerable acreage is brushy and is reverting to forest naturally.

Where farming is practiced, dairying is the principal enterprise. The principal crops are hay (mainly grass and legume mixtures), oats, and corn for silage. All the soils need heavy liming. At higher elevations the growing season is short. Medium fertility, shallow rooting zones, and, in the case of the Volusia and Mardin soils, seasonal wetness limit the use of these soils for crops. Slope is also limiting in places.

The seasonal water table and impervious subsoil of the Volusia and Mardin soils and the shallow depth to bedrock and high elevation of the Lordstown soils are the principal limitations to use of these soils for residential and other nonfarm purposes. During recent years, however, these high, hilly parts of the county have become a favorite place to build homes. This association contains many wooded areas and scenic landscape.

2. Volusia-Lordstown Association

Gently sloping to steep, deep, somewhat poorly drained soils that have a fragipan and well-drained, moderately deep soils; on uplands

This association is on uplands. It occupies long, gentle to moderate, uniform slopes; foot slopes below steep areas; steep slopes near the plateau summit; and nearly level to gently sloping hilltops and ridgetops. This association is extensive and occupies broad areas in the northern half of the county. It covers about 27 percent of Chemung County.

Volusia soils make up about 47 percent of the association; Lordstown soils about 23 percent; and minor soils, the remaining 30 percent.

Volusia soils are deep, somewhat poorly drained, and medium textured, and they contain many channery rock fragments. They have formed in compact glacial till that is derived mainly from the local shale, siltstone, and sandstone rocks. A dense fragipan about 12 to 18 inches below the surface restricts rooting and air and water movement. Volusia soils are gently sloping to moderately steep, and they occur mainly in concave areas where runoff is slow or on foot slopes that receive runoff from adjacent areas.

Figure 2.—**A dairy farm in the Lordstown-Volusia-Mardin association.**

Figure 3.—**Reforested land in the Lordstown-Volusia-Mardin association.**

Lordstown soils are scattered throughout the area. They are gently sloping to steep, moderately deep, well drained, channery, and medium textured. Lordstown soils are underlain by sandstone, siltstone, or shale bedrock at a depth of 20 to 40 inches. Outcrops of bedrock are common on the steeper slopes.

The minor soils are of the Mardin, Arnot, Tuller, and Chippewa series. The miscellaneous land type, Alluvial land, is also included. The Mardin, Arnot, Tuller, and Chippewa soils are medium textured and are interspersed with the Volusia and Lordstown soils on uplands. They are well drained to very poorly drained. Traces of Alluvial land occur on flood plains along the small streams that cross the association.

Only a small number of dairy farms in this association are still in operation. Because of the properties of the dominant soils, this association is potentially poor farm land. A large acreage is idle and abandoned. This association has a good potential for reforestation, recreational uses, and wildlife habitat.

Some of this association within commuting distance of population centers is used for residential development. The dominant soils, however, have some properties that limit their use for building, such as slow drainage, an impervious subsoil, and bedrock at a depth of less than 40 inches.

Much of the abandoned and idle land in this association has considerable value for recreational uses. There is still a large acreage of woodland, many sites are suitable for summer camps and cottages, and ponds have been constructed in many areas. The large acreage of brushy, idle land and native forest makes this association valuable for wildlife habitat.

3. Lordstown-Arnot Association

Steep and very steep, moderately deep and shallow, well drained to moderately well drained soils; on uplands

This association is mainly on the steep valley walls in the southern and eastern parts of the county. It makes up about 10.2 percent of the county.

About 60 percent of the association is Lordstown soils; 20 percent is Arnot soils; and the remaining 20 percent is minor soils.

Lordstown soils are well drained, medium textured, moderately deep, and channery. They are underlain by sandstone, siltstone, or shale bedrock at a depth of 20 to 40 inches. Outcrops of rock are common. Lordstown soils are mainly steep and very steep, and they occupy valley sides. On the steep slopes, on gently sloping hilltops, and in narrow treadlike areas on stairstep landscapes, areas of similar Arnot soils are intermingled with the Lordstown soil. These Arnot soils are less than 20 inches deep over underlying bedrock.

The minor soils are of the Volusia, Mardin, Chippewa, and Tuller series. Deeper, somewhat poorly drained Volusia soils and moderately well drained Mardin soils are intermingled in less steep areas. Poorly drained Chippewa soils are in depressions and seeps. Somewhat poorly drained to poorly drained, shallow Tuller soils are on hilltops and flat areas.

Steepness is the dominating characteristic of this association. Most of the acreage is forested (fig. 4). The few soils on hilltops and some of the less steep soils are idle or abandoned. Soils of this association have little potential for farming, but they can be used for recreational purposes and habitat for wildlife.

4. Valois-Lansing Association

Gently sloping to steep, deep, well-drained soils; on valley slopes and adjacent uplands

This association mainly occupies lower side slopes of valleys, in a rolling topography, and moderately steep upper slopes. It is limited to one area in the town of Veteran, and extends from Pine Valley north to the Schuyler County line. It is a minor association that makes up about 1.3 percent of the county.

Valois soils make up about 35 percent of the association; 30 percent is Lansing soils; and the remaining 35 percent is minor soils.

Valois soils are deep, well drained, gravelly, and medium textured. These soils are gently sloping to hilly. They formed in loose glacial till on morainic topography.

Lansing soils are deep, well drained, gravelly, and medium textured. They have a medium acid reaction in the upper layers. They formed in firm glacial till derived mainly from local siltstone, shale, and sandstone and some limestone. The gently sloping to moderately steep Lansing soils on rolling till plains are in close association with Valois soils.

The minor soils are of the Volusia, Mardin, Lordstown, and Howard series. The miscellaneous land type, Alluvial land, is also included. The deep, somewhat poorly

Figure 4.—**Steep, forested soils of the Lordstown-Arnot association adjacent to Cayuta Creek.**

drained Volusia soils; the deep, moderately well drained Mardin soils; and the moderately deep, well-drained Lordstown soils are intermingled mainly on landscapes abutting the higher uplands to the east. Traces of well-drained gravelly Howard soils are on kamy areas along the lower valley walls. Alluvial land is in small bottomland areas.

A considerable number of new homes have been built on the southern part of this association, within commuting distance of the town of Horseheads. The more extensive soils have many properties that are favorable for this nonfarm use.

Most of the acreage is used for farming. The major enterprise is dairying. The commonly grown crops, corn, oats, and hay, are used to feed dairy cows. Under good management, which includes liming and fertilizing, the dominant soils are well suited to these crops. There is a hazard of erosion if the soils are cultivated and not protected.

5. Hudson-Howard Association

Nearly level to steep, deep, moderately well drained to somewhat excessively drained soils; on glacial lake plains and glacial outwash terraces and kames

This association mainly occupies the strongly dissected glacial lake plain and glacial outwash terraces and kames north of Horseheads, extending from Pine Valley to the Schuyler County line. There is only one area of this association, and it covers about 2.5 percent of the county.

Hudson soils make up about 55 percent of the association; Howard soils, about 20 percent; and the remaining 25 percent is minor soils.

Hudson soils are deep and moderately well drained and well drained. They have a medium textured to moderately fine textured surface layer and a slowly permeable, moderately fine textured to fine textured subsoil. They formed in lake-laid silts and clays that are underlain in most places by sand and gravel at a depth below about 4 to 6 feet. They are nearly level to steep, and occupy areas representing the eroded surface of the old glacial lake plain.

Howard soils are deep, well-drained and somewhat excessively drained, gravelly soils. They formed in the gravelly glacial outwash materials that were not covered by the glacial lake sediments in this area. They are mostly nearly level to moderately sloping, and include some steep slopes.

The minor soils are of the Atherton, Chenango, Collamer, Homer, Madalin, Middlebury, Papakating, Phelps, Rhinebeck, and Tioga series. The Rhinebeck, Madalin, Collamer, Homer, and Atherton soils are intermingled with Hudson and Howard soils on lake plain and glacial outwash landscapes. These soils are moderately well drained to very poorly drained. The well-drained to very poorly drained Tioga, Middlebury, and Papakating soils mainly occupy the flood plain along Catharine Creek. Where some of the tributaries flow into Catharine Creek, there are small fans of well-drained to somewhat excessively drained Chenango soils.

There is some farming in this association, mainly in the southern part where topography and relief are more favorable. Dairying is the main enterprise, and the commonly grown crops, corn, oats, and hay, are used to feed dairy cows. The dominant soils have fair to good natural fertility, and, if properly managed, they are well suited to these crops. The silty and clayey lacustrine soils are easily eroded, even those that are gently sloping. Conservation practices are a necessary part of management. Maintaining good tilth, controlling runoff, and preventing soil loss through erosion are the principal management concerns. The gravelly Howard soils are droughty in places.

The properties of the dominant soils that affect their use for residential or industrial sites are variable. The silty and clayey lacustrine deposits are unstable and highly erodible, but they are underlain by more stable gravelly material in many places. The gravelly and sandy deposits, however, are underlain by wet, compressible materials in many places, making onsite investigation necessary if any heavy structures or vibratory loads are to be placed upon them.

6. Howard-Chenango Association

Nearly level to gently sloping, deep, well-drained to somewhat excessively drained, gravelly and channery soils; on glacial outwash terraces and old alluvial fans

This association consists of nearly level to gently rolling or sloping soils on outwash plains, alluvial fans, stream terraces, and flood plains. It principally occupies the large valley that extends from Big Flats to Horseheads and Elmira. Minor areas occur in smaller valleys in other parts of the county. This association covers about 13 percent of the county.

Howard soils make up about 26 percent of the association, Chenango soils make up about 15 percent, and the remaining 59 percent is minor soils.

Howard soils are deep, well drained to somewhat excessively drained, medium textured, and gravelly. They formed in glacial outwash material consisting of stratified sands and gravels. They occupy outwash terraces and are mainly nearly level to gently sloping.

Chenango soils formed in channery material deposited as old alluvial fans where side streams enter the main valleys. They are well-drained to somewhat excessively drained, deep soils that are nearly level to gently sloping. They occur around the edges of areas of Howard soils.

This association has a complex pattern of soils. Minor soils are of the Tioga, Middlebury, Papakating, Valois, Unadilla, Wallington, Collamer, Phelps, Atherton, and Homer series. They range from well drained to very poorly drained. The Tioga, Middlebury, and Papakating soils are on flood plains. Valois soil is intermingled with Howard soils along valley sides. The Unadilla, Williamson, Wallington, and Collamer soils occupy stream terraces and lake plains. The Phelps, Atherton, and Homer soils are the wetter associates of Howard soils and are intermingled on glacial outwash landscapes.

Most of this association is used for farming or urban development. The city of Elmira is in the area, and all of the land between this city and Horseheads is used for residential or industrial sites. The large area between Horseheads and Big Flats is rapidly being taken over for urban development (fig. 5). South of Elmira, along the Chemung River and in some of the minor valleys, areas

Figure 5.—**Housing development in the Howard-Chenango association at Big Flats.**

of this association are still used for farming. They are among the best farmlands of the county and are well suited to such commonly grown crops as corn, oats, and hay.

This association and the Tioga-Unadilla-Howard association occupy the most accessible parts of the county. They are rapidly being converted to industrial and residential sites.

7. Tioga-Unadilla-Howard Association

Nearly level to gently sloping, deep, well-drained to somewhat excessively drained soils on flood plains and silty and gravelly soils on adjacent terraces

This association occupies flood plains and adjacent terraces. It is mainly along the Chemung River, in the vicinity of Big Flats and south of Elmira. This association covers about 5 percent of the county.

Tioga soils make up about 25 percent of the association; Unadilla soils, about 22 percent; Howard soils, about 20 percent; and minor soils, the remaining 33 percent.

Tioga soils are deep, well drained, medium textured and moderately coarse textured. These soils formed in alluvial sediments on flood plains. They are subject to flooding, which generally takes place in spring but may occur during any period of heavy rainfall.

Unadilla soils are deep, well drained, nearly level, and silty. They formed on the higher stream terraces adjacent to Tioga soils. Their profile contains 40 inches or more of silt overlying stratified sand and gravel.

Deep, well-drained to somewhat excessively drained, gravelly Howard soils are interspersed with the Unadilla

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soils. Howard soils are nearly level to gently sloping, and they occupy gravelly outwash terraces.

The minor soils are of the Middlebury, Papakating, Williamson, Wallington, Phelps, Homer, and Atherton series. These soils range from moderately well drained to very poorly drained. Middlebury and Papakating soils are associated with Tioga soils on flood plains; Williamson and Wallington soils are adjacent to Unadilla soils on stream terraces. The Phelps, Homer, and Atherton soils are intermingled with Howard soils on glacial outwash terraces.

This association contains soils that are well suited to crops and are among the most intensively farmed soils in the county. Dairying is the dominant farm enterprise, and the corn, oats, and hay grown are used to feed dairy cows. The good drainage and favorable relief make this a desirable use of the dominant soils of the association (fig. 6).

Nonfarm uses of the Tioga and Middlebury soils are limited by the hazard of flooding. The silty veneer of Unadilla soils is unstable and very erodible, but these soils as well as the Howard soils are generally able to support low buildings. All of the soils in this association are underlain in places by wet, compressible sediments, making onsite investigation essential if heavy or vibratory loads are to be placed on them.

Use and Management of the Soils

In this section the general management practices applicable to the soils of the county are discussed. The soils are grouped into capability classes to show their relative suitability for farming, and suggestions for the use and management of the soils in each capability unit are given. Included in this section is a table showing estimated

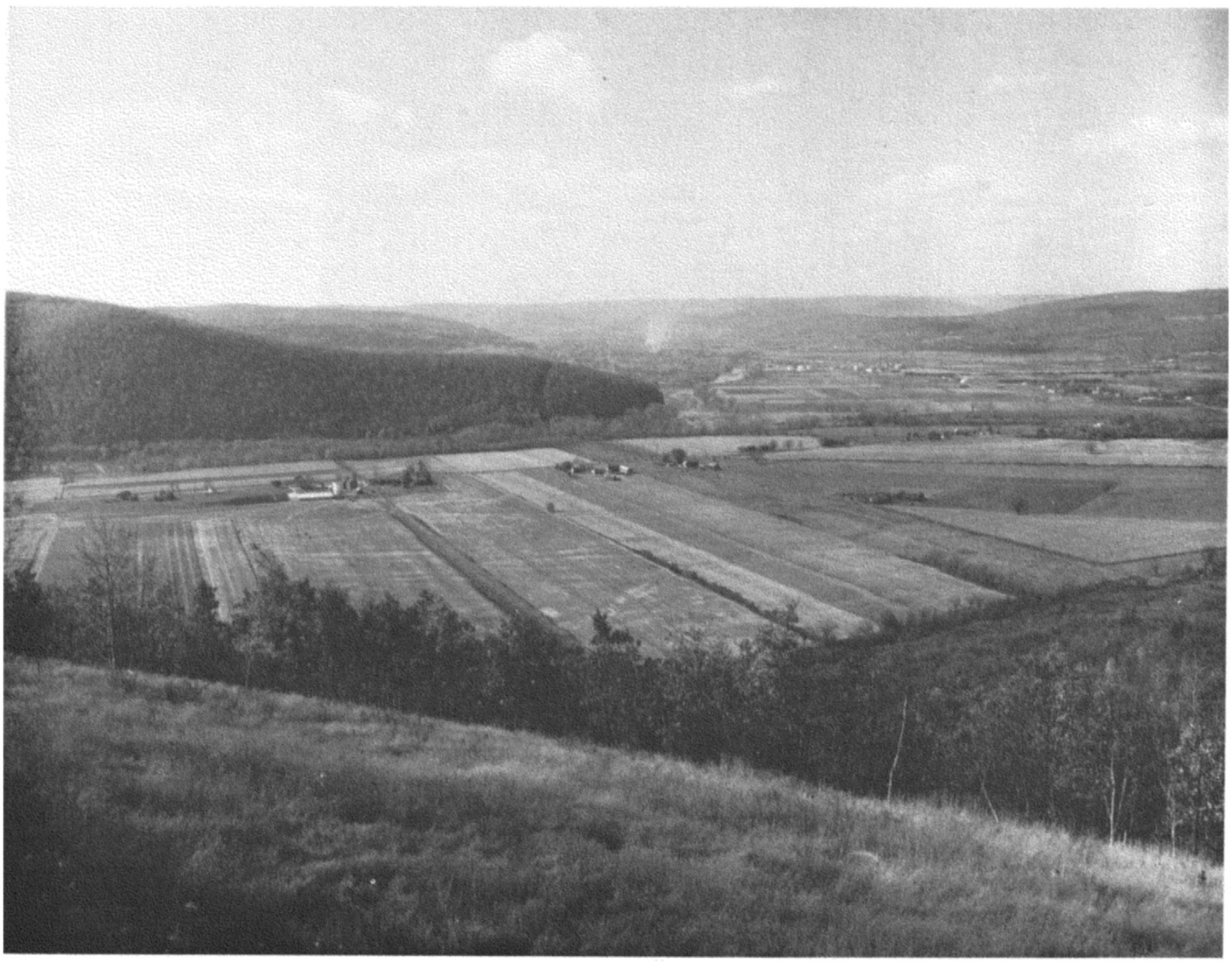

Figure 6.—**Well-drained bottom land in the Tioga-Unadilla-Howard association.**

average acre yields obtained from each of the soils under different levels of management. In addition, soils are grouped according to their suitability for use as woodland, and soil interpretations for wildlife habitat are discussed. The last part of this section presents information about soil properties that are important to engineers and builders, and it rates the soils for selected nonfarm uses.

General Management of the Soils for Farming [2]

This section is designed to help farmers and those who advise farmers to choose combinations of soil, water, and crop management practices suitable for the wise and economic utilization of the soils on a farm and appropriate for conditions prevailing at the time the choices are made. Before making his choice the user of this report should consider the latest information on soil and crop management.[3]

Subsoil characteristics that affect root growth

In choosing a crop to be grown on a given soil, the characteristics of the subsoil or underlying material need to be considered. These characteristics are given for each soil in the section "Descriptions of the Soils."

In some soils, such as those of the Chenango and Tioga series, the subsoil is loose and easily penetrated to a great depth by roots. In other soils, such as those of the Mardin, Volusia, and Chippewa series, a fragipan at a depth of 12 to 25 inches restricts drainage and rooting. The Arnot and Tuller soils are underlain by bedrock at a depth of 20 inches or less, which also restricts rooting. Figure 7 shows typical rooting zones for well drained, moderately well drained, somewhat poorly drained, and poorly drained soils.

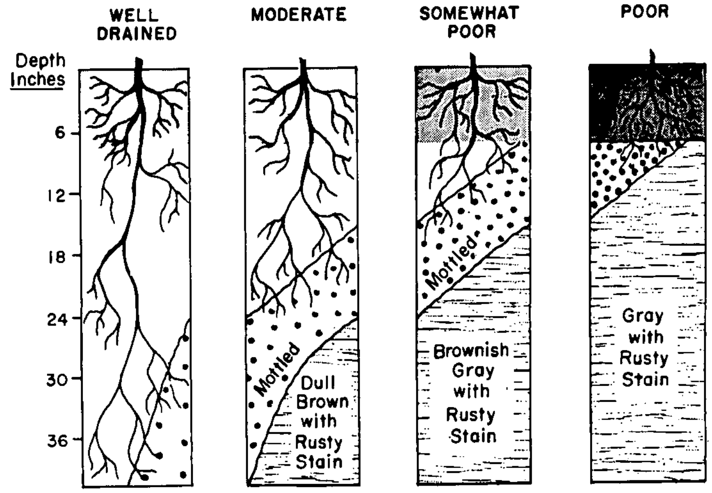

Figure 7.—**Effect of soil drainage on root growth.**

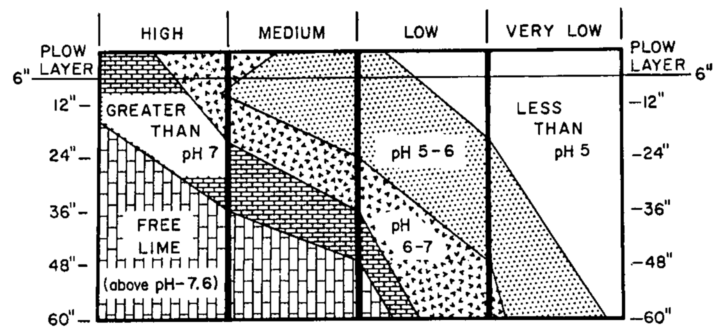

Figure 8.—**Lime level of different soil profiles.**

Acidity relationships of the soils

The natural lime content of Chemung County soils ranges from medium to very low. Figure 8 illustrates the relationship of the different lime levels, to a depth of 60 inches, in four different profiles.

Medium-lime soils, such as those of the Howard and Lansing series, are strongly acid to slightly acid to a depth of more than 12 inches, but they become less acid below that depth. They generally have free lime at a depth of 30 to 60 inches. Low lime to very low lime soils, such as those of the Mardin and Volusia series, are generally strongly acid to very strongly acid to a depth of more than 24 inches. In some places they have neutral material deep in the substratum, commonly beyond the reach of plant roots. In silt loam, the texture most common in surface layers in the county, lime moves downward at an average rate of half an inch each year. Crops also deplete lime. Therefore, to maintain the desired pH in the plow layer, it is necessary to apply lime periodically, usually once in each rotation sequence.

Nitrogen relationships of the soils

The average organic-matter content is 4 percent in the surface layer of soils on uplands in this county. Nitrogen is released from organic matter at the rate of 40 pounds to about 160 pounds per acre each year. Poorly drained soils that warm up slowly benefit from additions of nitrogen early in spring.

Phosphorus relationships of the soils

Most soils in this county are medium in ability to supply phosphorus. This means that they can release the equivalent of 10 pounds of phosphate[4] per acre each year. The addition of appropriate amounts of a commercial phosphate fertilizer is essential for good crop growth.

Potassium relationships of the soils

Most of the soils in Chemung County are medium or low in ability to supply potassium. Those that have a

[2] By E. L. McPHERRON, agronomist, Soil Conservation Service. Unless otherwise noted, the material is based on the results of research studies performed on the Aurora and Mount Pleasant Research Farms by staff members and associates of the New York State College of Agriculture at Cornell University.

[3] New research findings are reported currently in annually revised editions of "Cornell Recommends for Field Crops" and "Cornell Recommends for Vegetable Crops," both prepared by the staff of New York State College of Agriculture at Cornell University. Cornell Miscellaneous Bulletin Number 47 and current editions of other applicable publications on soil and crop management should also be consulted. Constantly revised information is available upon request from the local office of the Soil Conservation Service and of the Cooperative Extension Service.

[4] To convert phosphorus (P) to phosphate (P_2O_5), multiply by 2.3; to convert phosphate to phosphorus, multiply by 0.43.

medium ability to supply potassium release about 70 pounds of potash[5] per acre each year. Those that have low ability to supply potassium generally supply less than 70 pounds. Medium-textured soils, such as those of the Chenango and Lordstown series, have medium ability to supply potassium.

Crop adaptation relationships

The choice of an adapted crop variety depends largely on the climate, depth and character of the rooting zone, and on the natural drainage class of the soil or the artificial drainage available. As new crop varieties are developed and results of new research and observations are put into use, changes will be advocated in the annually revised "Cornell Recommends" publications.

Capability Grouping

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

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

In the capability system, all kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

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

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

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

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

Class V. Soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

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

Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. Class VIII is not used in Chemung County.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 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. Capability subclass *c* is not used in Chemung County.

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

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

In the following pages each of the capability units in Chemung County is described, and suggestions for the use and management of the soils in each unit are given. The names of soil series represented are mentioned in the description of each group, but this does not mean that all the soils of a given series are in the group. The "Guide to Mapping Units" shows which group each individual soil is in.

CAPABILITY UNIT I-1

This unit consists of silty soils of the Tioga and Unadilla series. These are deep, nearly level, well-drained soils on high bottoms and terraces. There are no rooting depth restrictions. These soils are moderately permeable and have a high available water capacity. They are medium acid to strongly acid in the surface layer, but tend to become less acid with depth. The supply of nitrogen and phosphorus is medium; the supply of potassium is low to medium. The Tioga soils are flooded occasionally, but rarely during the growing season.

Soils in this unit are easy to work and can be tilled early in spring. They are suited to all crops grown in the county, including vegetables, and are especially well

[5] To convert potash (K_2O) to potassium (K), multiply by 0.83; to convert potassium to potash, multiply by 1.2.

suited to deep-rooted crops. Generally, these soils are better suited to intertilled crops than to pasture. They respond well to good management.

Several consecutive years of row crops can be grown if the organic-matter content and soil structure are maintained. Organic-matter content can be maintained annually by using crop residue and cover crops or by occasionally growing a sod crop. Large additions of lime are needed on these naturally acid soils, and additional phosphorus and potassium are also needed. Minimum tillage helps to preserve soil structure. Irrigation water can be applied at a moderate to rapid rate.

CAPABILITY UNIT IIe-1

This unit consists of loamy soils of the Lansing and Valois series. These are deep, well-drained, gently sloping, gravelly soils on uplands and valley sides. Roots can penetrate these soils to a depth of 30 inches or more. Available water capacity is moderate to high. Unlimed, these soils are very strongly acid to slightly acid in the surface layer but become less acid as depth increases. The supply of nitrogen and phosphorus is medium. The potassium supply is high in Lansing soils and medium in the Valois soils. There is a slight to moderate hazard of erosion. Complex slopes are common, especially on Valois soils, and contour farming for erosion control and moisture conservation is not feasible in many places.

The soils of this unit are well suited to most of the forage and field crops commonly grown in the county. The more gentle slopes can be used intensively for row crops if a winter cover crop is grown and measures are taken to preserve tilth. Measures should include minimum tillage, disking before plowing, using a clod buster, and using crop residue. Contour stripcropping, grassed waterways, and other measures are needed to help control erosion if row crops are grown on long or steep slopes. Long slopes can be used more intensively for row crops if diversions are constructed. On complex slopes, sod crops in the cropping system help control erosion. Moderate quantities of stones and gravel interfere in some places with the operation of machinery used to cultivate and harvest truck crops. These soils are suitable for irrigation, but the supply of water is limited in places.

CAPABILITY UNIT IIe-2

Lordstown channery silt loam, 2 to 8 percent slopes, is the only soil in this unit. It is a moderately deep, well-drained soil on uplands. Depth of rooting is confined mainly to the 20 to 40 inches above bedrock. Available water capacity is low to moderate. Reaction is very strongly acid to strongly acid. The supply of nitrogen, potassium, and phosphorus is medium. There is a slight hazard of erosion if this soil is cultivated and not protected.

The soil in this unit is fairly well suited to crops, but the restricted rooting zone is a slight limitation. Also, early-maturing varieties may be needed in areas that have a shorter growing season. Lime is needed for most crops, especially legumes. This soil responds well to applications of fertilizer. Management practices to increase the infiltration rate are needed primarily during the growing season. Loss of soil and water can be reduced by contour farming, minimum tillage, and the use of crop residue.

CAPABILITY UNIT IIe-3

This unit consists of silty soils of the Collamer, Hudson, and Williamson series. These soils are deep, gently sloping, and moderately well drained. They occupy glacial lake plains along the major valleys. Rooting is mainly in the top 24 inches, and few roots extend below this depth. Available water capacity is moderate to high. The surface layer is strongly acid to neutral in Collamer and Hudson soils and strongly acid to medium acid in Williamson soils. The lime content increases with depth. The supply of nitrogen and phosphorus is medium. The supply of potassium is medium in the Collamer soils, very high in the Hudson soils, and low in the Williamson soils. The hazard of erosion is severe if these soils are cultivated and not protected.

These stone-free soils are well suited to all crops. Careful management is needed to reduce surface crusting and control erosion and compaction below the surface. Good soil structure is difficult to maintain. Plowing and fitting should not be done when the soils are wet. Using cover crops, crop residue, and minimum tillage are other measures that help to maintain good tilth. In places the moderately slowly permeable or slowly permeable subsoil causes wetness in spring and delays planting. Drainage of wet spots by land shaping and random installation of tile lines helps to make this soil suitable for all crops.

Terracing, contour stripcropping where topography permits, and maintaining year round surface cover are measures needed for erosion control. If these measures cannot be applied, the cropping system should not include more than 1 year of row crop and 1 year of grain to 3 years of sod in the rotation. Irrigation efficiency is reduced by the moderately slow permeability of the subsoil and the crusting of the surface layer.

CAPABILITY UNIT IIw-1

Mardin channery silt loam, 2 to 8 percent slopes, is the only soil in this unit. It is a deep, moderately well drained, gently sloping soil on uplands. A dense, slowly permeable fragipan at a depth of 15 to 25 inches restricts rooting and water movement. Available water capacity is low to moderate. The surface layer is very strongly acid or strongly acid. The supply of nitrogen, potassium, and phosphorus is medium. There is a slight to moderate hazard of erosion if this soil is cultivated and not protected.

If adequately limed and fertilized, the soil in this unit is suited to corn for silage and grain, oats, wheat, grass-legume hay, and pasture. Spring wetness may shorten the growing season; therefore, early-maturing varieties of corn are desirable. Legume varieties adapted to shallow hardpan soils should be selected for this soil. Large additions of lime and such conservation practices as contour tillage, stripcropping, and the use of diversion terraces are necessary if row crops are grown. Minimum tillage and management of crop residue help protect the surface layer from erosion.

CAPABILITY UNIT IIw-2

This unit consists of silty soils of the Collamer and Williamson series and the gravelly soils of the Phelps series. These are deep, nearly level, moderately well drained soils in areas of glacial outwash or on lake plains. The seasonal water table restricts rooting mainly to the topmost 18 to 24 inches; few roots extend below this depth. The available water capacity of the Collamer and Williamson soils is moderate to high in the rooting zone. Phelps soils have a moderate to low available water capacity. Reaction in the surface layer ranges from slightly acid to neutral in the Collamer and Phelps soils and from strongly acid to medium acid in Williamson soils. The supply of nitrogen and phosphorus is medium in all these soils; the supply of potassium is medium in the Collamer and Phelps soils and low in Williamson soils. Erosion generally is not a problem.

Soils in this unit are well suited to commonly grown crops, and intensive soil management generally is justified. Midseason vegetable crops grow well if the soils are properly managed. Stones on the surface of Phelps soils interfere in places with the precision machinery used for tillage of truck crops. Although slight wetness briefly delays spring planting in some places, the soils are relatively easy to work if the organic-matter content is maintained.

The Williamson soils require applications of lime to maintain a level of acidity desirable for plant growth. The Williamson and Collamer soils crust easily. Row crops can be planted year after year if careful management of crop residue is combined with a system of cover crops. Minimum tillage is also important. A rotation that includes a sod crop every 4 to 5 years helps to maintain good soil structure.

Random surface and tile drainage systems are generally desirable if these soils are used intensively. In places, frost heaving causes some winterkill of deep-rooted perennial crops. Supplemental irrigation is needed in some years to maintain good plant growth.

CAPABILITY UNIT IIw-3

This unit consists of loamy soils of the Tioga series. These are nearly level, well-drained, deep soils on flood plains. The rooting depth is not restricted. Available water capacity is high. The surface layer is strongly acid to medium acid. The supply of nitrogen and phosphorus is medium; the supply of potassium is medium to low. Flooding is the main limitation to use of these soils. Floods occur frequently in spring and occasionally during the growing season. Streambank erosion, detrimental deposition, and channel gouging are problems along some parts of streams.

Although planting may be delayed briefly by flooding in spring, these soils respond well to good management. Their ability to retain and furnish applied plant nutrients is good to excellent.

These soils are well suited to all crops grown in the county, except those that can not tolerate short periods of wetness. If the danger of flooding is eliminated, vegetables and all other crops are well suited. Row crops can be grown year after year if they are combined with cover crops and if crop residue is returned to the soil. Minimum tillage is important in maintaining good soil structure.

These soils are well suited to irrigation. Construction of dikes to prevent overflow may be desirable. Also, along troublesome parts of some streams, stream bank protection and channel improvement are needed.

CAPABILITY UNIT IIw-4

Middlebury silt loam is the only soil in this unit. It is a deep, moderately well drained to somewhat poorly drained soil on flood plains. Rooting is mainly within the top 24 inches. Available water capacity is high. Reaction is medium acid in the surface layer. The supply of nitrogen is medium to high; supplies of potassium and phosphorus are medium. Wetness may briefly delay planting, and in the spring, there is a hazard of flooding.

These soils are suited to most crops commonly grown in the county, except those that can not tolerate short periods of wetness. Legumes used in the forage mixture should be tolerant of wetness. Applying nitrogen early in the season allows crops to start growth earlier where soil temperatures are low.

All crop rotations that include sod are suitable. Several consecutive years of row crops can be used if crop residue is returned to the soil and a system of cover crops is used as often as possible. A year of sod every 5 years will also help to maintain good soil structure.

Drainage of low wet spots by land smoothing and use of tile drains is desirable. Streambank protection and channel improvement may also be necessary to protect these soils from flood damage.

CAPABILITY UNIT IIs-1

This unit consists of loamy soils of the Chenango and Howard series. These are deep, well drained to somewhat excessively drained, nearly level to gently sloping soils on gravelly glacial outwash terraces and fans. The effective rooting zone is in the upper 36 inches. Available water capacity is low to moderate. Unlimed, the surface layer is slightly acid in the Howard soils, and strongly acid or very strongly acid in the Chenango soils. Lime content increases markedly with depth in Howard soils. Chenango soils are acid throughout. The supply of nitrogen, potassium, and phosphorus is medium. Lack of moisture during the growing season is one of the major limitations to farming. There is also a slight hazard of erosion on the sloping areas.

The soils in this unit are easy to work, they warm up early in spring, and they are suited to all crops grown in the county. Deep-rooted perennial crops are preferred. If properly managed, these soils are well suited to specialized fruits and vegetables. Gravelly and channery fragments on the surface interfere with the use of precision machinery, but transplanted crops do well. Stands are adversely affected by erosion and droughtiness in places.

Planting on the contour and maintaining plant cover on slopes help control erosion. Returning crop residue to the soil and maintaining a winter cover crop are necessary practices where these soils are used for cultivated crops.

These soils are well suited to row crops if minimum tillage is used and crop residue is left on the surface. These soils absorb irrigation water readily, and irrigation should be included in management of high-value crops. It is important to apply fertilizer at the time plants are ready to use it, because these soils leach out and have a low to moderate available water capacity.

CAPABILITY UNIT IIIe-1

This unit consists of loamy soils of the Howard, Lansing, and Valois series. These are deep, moderately sloping and rolling, well-drained, gravelly soils. They are on outwash deposits in valleys and moraines and till deposits on uplands. Roots penetrate these soils to a depth of 30 inches or more. Available water capacity is low to moderate in Howard soils, moderate in Valois soils, and moderate to high in Lansing soils. Unlimed, these soils are very strongly acid to slightly acid in the surface layer, but lime content increases with depth. The supply of nitrogen and phosphorus is medium. The supply of potassium is medium in the Howard and Valois soils and high in Lansing soils. The hazard of erosion is moderate to severe. Complex slopes are common.

These soils are suited to all crops commonly grown in the county. They are well suited to fruit trees and forage crops which require good drainage and deep rooting. The soils can be cultivated early, and if erosion is controlled, fruit and vegetables can be grown.

Surface runoff is rapid, and measures are needed to conserve both soil and water. Long slopes that can be contoured or stripcropped can be used more intensively than short slopes. On complex slopes where contour farming is not practical, the long-term use of sod crops is favored. Winter cover is essential if these soils are to be cultivated. Minimum tillage and returning crop residue to the soils are practices needed to maintain organic-matter content.

These soils are not well suited to irrigation because of the hazard of erosion.

CAPABILITY UNIT IIIe–2

Lordstown channery silt loam, 8 to 15 percent slopes, is the only soil in this unit. It is a moderately deep, well-drained soil on uplands. Rooting is mainly in the 20 to 40 inches above bedrock. Available water capacity is low to moderate. Reaction is very strongly acid or strongly acid. The supply of nitrogen, potassium, and phosphorus is medium. Runoff is rapid, and the hazard of erosion is moderate to severe.

The soil is fairly well suited to crops commonly grown in the county, and crops respond well to good management.

Because of slope, this soil is not suited to cultivated crops unless adequate measures are taken to control erosion and conserve moisture. These are contour farming, contour stripcropping, and use of grassed waterways. Minimum tillage, use of cover crops, and management of crop residue are measures needed to preserve soil structure and increase the rate of water intake.

Unless slopes more than 300 feet in length are protected, they should be used for a rotation of no more than 1 year of a cultivated crop followed by 2 years of a sod-forming crop. Deep-rooted legumes are desirable because they make full use of the available moisture.

Deep placement of lime by plowing is desirable on this soil.

CAPABILITY UNIT IIIe–3

Mardin channery silt loam, 8 to 15 percent slopes, is the only soil in this unit. It is a deep, moderately sloping, moderately well drained soil on uplands. A dense, slowly permeable fragipan at a depth of 15 to 25 inches restricts rooting and water movement. Available water capacity is low to moderate. The surface layer is very strongly acid or strongly acid. The supply of nitrogen, potassium, and phosphorus is medium. Runoff is rapid, and the hazard of erosion is moderate to severe.

The soil is suitable for corn, small grain, hay, and pasture. Corn varieties that mature early and legumes that can tolerate the wetness should be selected. Protection from loss of soil and water is essential for all crops.

The use of diversions, contour strips, minimum tillage, and the return of crop residue are measures needed to control erosion and maintain good soil structure. In places, diversions are needed to break up long slopes or to divert water concentrated in adjacent areas. Careful harvesting and fertilizing practices are needed to maintain legume stands for more than 1 year.

CAPABILITY UNIT IIIe–4

Arnot channery silt loam, 2 to 8 percent slopes, is the only soil in this unit. It is a shallow, nearly level, well drained to moderately well drained, gently sloping soil on uplands. Rooting is mainly in the 10 to 20 inches above bedrock. Available water capacity is low to very low. Reaction is strongly acid or very strongly acid. The supply of plant nutrients is medium. Erosion is a hazard on the more sloping areas.

This soil is not well suited to many of the crops grown in the county because it is shallow and droughty. Early maturing varieties and crops that withstand long dry periods should be selected.

Water and soil loss need to be kept to a minimum if this soil is to be cultivated. Minimum tillage and management of crop residue help to protect the surface layer. The more sloping areas need to be contour farmed to conserve moisture and reduce erosion.

CAPABILITY UNIT IIIe–5

Volusia channery silt loam, 8 to 15 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, moderately sloping soil on uplands. It has a dense, slowly permeable fragipan at a depth of 12 to 18 inches that restricts rooting and water movement. Available water capacity is low to moderate. Reaction is strongly acid. The total supply of nitrogen is medium to high, but it is released slowly in spring when the soil is cold and wet. The supply of potassium and phosphorus is medium. Runoff is rapid, and there is a hazard of erosion. Wetness and droughtiness are also limitations.

This soil is suited to crops and pasture. Crops that tolerate fairly poor drainage should be selected because the soil remains wet and cold until late in spring. Early-maturing corn and wetness-tolerant legumes are included in these crops. Early spring grazing is not feasible, but grass sod responds to applications of nitrogen early in spring. Because of the shallow root zone, plant growth is affected by the long summer dry spells. A rotation of 1 year of cultivated row crops, 1 year of small grain, and 2 to 3 years of sod is suitable if slopes are protected from erosion.

Loss of soil and water can be reduced by using graded stripcropping and grassed waterways and by returning crop residue. Drainage diversions are needed in places to break up long slopes and intercept water from adjacent areas. Spot drainage of wetter soils is also desirable.

CAPABILITY UNIT IIIw-1

This unit consists of silty soils of the Homer, Rhinebeck, and Wallington series. These are deep, nearly level, somewhat poorly drained soils on glacial lake plains and outwash terraces. They have a moderately slowly permeable or slowly permeable subsoil that restricts water movement. Depth of rooting is influenced by the water table and the periodic saturation of the subsoil. The water table is commonly at a depth of 14 to 24 inches. Available water capacity is moderate to high. The surface layer of the Homer and Rhinebeck soils ranges from medium acid to neutral, and that of the Wallington soils ranges from very strongly acid to medium acid. The supply of nitrogen is medium to high in all these soils, but it is released slowly in spring when the soils are wet and cold. The potassium supply in Homer soils is medium, in the Rhinebeck soils it is very high, and in Wallington soils it is low. The supply of phosphorus is medium in all these soils. Excess water is the main limitation.

Artificial drainage is essential for cultivated crops on these soils. If drainage is impractical, the soils are suited to water-tolerant forage crops that are fertilized annually with complete fertilizers high in nitrogen content. Unless annual cover crops are used, the soils should not be plowed more than 3 years in succession before they are planted to at least 1 year of sod. Runoff from higher land should be diverted and channeled to safe outlets. Surface depressions often need smoothing to supplement drainage systems.

These soils crust or puddle easily. Maintaining good tilth is necessary if use of the soils is moderately intensive. Plowing should be done only when the soil moisture content is moderate or low. Fall plowing may be desirable. All crop residue should be returned to the soil. Minimum tillage, including disking stubble before plowing, is desirable.

If irrigated, these soils tend to crust over rapidly, so the rate of water application should be moderate.

CAPABILITY UNIT IIIw-2

This unit consists of silty soils of the Rhinebeck and Wallington series. These are deep, gently sloping, somewhat poorly drained soils on glacial lake plains. They have moderately slowly permeable or slowly permeable subsoils that restrict water movement. Depth of rooting is influenced by the water table and the periodic saturation of the subsoil. The water table is commonly in the top 14 to 24 inches. Available water capacity is high in the Rhinebeck soils and moderate in the Wallington soils. Unlimed, the reaction of the surface layer is slightly acid to neutral in the Rhinebeck soils and very strongly acid to medium acid in the Wallington soils. The supply of nitrogen is medium to high in both of these soils, but it is released slowly in spring when the soils are cold and wet. The potassium supply in the Rhinebeck soils is very high, and in the Wallington soils it is low. The supply of phosphorus in both soils is medium. Wetness and the hazard of erosion are major concerns if these soils are cultivated and not protected.

If drainage and erosion control measures are adequate, these soils are suitable for crops commonly grown in the county. Vegetables for midseason production and processing are also suited. Response to drainage is variable. In some places random draining of wet spots is desirable. If these soils are undrained, they are limited to sod crops that tolerate wetness, small grain, or short-season row crops. The Wallington soils need lime for good crop growth.

Contouring and terracing permit more intensive cultivation of sloping areas. Any rotation that includes a sod crop is suitable. Occasionally, long slopes need terraces or graded strips, sod waterways, and winter cover for erosion control. These soils crust and puddle easily if cultivated at the wrong level of moisture content. Growing cover crops and returning crop residue to the soil help to maintain good tilth. Waterways and side slopes of open ditches need to be protected with a strong grass sod.

CAPABILITY UNIT IIIw-3

Volusia channery silt loam, 2 to 8 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, gently sloping soil on uplands. A dense, slowly permeable fragipan at a depth of 12 to 18 inches restricts rooting and water movement. Available water capacity is low to moderate. Reaction is strongly acid. The supply of potassium and phosphorus is medium. Wetness and droughtiness are the main management concerns, and erosion is also a hazard.

This soil is suited to corn, oats, hay, and pasture if effective drainage is provided. It remains cold and wet for long periods in spring and is not suited to early planting or early grazing. Early-maturing corn varieties and grasses and legumes tolerant to cold, wet soil are suitable if drainage practices are applied. If this soil is drained and protected from erosion, 1 year of a cultivated crop, 1 year of oats, and 1 to 2 years of sod is a suitable rotation. A combination of measures is needed for erosion control. Graded stripcropping, use of diversions and grassed waterways, minimum tillage, crop residue management, and tile drainage of low, wet spots are beneficial practices. Applications of nitrogen on grass species that tolerate wet conditions give good response.

CAPABILITY UNIT IIIw-4

Tuller channery silt loam, 0 to 8 percent slopes, is the only soil in this unit. It is a shallow, somewhat poorly drained to poorly drained soil on uplands. Bedrock at a depth of 10 to 20 inches restricts rooting and water movement. Available water capacity is low to very low. Reaction is very strongly acid to medium acid. The supply of nitrogen is medium to high, but it is released slowly in spring when the soil is cold and wet. The potassium and phosphorus supply is medium. Wetness and droughtiness in this soil are the main concerns in management. Erosion is also a hazard on sloping areas.

If drained, this soil responds fairly well to good management and can be used for corn, oats, and hay. Undrained, it is better suited to pasture and natural woodland. Because of the shallow depth to bedrock, drainage can be supplied only by surface smoothing and the use of grassed waterways. Sloping areas that are cultivated must also be protected from erosion. Minimum tillage and the use of crop residue on graded stripcropping are beneficial practices. Applying nitrogen fertilizers to grass sod in spring is beneficial to spring and summer pasture. This soil is not suited to early grazing. Grass species tolerant of wet, cold soils are suitable.

CAPABILITY UNIT IVe-1

This unit consists of loamy soils of the Howard, Lansing, and Valois series. These are deep, moderately steep or hilly, well-drained, gravelly soils on outwash deposits in valleys and moraines and on till deposits on uplands. Roots can penetrate these soils to a depth of 30 inches or more. Available water capacity is low to moderate in the Howard soils, moderate in the Valois soils, and moderate to high in the Lansing soils. These soils are very strongly acid to slightly acid in the surface layer, but the lime content increases with depth. The supply of nitrogen and phosphorus is medium. The potassium supply in Howard and Valois soils is medium, and in Lansing soils it is high. Runoff is very rapid, and the hazard of erosion is severe. Complex slopes are common.

These soils have a limited use for crops and pasture. If they are cultivated, erosion damage can be reduced by use of contour strips, no tillage, and residue management. Operation of farm equipment on these slopes is difficult and hazardous. Because of the hazard of erosion and difficulty of working these soils, sod crops are more practical than row crops. Deep-rooted legumes are preferred in seeding mixtures. Moderate amounts of lime and fertilizer need to be added as topdressing annually to maintain maximum forage production. Careful harvesting management and a good fertilizer program are needed on legume and grass mixtures that are used for either hay or pasture.

CAPABILITY UNIT IVe-2

This unit consists of loamy, moderately steep soils on uplands. These soils are of the Lordstown and Mardin series. Lordstown soil is well drained and is underlain by bedrock at a depth of 20 to 40 inches. Mardin soil is moderately well drained and has a dense, slowly permeable fragipan at a depth of 15 to 25 inches. The depth of rooting is mainly above the bedrock or fragipan. Available water capacity of both soils is low to moderate. Reaction is very strongly acid or strongly acid. The supply of nitrogen, potassium, and phosphorus is medium. Runoff is very rapid, and the hazard of erosion is severe.

The use of these soils for crops is limited by slope, excessive runoff, and the hazard of erosion. The use of farm equipment is difficult and hazardous on these soils. These soils tend to be droughty in summer. Contour tillage, residue management, and reseeding in narrow strips reduce erosion and aid in preserving moisture from summer rainfall. Deep-rooted legumes are recommended in seeding mixtures. Large amounts of lime need to be added to these strongly acid soils. Careful harvest management of forage crops is essential.

CAPABILITY UNIT IVe-3

Volusia channery silt loam, 15 to 25 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, moderately steep soil on uplands. This soil has a dense, slowly permeable fragipan at a depth of 12 to 18 inches that restricts rooting and water movement. Available water capacity is low to moderate. Reaction is strongly acid. The supply of nitrogen is medium to high, but nitrogen is released slowly in spring when the soil is cold and wet. The potassium and phosphorus supply is medium. The hazard of erosion is severe, and extremes of wetness and droughtiness are also management concerns.

Steep slopes severely restrict the use of this soil for crops. The use of farm machinery is difficult and hazardous. The soil is wet, and it warms up late in spring. Spring applications of nitrogen on grass sods are beneficial to good summer pasture. Because of the shallow rooting zone, plant growth is restricted during long summer dry spells. Legume-grass mixtures that tolerate wetness are suited if the soils are well managed. In cultivated areas minimum tillage and crop residue management are important in maintaining good soil structure. This soil generally is better suited to woodland and grass than to crops.

CAPABILITY UNIT IVe-4

Hudson silty clay loam, gravelly substratum, 8 to 20 percent slopes, eroded, is the only soil in this unit. This is a deep, moderately well drained, rolling to hilly soil on dissected lake plains. Because of erosion the organic-matter content of the surface layer has been depleted and the texture is heavier than is typical for the series. Rooting is mainly in the uppermost 24 inches. Available water capacity is moderate to high. Reaction in the surface layer is strongly acid to neutral. The lime content increases with depth. The supply of nitrogen and phosphorus is medium to low, and the supply of potassium is very high. There is a severe hazard of continued erosion.

This soil needs protective cover all year. It is, therefore, better suited to permanent pasture or hay than to crops. It produces good forage, including deep-rooted legumes, if it is properly treated with a complete fertilizer. If the soil is cultivated, intensive erosion control measures are necessary. These include crop residue management or growing winter grains to protect the surface layer. Corn can be grown without tillage if the soil is kept bare for only short periods. The use of other conservation practices on this soil is difficult because of the topography. Tillage should be kept to a minimum because the soil is subject to severe crusting. Good tilth must be maintained. The soil is poorly suited to irrigation because of the hazard of erosion and the tendency to crust.

CAPABILITY UNIT IVw-1

This unit consists of loamy soils of the Chippewa series. These are deep, depressional to moderately sloping, poorly drained soils on uplands. A dense, slowly permeable fragipan at a depth of about 15 to 24 inches causes these soils to be saturated with water for long periods and restricts rooting. Available water capacity is low to moderate, but plants rarely require additional moisture. Unlimed, these soils are strongly acid. Lime content increases with depth. The supply of nitrogen is high, but it is released slowly in spring when the soils are cold and wet. The supply of potassium and phosphorus is medium. There is a hazard of erosion if the sloping areas are cultivated. Excess water is the main limitation to farming.

Undrained, these soils are unsuited to crops. If completely drained, they are suited to corn, oats, and hay.

If they are only partly drained, improved sods which are tolerant of wet soils can be grown for forage. Good forage can be obtained by applying nitrogen to the grass sods.

Because the soils are wet and cold in spring, crops respond to early applications of nitrogen. Minimum tillage and the use of crop residue are needed to maintain soil structure. Diversions can be used to break up slopes and intercept water from the adjacent areas.

CAPABILITY UNIT IVw-2

This unit consists of loamy soils of the Atherton and Madalin series. These are deep, poorly or very poorly drained, nearly level soils in depressions. They are on glacial outwash or stream terraces and lake plains. They are saturated for long periods, and the rooting zone is mainly in the upper 18 inches. Available water capacity is moderate to low, but plants rarely lack moisture. The surface layer ranges from medium acid to neutral, and the content of lime increases with depth. The supply of nitrogen is high, but it is released slowly in spring when the soils are cold and wet. The potassium supply is medium in Atherton soils and is very high in Madalin soils. The supply of phosphorus in both soils is medium.

The major limitations to use of these soils are ponding, frost heaving, poor tilth, and the difficulty of harvesting late in the season.

Undrained areas are too wet for cultivated crops or hay but are suited to grazing. Ponding in winter may result in a damaging cover of ice. Under good management these soils are suited to corn, beans, and other annual crops. Midseason vegetables are also grown. Crops respond well to nitrogen applied early in spring.

Practices needed to maintain good tilth are fall plowing, tilling when moisture conditions are favorable, utilizing crop residue, land smoothing, and minimum tillage. Fields should not be plowed more than three times between sod crops. If they have been cropped repeatedly, they require the use of cover crops and return of crop residue to help maintain tilth. Grasses that are tolerant of wetness respond well to fertilizer.

CAPABILITY UNIT IVw-3

Papakating silt loam is the only soil in this unit. It is a deep, nearly level or depressional, poorly drained to very poorly drained soil on flood plains. Unless this soil is drained, the water table is at or near the surface much of the time. Depth of rooting is influenced by the water table and is mostly in the uppermost 18 inches. Available water capacity is moderate, but plants seldom lack moisture. Reaction in the surface layer ranges from strongly acid to medium acid. The supply of nitrogen is high, but it is released slowly because the soil is wet. The supply of potassium and phosphorus is medium. Prolonged wetness and flooding are the major limitations to use of this soil.

If this soil can be drained and the flooding hazard is minimized, common field crops can be grown. Midseason and late crops tolerant to wet conditions are suitable. Undrained, the soil is better suited to pasture or forest. Species that tolerate wet, cold conditions should be selected. Applications of nitrogen on grass sods after spring runoff improve early growth and total forage production.

If the soil is drained, rotations used on adjacent soils are suitable. Minimum tillage, cover crops, and management of crop residue help to maintain structure of the surface layer.

CAPABILITY UNIT Vw-1

Only Alluvial land is in this unit. It consists of recent alluvium adjacent to streams and small remnants of terraces channeled by stream courses. It is very gravelly or stony in places, and drainage ranges from good to poor within very short distances. Individual areas are too small or too variable to be classified.

Most of the acreage is not suited to cultivation, but it is suited to native vegetation or to permanent pasture. Areas that are drained and protected from overflow commonly are farmed with adjoining fields. Areas that can be mowed periodically for weed and brush control can be cleared and seeded to reed canarygrass or to birdsfoot trefoil and timothy. Grazing must be restricted to permit the regrowth of pasture plants and to avoid compaction of the soil. A mixture of orchardgrass and Ladino clover can be planted in some of the higher areas. If grazed only lightly in spring, these areas provide good nesting places.

CAPABILITY UNIT VIe-1

This unit consists of loamy soils of the Howard, Hudson, and Valois series. These are deep, generally well drained, steep soils on glacial outwash deposits, moraines, and dissected lake plains. The steep slopes limit the use of these soils. Runoff is very rapid, and little moisture soaks in regardless of the water capacity. The hazard of erosion is severe.

The soils in this unit are too steep for cultivation. They should be kept in permanent vegetation. Deep-rooted legumes are well adapted on slopes where lime and fertilizer can be applied and where management practices can be used.

CAPABILITY UNIT VIIw-1

Muck soils of varying depths make up this unit. These are very poorly drained, nearly level and depressional, organic soils that are saturated with water much of the year. Reaction of the soils and their capacity to supply plant nutrients are variable.

Undrained, these soils are suited only to natural cover. Deep muck that can be drained is suitable for crops in some places. Onsite investigations are necessary to determine the suitability of the soil for crops.

CAPABILITY UNIT VIIs-1

This unit consists of very rocky soils of the Lordstown and Arnot series. These are moderately deep and shallow, well-drained, steep and very steep soils on uplands. Rock outcrops are common. The depth of the rooting zone and the available water capacity are highly variable. Reaction is very strongly acid or strongly acid. The supply of nutrients is medium.

These soils are better suited to permanent cover than to crops. On the steep, rocky slopes, field grazing is the only method of harvest, but it should be regulated to maintain a protective cover all year. Because runoff is rapid, loss of moisture is critical and the hazard of erosion is very severe.

Estimated Yields [6]

Table 1 lists, for each soil in the county, the estimated yields per acre of corn, oats, wheat, alfalfa, and hay under two levels of management.

The figures in columns A represent yields to be expected under average management. Under this management, the application of soil, water, and crop management practices is below those suggested in "Cornell Recommends." Lime applications maintain only pH 6.0 or less. Fertilizer is seldom applied to sod crops and does not meet crop needs. Only spot drainage is used, and summer rainfall is often wasted because erosion control practices are lacking. Rotations, for instance, are haphazard and the best adapted crop varieties are only occasionally used. Field operations are often not performed on time. The control of weeds, insects, and plant diseases are not consistently carried out. The estimates shown in columns A are a little above the average yields obtained by farmers in the county in the late 1960's.

The figures in columns B represent yields that can be expected under improved management. This management consists of using suitable crop rotations; applying lime and fertilizer in kinds and amounts indicated by soil tests; providing adequate drainage and irrigation; using contour farming, stripcropping, sodded waterways, or other measures to conserve soil and water; controlling weeds and insects; and tilling at the right time and in the right way. Yields are now increasing at the rate of about 2 percent each year and can be expected to increase further as new varieties of crops are developed and management is improved.

Estimated pasture yields are not included. Pasture yields may be computed for each mapping unit. It is estimated that a mature animal requires 35 pounds of hay equivalent per cow day. By using the B level hay yields in table 1, the cow-acre-days can be estimated for each mapping unit by using the following formula:

$$\text{Estimated hay yield (tons)} \times 20 \div 0.35 = \text{cow-acre-days.}$$

The annually revised editions of "Cornell Recommends for Field Crops" and "Cornell Recommends for Vegetable Crops" can be used as a guide for the management needed to obtain the yields shown in columns B.

Use of the Soils for Woodland [7]

Woodland occupies approximately 53 percent, or 138,600 acres, of Chemung County (*9*). The wooded area is well distributed throughout the county and ranges from 31 percent in the town of Veteran to a high of 57 percent in the town of Catlin (*10*). The town of Catlin has 502 acres of State forest, and the town of Ashland has 330 acres of State parks.

The forests are concentrated on the ridges and steeper slopes. The oak forest is most common on the dry, south-facing slopes. In the northeastern part of the county, some of the best oak stands are found on the deeper soils having north and east exposures. High quality white ash, basswood, hard maple, and black cherry predominate in other stands. Hemlock occurs along streams.

According to the preliminary Forest Survey Statistics, the areas of commercial forest-type groups in the county are as follows: White and red pine, 13,600 acres; other softwood including plantations, 10,100 acres; oak, 11,300 acres; elm, ash, and red maple, 28,200 acres; maple, beech, and birch, 66,300 acres; aspen and birch 9,100 acres.

The soils of Chemung County have been placed in woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group is made up of soils that are suited to the same kinds of trees, that need approximately the same kind of management when the vegetation on them is similar, and that have about the same potential productivity.

In table 2 the soils of the county are placed in woodland suitability groups. Management limitations based on soils are given, as are some of the tree species preferred for planting and to favor in existing stands.

Each woodland group is identified by a three-part symbol, such as 2r1, 3w2, or 4d1. The first part of the symbol, always a number, indicates relative potential productivity of the soils in the group: 1 = very high; 2 = high; 3 = moderately high; 4 = moderate; and 5 = low. None of the soils in Chemung County are placed in the very high group. These ratings are based on field determinations of average site index made in several New York counties for the same soil series that occur in Chemung County or for similar soils. Site index is the height, in feet, that the dominant trees of a given species on a specified kind of soil reach in a natural, unmanaged stand in a stated number of years. For the merchantable hardwoods and softwoods in this county, the site index is the height reached in 50 years.

The five foregoing ratings are based on field determinations of average site index of an indicator forest type or species. In Chemung County, sugar maple was selected as the indicator species for the better drained soils. Red maple was selected as the indicator species for the poorly and very poorly drained soils of woodland suitability groups 4w1 and 5w1. Site indexes are grouped into site quality classes, and the classes are used to arrive at approximate expected yields per acre in cords and board feet. On the basis of research studies, site index can be converted into approximate expected growth and yield per acre in cords and board feet.

The second part of the symbol identifying a woodland group is a small letter. This letter indicates an important soil property that imposes a moderate or severe hazard or limitation in managing the soils of the group for wood crops. A letter *x* shows that the main limitation is due to stones or rocks in the upper part of the soils in the group; *w* shows that water in or on the soil, either seasonally or year round, is the chief limitation; *d* shows that the main limitation is due to a restricted rooting depth because the soils are shallow to hard rock; *r* shows that the main limitation is due to steepness of slopes; and *o* shows that the soils have few limitations that restrict their use for trees.

[6] E. L. McPherron, agronomist, Charles J. Charwat, district conservationist, and William H. McEvoy, cooperative extension agent, helped prepare this section.

[7] Prepared by Meredith A. Peters, woodland conservationist, Soil Conservation Service.

Table 1.—*Estimated average acre yields of specified crops under two levels of management*

[Yields in columns A are those obtained under ordinary management; those in columns B are yields to be expected under improved management. Absence of figure indicates that crop is considered unsuitable or is not commonly grown, or no information is available on which to base an estimate. No ratings are given for Alluvial land, Howard gravelly silt loam, 25 to 45 percent slopes, Lordstown and Arnot very rocky soils, Made land, Muck, or Valois gravelly loam, 25 to 40 percent slopes]

Mapping unit	Corn				Oats		Wheat		Alfalfa		Forage mixtures (hay)			
	For silage		For grain								Alfalfa, trefoil, and grass		Trefoil and grass	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Arnot channery silt loam, 2 to 8 percent slopes	10	12	50	60	45	60	----	----	1.5	2.5	1.5	2.5	1.0	2.0
Atherton mucky silt loam	10	15	50	75	----	----	----	----	----	----	----	----	1.0	2.5
Chenango channery silt loam, fans, 0 to 8 percent slopes	18	20	90	100	65	80	35	45	3.0	5.0	3.0	4.5	2.0	3.0
Chippewa silt loam, 0 to 3 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	1.0	2.0
Chippewa silt loam, 3 to 8 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	1.0	2.5
Chippewa silt loam, 8 to 15 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	1.0	2.5
Collamer silt loam, 0 to 3 percent slopes	18	22	90	110	60	75	35	45	3.5	4.5	3.5	4.5	2.5	3.5
Collamer silt loam, 3 to 8 percent slopes	18	22	90	110	60	75	35	45	3.5	4.5	3.5	4.5	2.5	3.5
Homer silt loam	15	20	75	100	55	70	30	40	----	----	1.5	3.0	1.5	3.0
Howard gravelly silt loam, 0 to 3 percent slopes	18	20	90	100	65	80	35	45	3.5	5.0	3.5	4.5	2.5	3.0
Howard gravelly silt loam, 3 to 8 percent slopes	18	20	90	100	65	80	35	45	3.5	5.0	3.5	4.5	2.5	3.0
Howard gravelly silt loam, 8 to 15 percent slopes	16	18	80	90	60	75	30	40	3.5	5.0	3.5	4.5	2.5	3.0
Howard gravelly silt loam, 15 to 25 percent slopes				----	40	55	20	30	3.0	4.0	3.0	3.5	2.0	2.5
Hudson silt loam, gravelly substratum, 2 to 8 percent slopes	17	22	85	110	60	75	35	45	2.5	4.0	3.0	3.5	2.5	3.5
Hudson silty clay loam, gravelly substratum, 8 to 20 percent slopes, eroded	13	17	65	85	50	65	25	35	2.5	3.5	2.5	3.5	2.0	3.0
Hudson silty clay loam, gravelly substratum, 20 to 40 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----	----	----	1.0	2.0
Lansing gravelly silt loam, 2 to 8 percent slopes	18	20	90	100	65	80	35	45	3.0	4.5	2.5	3.5	2.0	3.0
Lansing gravelly silt loam, 8 to 15 percent slopes	16	18	80	90	60	75	30	40	3.0	4.0	2.5	3.5	2.0	3.0
Lansing gravelly silt loam, 15 to 25 percent slopes	----	----	----	----	50	65	25	35	2.0	3.0	2.0	3.0	1.0	2.0
Lordstown channery silt loam, 2 to 8 percent slopes	14	16	70	80	60	75	30	40	1.5	3.5	1.5	3.0	1.0	2.5
Lordstown channery silt loam, 8 to 15 percent slopes	13	15	65	75	55	70	25	35	1.5	3.5	1.5	3.0	1.0	2.5
Lordstown channery silt loam, 15 to 25 percent slopes	----	----	----	----	45	60	20	30	1.0	3.0	1.0	2.5	.5	2.0
Madalin silt loam, gravelly substratum	----	----	----	----	----	----	----	----	----	----	----	----	1.0	2.0
Mardin channery silt loam, 2 to 8 percent slopes	15	17	75	85	55	65	30	35	----	----	2.0	3.5	2.0	3.0
Mardin channery silt loam, 8 to 15 percent slopes	15	16	75	80	50	60	30	35	----	----	2.0	3.5	2.0	3.0
Mardin channery silt loam, 15 to 25 percent slopes	----	----	----	----	45	55	25	30	----	----	1.5	3.0	1.5	2.5
Middlebury silt loam	18	22	90	110	65	80	35	45	3.0	4.0	3.0	4.0	2.5	3.5
Papakating silt loam	14	18	70	90	----	65	----	----	----	----	----	----	1.0	2.5
Phelps gravelly loam, 0 to 4 percent slopes	18	22	90	110	70	75	30	45	3.0	4.0	3.0	4.0	2.5	3.5
Rhinebeck silt loam, gravelly substratum, 0 to 3 percent slopes	16	20	80	100	60	75	35	45	2.5	3.5	2.5	3.5	2.0	3.0
Rhinebeck silt loam, gravelly substratum, 3 to 8 percent slopes	16	20	80	100	60	75	35	45	2.5	3.5	2.5	3.5	2.0	3.0
Tioga fine sandy loam	20	24	100	120	70	75	35	45	3.5	5.0	3.5	4.5	3.0	4.0
Tioga silt loam	20	24	100	120	70	75	35	45	3.5	5.0	3.5	4.5	3.0	4.0
Tioga silt loam, high bottom	20	24	100	120	75	80	35	45	3.5	5.0	3.5	4.5	3.0	4.0
Tuller channery silt loam, 0 to 8 percent slopes	8	12	40	60	----	----	----	----	----	----	----	----	1.0	2.0
Unadilla silt loam, 0 to 3 percent slopes	18	22	90	110	75	80	35	45	3.5	5.0	3.5	4.5	3.0	4.0
Valois gravelly loam, 2 to 8 percent slopes	16	18	80	90	70	75	30	40	3.0	4.0	3.0	4.0	2.0	3.0
Valois gravelly loam, 8 to 15 percent slopes	15	17	75	85	70	75	30	40	3.0	4.0	3.0	4.0	2.0	3.0
Valois gravelly loam, 15 to 25 percent slopes	----	----	----	----	60	65	25	35	2.5	3.5	2.5	3.5	1.0	2.5
Volusia channery silt loam, 2 to 8 percent slopes	12	15	60	75	50	60	20	30	----	----	1.5	3.0	1.5	3.0
Volusia channery silt loam, 8 to 15 percent slopes	11	14	55	70	45	55	15	25	----	----	1.5	3.0	1.5	3.0
Volusia channery silt loam, 15 to 25 percent slopes	----	----	----	----	----	----	----	----	----	----	1.0	2.5	1.0	2.5
Wallington silt loam, gravelly substratum, 0 to 3 percent slopes	12	16	60	80	50	70	25	30	----	----	1.5	3.0	1.5	3.0

TABLE 1.—*Estimated average acre yields of specified crops under two levels of management*—Continued

Mapping unit	Corn				Oats		Wheat		Alfalfa		Forage mixtures (hay)			
	For silage		For grain								Alfalfa, trefoil, and grass		Trefoil and grass	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Wallington silt loam, gravelly substratum, 3 to 8 percent slopes	12	16	60	80	50	70	25	30	----	----	1.5	3.0	1.5	3.0
Williamson silt loam, gravelly substratum, 0 to 3 percent slopes	17	19	85	95	60	70	30	40	----	----	2.0	3.5	2.0	3.5
Williamson silt loam, gravelly substratum, 3 to 8 percent slopes	17	19	85	95	60	70	30	40	----	----	2.0	3.5	2.0	3.5

The third part of the symbol, always a number, shows the complete placement of each kind of soil into the woodland suitability classification system. In summary, the first part of the symbol, a number, indicates the productivity class; the second part of the symbol, a letter, identifies the soil property causing a management problem; and the third part of the symbol is simply a consecutive numbering of groups of soils having similar productivity, similar management problems, and similar suitability for the same kinds of trees.

The hazards or limitations that affect management of soils for woodland are hazard of erosion, equipment limitations, seedling mortality, plant competition, and windthrow hazard.

To facilitate management, the soils of Chemung County have been placed in woodland groups that are shown and described in table 2. Some soils and miscellaneous land types that are not usually suitable as commercial woodland sites have not been classified and placed in woodland suitability groups. Special use plantings may be successful in areas of these soils or land types if onsite examination indicates suitable conditions. The soils and land types omitted from the groups are Alluvial land, Made land, and Muck. Important parts of the description of each woodland group are the verbal ratings made for hazard of windthrow, hazard of erosion, limitation on use of equipment, hazard of seedling mortality, and risk of competition from undesirable plants. These ratings are always slight, moderate, or severe. The following explanations of these ratings apply to the descriptions of all the woodland suitability groups in Chemung County.

The hazard of erosion refers to the potential hazard of soil losses in well-managed woodland. The hazard is *slight* if expected soil losses are small; *moderate* if some soil losses are expected and care is needed during logging and construction to reduce soil losses; and *severe* if special methods of operation are necessary for preventing excessive soil losses. In Chemung County, only the steep soils are subject to severe erosion.

Equipment limitations are rated on the basis of soil characteristics that restrict or prohibit the use of equipment commonly used in tending and harvesting the trees. In Chemung County soil characteristics having the most limiting effect are rockiness, drainage, depth to water table, slope, and texture of the surface layer. *Slight* means there is no restriction in the kind of equipment or in the time of the year it is used; *moderate* means that use of equipment is restricted for less than 3 months of the year; and *severe* means that special equipment is needed and its use is restricted for more than 3 months of the year.

Seedling mortality refers to the expected degree of mortality of planted seedlings as influenced by kinds of soil when plant competition is not a limiting factor. Considered in the ratings are depth to the water table, hazard of flooding, drainage, soil depth and structure, and degree of erosion. Normal rainfall, good planting stock, and proper planting are assumed. A rating of *slight* indicates an expected loss of less than 25 percent of the planted seedlings; of *moderate*, a loss of 25 to 50 percent of the seedlings; and of *severe*, a loss of more than 50 percent of the seedlings. Special preparation of the site is needed before planting on soils rated severe and on most soils rated moderate.

Plant competition is rated on the basis of the degree to which unwanted plants invade openings in the tree canopy. Considered in the ratings are available moisture capacity, fertility, drainage, and degree of erosion. A rating of *slight* means that competition from other plants is not a problem; *moderate* means that plant competition delays development of fully stocked stands of desirable trees; and *severe* means that plant competition prevents establishment of a desirable stand, except where intensive site preparation and such practices as weeding are used.

Windthrow hazard measures the effect of the soils on root development and the ability of the soil to hold trees firmly. The hazard is *slight* if roots extend to a depth of more than 20 inches and trees are not expected to be blown down by commonly occurring winds; it is *moderate* if roots extend to a depth of 10 to 20 inches and some trees are blown down during periods of excessive soil wetness and strong wind; and it is *severe* if roots extend to a depth of 10 inches or less and trees will not stand alone in strong wind.

TABLE 2.—*Management data*

[Asterisk indicates species suitable

Woodland suitability groups	Estimated site index [1]	Hazard and limitations	
		Erosion hazard	Equipment restrictions
Group 2o1: Deep, somewhat excessively drained to moderately well drained, nearly level or rolling, medium-textured soils. They developed in materials ranging from clay, silt, and fine sand to glacial till and outwash. Lime content ranges from low to high. Collamer: CoA, CoB; Howard: HoA, HoB, HoC; Hudson: HsB; Lansing: LbB, LbC; Phelps: PhA; Unadilla: UnA.	66–73	Slight	Slight
Group 2o2: Deep, level, medium-textured to moderately coarse textured soils. They are well drained to moderately well drained, except for the Middlebury soils, which range from moderately well drained to somewhat poorly drained. They developed in recent alluvial deposits. Flooding is usually seasonal, ranging from once a year to once in 10 years. Lime content is low. Middlebury: Me; Tioga: Tf, Tg, Th.	66–73	Slight	Slight
Group 2r1: Deep, well drained or moderately well drained, rolling to hilly, moderately fine textured soil. It developed in sorted material which is very erodible. Lime content is high. Hudson: HtC3.	66–73	Moderate	Slight
Group 2r2: Deep, well-drained, moderately steep, medium-textured soil. It developed in glacial till. Lime content is medium. Lansing: LbD.	66–73	Moderate	Moderate
Group 2r3: Deep, well drained or moderately well drained, moderately steep to steep, moderately fine textured soil. It developed in material that is very erodible. Lime content is high. Hudson: HtE3.	66–73	Severe	Moderate
Group 2r4: Deep, well-drained, moderately steep to steep, medium-textured soils. They developed in sorted material containing gravel, and they are friable throughout the rooting zone. Lime content is medium. Howard: HoD, HoE.	66–73	Slight	Moderate
Group 3o1: Deep or moderately deep, somewhat excessively drained to moderately well drained, level to sloping, medium-textured soils. They developed in glacial till and lacustrine materials. Lime content is low. Chenango: CeB; Lordstown: LnB, LnC; Mardin: MdB, MdC; Valois: VaB, VaC; Williamson: WlA, WlB.	59–66	Slight	Slight
Group 3r1: Deep or moderately deep, well drained and moderately well drained, moderately steep, medium-textured soils. They developed in glacial till. Lime content is low. Lordstown: LnD; Mardin: MdD; Valois: VaD.	59–66	Slight	Moderate
Group 3r2: Deep, somewhat poorly drained, moderately steep, medium-textured soil. It developed in glacial till and has a fragipan. Lime content is low. Volusia: VoD.	59–66	Moderate	Moderate
Group 3r3: Deep, well-drained, steep, medium-textured soil. It developed in glacial till and is low in lime content. Valois: VaE.	59–66	Moderate	Severe
Group 3w1: Deep, somewhat poorly drained, level to gently sloping, medium-textured soils. They developed in glacial outwash or lacustrine sediments. Lime content is medium to high. Homer: Hm; Rhinebeck: RhA, RhB.	59–66	Slight	Moderate
Group 3w2: Deep, somewhat poorly drained, nearly level to sloping, medium- textured soils that have a dense fragipan at 12 to 18 inches. The pan is nearly impervious to roots and water. These soils developed in glacial till or glacio-lacustrine deposits. Lime content is low. Volusia: VoB, VoC; Wallington: WaA, WaB.	59–66	Slight	Moderate

See footnote at end of table.

for woodland suitability groups

for Christmas tree plantings]

Hazards and limitations—Continued				Tree species	
Seedling mortality	Plant competition		Windthrow hazard	For planting	To favor in existing stands
	Hardwoods	Conifers			
Slight	Moderate	Severe	Slight	White pine, red pine, Norway spruce, white spruce, larch, Scotch pine,* and Douglas-fir.*	Sugar maple, white ash, basswood, white pine, hemlock, and yellow birch.
Slight	Moderate	Severe	Slight	White pine, Norway spruce, black walnut, larches, Scotch pine,* and Douglas-fir.*	Sugar maple, white pine, white ash, and basswood.
Slight	Moderate	Severe	Slight	White pine, Norway spruce, white spruce, larches, black locust, Scotch pine,* and Douglas-fir.*	Sugar maple, white pine, basswood, white ash, and black cherry.
Slight	Moderate	Severe	Slight	Norway spruce, white spruce, larches, white pine, Scotch pine,* and Douglas-fir.*	Sugar maple, white pine, red oak, black cherry, white ash, and basswood.
Slight	Moderate	Severe	Slight	White pine, black walnut, yellow-poplar, Scotch pine,* and Douglas-fir.*	Sugar maple, basswood, white ash, black walnut, red oak, and black cherry.
Slight	Moderate	Severe	Slight	White pine, red pine, larches, Scotch pine,* and Douglas-fir.*	Sugar maple, white pine, red oak, and hemlock.
Slight	Slight	Moderate	Slight	White pine, Norway spruce, white spruce, larches, Douglas-fir,* and Scotch pine.*	Sugar maple, basswood, white ash, red oak, and black cherry.
Slight	Slight	Moderate	Slight	White pine, red pine, Norway spruce, larches, Douglas-fir,* and Scotch pine.*	Sugar maple, white pine, red oak, and white ash.
Moderate	Moderate	Severe	Moderate	White pine, Norway spruce, white spruce, larches, Douglas-fir,* and Scotch pine.*	Sugar maple, black cherry, red oak, white ash, and hemlock.
Slight	Slight	Moderate	Slight	White pine, red pine, larches, Douglas-fir,* and Scotch pine.*	Sugar maple, black cherry, white ash, red oak, and hemlock.
Slight	Moderate	Severe	Moderate	White pine, Norway spruce, Douglas-fir.* and Scotch pine.*	Sugar maple, white pine, red oak, white ash, basswood, and hemlock.
Moderate	Moderate	Severe	Moderate	White pine, white spruce, Norway spruce, larches, Douglas-fir,* and Scotch pine.*	Sugar maple, white ash, red oak, black cherry, and hemlock.

TABLE 2.—*Management data*

Woodland suitability groups	Estimated site index [1]	Hazard and limitatsons	
		Erosion hazard	Equipment restrictions
Group 3x1: Moderately deep and shallow, well drained to moderately well drained, steep, very rocky, medium-textured soil. It developed in thin glacial till. Lime content is low. Lordstown: LoE.	59–66	Slight	Moderate
Group 4d1: Shallow, well drained and moderately well drained, gently sloping, medium-textured soil. It developed in thin glacial till underlain by bedrock at a depth of 10 to 20 inches. Lime content is low. Arnot: ArB.	52–59	Slight	Slight
Group 4w1: Deep, poorly drained and very poorly drained, nearly level, medium-textured soils without a fragipan. They developed in depressions in water-sorted materials. Lime content is low to medium. The Papakating soil is subject to flooding. Atherton: At; Papakating: Pg.	60–70	Slight	Severe
Group 4x1: Shallow and moderately deep, well drained to moderately well drained, very steep, very rocky, medium-textured soil. It developed in thin mantles of glacial till over shale, siltstone, and sandstone bedrock. Lime content is low. Lordstown: LoF.	52–59	Moderate	Severe
Group 5w1: Deep to shallow, poorly drained and very poorly drained, level to sloping, medium-textured soils. They developed in lacustrine silt and clay and in glacial till. Lime content is low to high. Chippewa: ChA, ChB, ChC; Madalin: Ma; Tuller: TuB.	50–60	Slight	Severe

[1] Sugar maple was used as the indicator species to determine estimated site index for all woodland suitability groups except 4w1 and 5w1. Red maple was used as the indicator species for groups 4w1 and 5w1.

Wildlife [8]

Wildlife is an important natural resource of Chemung County. The part of the county which is in the Allegheny Plateau has populations of white-tailed deer, ruffed grouse, gray squirrel, wild turkey, ring-necked pheasant, and cottontail rabbit.

The kind and amount of wildlife that live in a given area are closely related to land use; to the resulting kinds, amounts, and patterns of vegetation; and to the supply and distribution of water. These are generally related to the type of soil.

Soils are rated in table 3 for eight wildlife habitat elements (grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood plants, coniferous wildlife habitat, wetland food and cover plants, shallow diked impoundments, and shallow excavated impoundments) and three classes of wildlife (openland, woodland, and wetland) (*1*).

In the following paragraphs, the rating system is explained, the habitat elements and classes of wildlife are discussed, and some ways to use the suitability ratings are listed.

A rating of 1 indicates that the soil is well suited to the habitat element and has few limitations, 2 indicates that it is suited and has moderate limitations, 3 indicates that it is poorly suited and has severe limitations, and 4 indicates that it is unsuitable.

[8] This subsection was prepared by ROBERT E. MYERS, wildlife biologist, Soil Conservation Service, Syracuse, N.Y.

Habitat elements

Each soil is rated in table 3 according to its suitability for various kinds of plants or developments that make up the wildlife habitat element.

GRAIN AND SEED CROPS.—These crops include such seed-producing annuals as corn, sorghum, wheat, barley, oats, millet, buckwheat, and sunflower.

GRASSES AND LEGUMES.—In this group are domestic grasses and legumes that are established by planting. Among these are alfalfa, trefoil, clover, bluegrass, switchgrass, fescue, bromegrass, timothy, orchardgrass, and reed canarygrass.

WILD HERBACEOUS UPLAND PLANTS.—In this group are perennial grasses and weeds that generally are established naturally. They include bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, and dandelion.

HARDWOOD PLANTS.—These plants are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs, or foliage that wildlife eat. They are generally established naturally but may be planted. Among the native kinds are oak, beech, cherry, maple, birch, poplar, apple, hawthorn, dogwood, viburnum, grape, and briers.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Among the shrubs that can be grown on soils rated well suited are autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky dogwood. In addition, highbush cranberry, silky dog-

for woodland suitability groups—Continued

Hazards and limitations—Continued				Tree species	
Seedling mortality	Plant competition		Windthrow hazard	For planting	To favor in existing stands
	Hardwoods	Conifers			
Moderate	Slight	Moderate	Slight	White pine, red pine, and larches.	Sugar maple, black cherry, hemlock, white ash, and red oak.
Moderate	Slight	Moderate	Moderate	White pine, red pine, larches, Douglas-fir,* and Scotch pine.*	Sugar maple, white pine, red oak, and hemlock.
Severe	Severe	Severe	Severe	White pine and white spruce.	Red maple, white pine, and white-cedar.
Moderate	Slight	Moderate	Moderate	White pine, red pine, larches, Douglas-fir,* and Scotch pine.*	Sugar maple, red oak, white pine, and hemlock.
Severe	Severe	Severe	Severe	Generally unplantable	Red maple and white-cedar.

wood, and other shrubs with similar site requirements can be planted on soils that have a rating of suited. Hardwoods that are not available commercially can commonly be transplanted successfully.

Conifers.—This element consists of cone-bearing evergreen trees and shrubs that are used by wildlife primarily as cover, although some provide browse and seeds. Among these are Norway spruce, white pine, white-cedar, and hemlock. It is important that living branches be maintained close to the ground so that food and cover are readily available to rabbits, pheasants, and other small animals. The lower branches die if trees form a dense canopy that shut out the light.

Soils that are rated well suited are those on which conifers grow at a moderate to rapid rate. These are the deeper soils that are well drained or moderately well drained and have good available moisture capacity. Cover is more easily and quickly established than on less suited soils; however, more management is required to control invading hardwoods. Stands also must be thinned more frequently or planted at wider intervals to prevent canopy closure.

Because of the slow growth of these trees, canopy closure is retarded on soils rated poorly suited. Seedling mortality is also high.

Wetland Food and Cover Plants.—These are wild, herbaceous, annual and perennial plants that grow on moist to wet sites. They include smartweed, wild millet, rushes, spikerush, sedges, rice cutgrass, mannagrass, and cattails.

Shallow Diked Impoundments.—This habitat element is rated on the basis of the soil being suitable for the construction of a low dike to impound a shallow body of water. Included here are marshes that receive surface runoff and shallow ponds developed as watering facilities for wildlife. Fishponds are not included. Detailed field investigation of soil and site are necessary to determine feasibility of water developments. Soil limitations for reservoir areas and embankments for ponds are discussed in the engineering section.

Shallow Excavated Impoundments.—These are level ditches and potholes constructed in soils that have a high water table to provide areas of open water primarily for waterfowl. Detailed field investigation of soil and site are necessary to determine feasibility of water developments. Soil limitations for reservoir areas and embankments for ponds are discussed in "Engineering Uses of the Soils." Fishponds are not included in this habitat element.

Classes of wildlife

Each rating under openland, woodland, and wetland wildlife is based on the rating listed for selected essential habitat elements in the first part of table 3 in proportion to their significance for that class of wildlife. The rating for openland wildlife is based on the rating for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood plants, and conifers. The rating for woodland wildlife is based on the rating listed for all the above elements except grain and seed crops. That for wetland wildlife is based on the rating shown for wetland

TABLE 3.—*Rating of soils for wildlife*

[A rating of 1 indicates that the soil is well suited; 2, the soil is suited; 3, poorly

Soil name	Wildlife habitat elements: Grain and seed crops	Grasses and legumes
Arnot channery silt loam, 2 to 8 percent slopes	2	2
Atherton mucky silt loam	4	3
Chenango channery silt loam, fans, 0 to 8 percent slopes	2	2
Chippewa silt loam, 0 to 3 percent slopes	4	3
Chippewa silt loam, 3 to 8 percent slopes	4	3
Chippewa silt loam, 8 to 15 percent slopes	4	3
Collamer silt loam, 0 to 3 percent slopes	2	1
Collamer silt loam, 3 to 8 percent slopes	2	1
Homer silt loam	2	2
Howard gravelly silt loam, 0 to 3 percent slopes	2	1
Howard gravelly silt loam, 3 to 8 percent slopes	2	1
Howard gravelly silt loam, 8 to 15 percent slopes	2	1
Howard gravelly silt loam, 15 to 25 percent slopes	3	2
Howard gravelly silt loam, 25 to 45 percent slopes	4	3
Hudson silt loam, gravelly substratum, 2 to 8 percent slopes	2	1
Hudson silty clay loam, gravelly substratum, 8 to 20 percent slopes, eroded	2	1
Hudson silty clay loam, gravelly substratum, 20 to 40 percent slopes, eroded	3	2
Lansing gravelly silt loam, 2 to 8 percent slopes	2	1
Lansing gravelly silt loam, 8 to 15 percent slopes	2	1
Lansing gravelly silt loam, 15 to 25 percent slopes	3	2
Lordstown channery silt loam, 2 to 8 percent slopes	2	2
Lordstown channery silt loam, 8 to 15 percent slopes	2	2
Lordstown channery silt loam, 15 to 25 percent slopes	3	2
Lordstown and Arnot very rocky soils, 25 to 35 percent slopes	4	3
Lordstown and Arnot very rocky soils, 35 to 70 percent slopes	4	4
Madalin silt loam, gravelly substratum	4	3
Mardin channery silt loam, 2 to 8 percent slopes	2	1
Mardin channery silt loam, 8 to 15 percent slopes	2	1
Mardin channery silt loam, 15 to 25 percent slopes	3	2
Middlebury silt loam	2	1
Muck	4	3
Papakating silt loam	4	3
Phelps gravelly loam, 0 to 4 percent slopes	2	1
Rhinebeck silt loam, gravelly substratum, 0 to 3 percent slopes	2	2
Rhinebeck silt loam, gravelly substratum, 3 to 8 percent slopes	2	2
Tioga fine sandy loam	2	1
Tioga silt loam	2	1
Tioga silt loam, high bottom	1	1
Tuller channery silt loam, 0 to 8 percent slopes	3	2
Unadilla silt loam, 0 to 3 percent slopes	1	1
Valois gravelly loam, 2 to 8 percent slopes	2	1
Valois gravelly loam, 8 to 15 percent slopes	2	1
Valois gravelly loam, 15 to 25 percent slopes	3	2
Valois gravelly loam, 25 to 40 percent slopes	4	3
Volusia channery silt loam, 2 to 8 percent slopes	3	2
Volusia channery silt loam, 8 to 15 percent slopes	3	2
Volusia channery silt loam, 15 to 25 percent slopes	3	2
Wallington silt loam, gravelly substratum, 0 to 3 percent slopes	2	2
Wallington silt loam, gravelly substratum, 3 to 8 percent slopes	2	2
Williamson silt loam, gravelly substratum, 0 to 3 percent slopes	2	1
Williamson silt loam, gravelly substratum, 3 to 8 percent slopes	2	1

habitat elements and classes of wildlife

suited; and 4, unsuited. Alluvial land and Made land are too variable to rate]

Wildlife habitat elements—Continued						Classes of wildlife		
Wild herbaceous upland plants	Hardwood plants	Coniferous wildlife habitat	Wetland food and cover plants	Shallow diked impoundments	Shallow excavated impoundments	Openland	Woodland	Wetland
2	2	2	4	4	4	2	2	4
3	2	2	1	4	3	3	2	3
2	2	2	4	4	4	2	2	4
3	2	2	2	2	1	3	2	2
3	2	2	3	4	4	3	2	4
3	2	2	4	4	4	3	2	4
1	1	3	4	3	3	1	1	3
1	1	3	4	4	4	1	1	4
1	1	2	3	4	3	2	1	3
1	2	2	4	4	4	1	2	4
1	2	2	4	4	4	1	2	4
1	2	2	4	4	4	1	2	4
1	2	2	4	4	4	2	2	4
1	2	2	4	4	4	3	2	4
1	1	3	4	4	4	1	1	4
1	1	3	4	4	4	1	1	4
1	1	3	4	4	4	2	2	4
1	1	3	4	4	4	1	1	4
1	1	3	4	4	4	1	1	4
1	1	3	4	4	4	2	2	4
1	2	2	4	4	4	2	2	4
1	2	2	4	4	4	2	2	4
1	2	2	4	4	4	3	2	4
2	2	2	4	4	4	3	2	4
2	2	2	4	4	4	4	2	4
3	2	2	2	2	1	3	2	2
1	2	2	4	4	4	1	2	4
1	2	2	4	4	4	1	2	4
1	2	2	4	4	4	2	2	4
1	1	3	4	4	3	1	1	3
3	2	2	1	4	2	3	3	2
3	2	2	1	3	2	3	2	2
1	2	2	4	4	3	1	2	3
1	1	2	3	2	2	2	1	2
1	1	2	3	4	4	2	1	4
1	1	1	4	4	4	1	1	4
1	1	1	4	4	4	1	1	4
1	1	1	4	4	4	1	1	4
2	2	2	3	4	4	2	2	4
1	1	1	4	4	4	1	1	4
1	1	1	4	4	4	1	1	4
1	1	1	4	4	4	1	1	4
1	1	1	4	4	4	2	2	4
1	1	1	4	4	4	3	2	4
2	2	2	3	2	2	2	2	2
2	2	2	4	4	4	2	2	4
2	2	2	4	4	4	2	2	4
1	2	2	3	4	4	2	2	4
1	2	2	3	4	4	2	2	4
1	1	1	4	3	3	1	1	3
1	1	1	4	4	4	1	1	4

food and cover plants, shallow diked impoundments, and shallow excavated impoundments.

Openland Wildlife.—Examples of openland wildlife are pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their homes in areas of crops, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, and shrubs.

Woodland Wildlife.—Among the birds and mammals that prefer woodland are ruffed grouse, woodcock, thrush, vireo, scarlet tanager, gray and red squirrel, gray fox, white-tailed deer and raccoon.

Wetland Wildlife.—Duck, geese, rail, heron, shore birds, red-wing blackbird, mink, muskrate, and beaver are familiar examples of birds and mammals that normally make their homes around ponds, marshes, and swamps or in other wet areas.

Ratings for classes of wildlife can be used as an aid in planning the broad use of land for wildlife refuge, nature-study areas, or other developments for wildlife and in determining areas that are suitable for acquisition for wildlife development.

Habitat element ratings can be used to select the best soils for establishing, improving, or maintaining specific wildlife habitat elements; determining the relative intensity of management required for individual habitat elements; and avoiding sites that would be difficult or not feasible to manage.

Engineering Uses of the Soils [9]

Although this soil survey was made primarily for use by farmers and those who advise farmers, it has considerable value for others. Some soil properties are of special interest to engineers because they affect the design, construction, and maintenance of roads, airports, pipelines, building foundations, and sewage disposal systems. Among the properties most important to the engineer are permeability to water, shear strength, grain size, compaction characteristics, soil drainage, plasticity, and pH. Relief, depth to the water table, depth to bedrock, and kind of bedrock are also important.

Information in this survey can be used to:

1. Make studies that will aid in selecting and developing sites for industrial, commercial, residential, and recreational purposes.
2. Make preliminary estimates of soil properties that are significant in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highway, airports, pipelines, and cables and in planning detailed investigations of selected locations.
4. Locate probable sources of gravel and other construction material.
5. Correlate performance of engineering structures with soils and thus gain information that will be useful in designing and maintaining the structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and from aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. Tables 4, 5, and 6 give information and interpretations significant to engineers. The estimates in table 5 are generally to a depth of about 4 to 6 feet, and the interpretations in table 6 normally do not apply to greater depth. Also each soil area (mapping unit) contains small inclusions of other soils that may differ considerably from the named soil for which the estimates and interpretations have been provided. It should be emphasized that the information in this survey does not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and excavations deeper than the depths of layers here reported. However, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Additional information about the soils can be found in other sections of the survey, particularly the sections "Descriptions of the Soils" and "Formation, Morphology, and Classification of the Soils."

Terminology

Some of the terms used by soil scientists may be unfamiliar to engineers, and some terms, such as clay, silt, and sand, may have a special meaning in soil science. These terms and others are defined in the Glossary at the back of this publication. Following are definitions of several terms used in this section of the survey:

Bearing capacity.—The unit load that can be placed on a soil without detriment to the structure that is supported. It is generally expressed in tons or pounds per square foot. In this survey the adjective ratings given for bearing capacity are estimated and should not be used to assign specific values of bearing capacity.

Compressibility.—The capability of a soil to be compressed by a superimposed load.

Liquid limit.—The moisture content at which the soil material passes from a plastic to a viscous, semiliquid state.

Moisture content.—The ratio of the weight of water contained in the soil to the dry weight of the soil. It is generally expressed as a percentage.

Moisture-density relations.—If a soil material is compacted at a successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material will increase until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed maximum dry density. The moisture-density relationship is important in earthwork, for, as a rule, optimum

[9] This section was prepared by John B. Fleckenstein, senior agronomist, New York State Department of Transportation, Bureau of Soil Mechanics, and by Donald L. Basinger, assistant State conservation engineer, and Donald F. Flora, soil scientist, Soil Conservation Service.

stability is obtained for any given compactive effort if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Plastic limit.—The moisture content at which the soil material passes from a semisolid to a plastic state.

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

Shear strength.—The ability to resist sliding along internal surfaces within a soil mass when external forces are applied.

Shrink-swell potential.—An indication of the volume change to be expected of the soil material with changes in moisture content.

Engineering classification systems

In this section, soil texture is described according to the classification system used by the U.S. Department of Agriculture, the system used by the American Association of State Highway Officials (AASHO), and the Unified system developed by the Corps of Engineers, U.S. Army.

In the system used by scientists of the U.S. Department of Agriculture, the texture of the soil horizon depends on the proportional amounts of the different sized mineral particles. The percentage of soil material smaller than 2.0 millimeters (classified as clay, silt, and sand) determines the basic textural classification. Coarse fragments greater than 2.0 millimeters, such as gravel, become part of the textural class when they are present in sufficient quantities (*11*, *12*).

The AASHO system is based on the field performance of soils used in highway construction, according to the gradation of particle sizes, liquid limit, and plasticity index (*2*). The soils having about the same general load-carrying capacity are grouped together in one of seven basic groups, though the range in load-carrying capacity within each group is wide, and there is an overlapping of load-carrying capacity from one group to another. The groups range from A-1 (gravelly soils of high bearing capacity, the best soils for subgrade) to A-7 (clayey soils that have low bearing capacity when wet, the poorest soils for subgrade).

Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are subdivided into 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 additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 4; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the county.

The Unified soil classification system is based on identification of soils according to their texture and plasticity and on their performance as engineering construction materials (*13*). In this system two letters are used to designate each of 15 possible classes. There are 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. If the soils are on the borderline between two classifications, a joint classification is used, for example, GM-GC.

Soil data and interpretations

Table 4 presents data obtained by laboratory tests on samples of soil series in the county. Two of these series, Volusia and Mardin, are among the most extensive in the upland areas. The others are also important to engineering uses of soils in the county. The series were sampled at one or more locations. These soils formed in highly variable glacial till and water-deposited materials, which range considerably in grain size (texture). Thus, the engineering soil classification given in table 4 may not apply to all parts of the mapped soil unit. The classification does apply to the soil as it occurs throughout most of its acreage in the county. In establishing the engineering soil classification, particles larger than 3 inches were not considered.

Table 5 lists estimated properties of the soils that are significant to engineers. The estimates in table 5 are based on test data shown in table 4, on information taken from the soil survey, and on knowledge gained through experience in using the soils for engineering construction.

Table 6 lists some appraisals of the suitability of the soils for use in highways, embankments, and building foundations and as a source of topsoil, sand, gravel, and fill material. Also shown in table 6 are characteristics that affect the suitability of the soils for the installation of conservation engineering structures.

The following paragraphs briefly describe the columns shown in table 5:

Depth to bedrock: The estimated depth to bedrock is based on observations made during the course of the survey. From place to place, however, the depth to bedrock may vary considerably.

Depth to seasonal high water table: The shallowest depth is given at which the soil is saturated with water during frost-free periods. It is either a perched water table or other ground-water table. Soil conditions immediately after heavy precipitation are not considered.

Depth from surface: The depths given in this column for each soil corresponds to significant changes in texture or some other property in the typical soil described for each series. The estimated data given is for the range of soil properties in each series.

Engineering classification: The estimated classifications are based on actual test data from this county and other survey areas. See "Engineering Classification Systems" for an explanation of these headings.

USDA texture: Textures indicated correspond to the textures given in the technical description of each soil.

Percentage passing sieve: These columns show estimated particle size distribution according to standard size sieves.

Range in permeability: Permeability values are estimates of the range in rates that water moves in the major soil horizons. They are estimates based on soil texture, soil structure, porosity, permeability and infiltration tests, and drainage observations of the hydraulic conductivity of the soils.

TABLE 4.—*Engineering*

[Tests performed by New York State, Department of Transportation, Bureau of Soil

Soil name and location	Parent material	Report No. S67NY-8	Depth from surface	Moisture-density data [1]: Maximum dry density	Moisture-density data [1]: Optimum moisture	Moisture-density data [1]: In-place moisture content	Moisture-density data [1]: In-place density	Lineal shrinkage	Reaction	Organic matter [2]	Percolation rate
			In.	*Lb. per cu. ft.*	*Percent*	*Percent*	*Lb. per cu. ft.*	*Percent*	*pH*	*Percent*	*Min. per in.*
Atherton mucky silt loam: Town of Big Flats, 500 feet northeast of junction of State Highway 17 and Kahler Road, 200 feet east of Kahler Road.	Calcareous glacial outwash derived from sandstone, shale, and limestone.	11-1	0-8	79	35	42	--------	5. 4	6. 5	12. 4	--------
		11-2	8-13	92	27	27	--------	8. 6	6. 8	6. 61	--------
		11-3	13-31	112	16	21	98	4. 6	7. 7	------	0. 7
		11-4	31-48	133	8	13	--------	3. 4	------	------	--------
Chenango channery silt loam, fans: Town of Big Flats, half mile north of junction of Sing Sing Road and Barnes Hill Road. (Modal.)	Old alluvial fan derived from acid gray siltstone and shale.	13-1	0-10	99	21	24	84	6. 2	6. 0	5. 33	--------
		13-2	10-14	102	20	23	--------	7. 0	5. 7	3. 25	--------
		13-3	14-26	116	14	16	--------	5. 6	5. 5	1. 12	4. 1
		13-4	26-40	130	9	8	--------	4. 0	6. 1	------	--------
Town of Catlin, quarter mile north of junction of State Highway 414 and Beaver Dam Road, 150 feet west of Beaver Dam Road. (Finer textured in upper part of subsoil than modal.)	Old alluvial fan derived mainly from acid siltstone and shale.	14A-1	0-8	103	17	23	84	5. 0	6. 8	5. 14	--------
		14A-2	8-11	108	19	19	94	4. 2	6. 0	1. 78	--------
		14A-3	11-27	125	11	10	108	3. 4	5. 3	1. 04	--------
		14A-4	27-50	126	10	10	108	5. 4	5. 8	------	--------
Chippewa silt loam: Town of Catlin, 0.1 mile south of junction of C. DeMunn and Sturdivent Roads, 75 feet east of C. DeMunn Road.	Slightly acid glacial till derived mainly from siltstone and shale.	17-1	0-11	88	28	34	78	5. 4	5. 2	4. 52	--------
		17-2	11-18	114	16	17	113	4. 0	5. 8	1. 87	>120. 0
		17-3	18-35	128	9	12	126	2. 0	6. 6	1. 72	--------
		17-4	35-45	124	11	13	--------	4. 0	6. 7	------	--------
Collamer silt loam: Town of Big Flats, 1,800 feet northeast of junction of Hickory Grove Road and Colonial Drive, 20 feet east of Hickory Grove Road. (Modal.)	Calcareous lacustrine silt and very fine sand.	6-1	0-9	108	17	18	89	2. 8	7. 2	2. 80	--------
		6-2	9-12	122	11	11	--------	2. 0	7. 4	1. 39	--------
		6-3	12-18	125	12	12	--------	3. 8	7. 4	. 83	--------
		6-4	18-32	123	12	15	107	4. 0	7. 9	. 59	6. 5
		6-5	32-64	124	12	18	111	3. 4	8. 2	------	>120. 0
Town of Big Flats, 2,000 feet northeast of junction of Hickory Grove Road and Colonial Drive, 150 feet east of Hickory Grove Road. (Finer textured surface and subsurface layers than modal.)	Calcareous lacustrine silt and very fine sand.	5-1	0-8	106	18	14	79	3. 0	6. 9	3. 44	--------
		5-2	8-13	114	15	14	89	2. 0	6. 8	1. 24	--------
		5-3	13-20	120	12	12	--------	1. 8	6. 1	. 86	--------
		5-4	20-45	120	13	14	105	3. 2	8. 0	. 48	46. 0
		5-5	45-60	122	12	14	108	2. 6	8. 2	------	>120. 0
Hudson silt loam, gravelly substratum: Town of Catlin, quarter mile northeast of junction of Johnson Hollow Road and Vanderhoff Road at gravel pit.	Calcareous lacustrine silts and clays underlain by stratified gravel and sand at a depth of 54 inches.	19-1	0-6	101	20	18	--------	3. 8	4. 8	4. 51	--------
		19-2	6-10	107	18	16	--------	3. 6	5. 0	1. 88	--------
		19-3	10-17	109	18	17	--------	5. 2	5. 2	1. 50	7. 0
		19-4	17-41	111	15	18	--------	6. 0	5. 8	1. 41	--------
		19-5	41-45	109	18	15	--------	7. 0	7. 6	------	--------

See footnotes at end of table.

test data

Mechanics. Dashes indicate determination was not made or information does not apply]

Mechanical analysis [3]											Liquid limit	Plasticity index	Classification	
Percentage passing sieve—							Percentage smaller than—						AASHO [4]	Unified
3 in.	1½ in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
											Percent			
100	98	96	92	91	89	87	73	42	13	6	49	9	A-5(10)	ML-OL
--------	--------	100	97	96	95	92	81	55	27	16	48	11	A-7-5(10)	ML-OL
100	94	89	85	83	82	78	65	37	17	13	25	4	A-4(8)	ML-CL
100	82	63	44	37	26	18	14	8	3	2	19	3	A-1-b(0)	GM
95	94	90	84	80	74	69	61	42	19	19	37	8	A-4(7)	ML
92	86	85	82	80	77	73	64	45	21	12	34	8	A-4(8)	ML
92	79	70	61	57	53	50	43	30	14	8	24	5	A-4(3)	GM-GC
93	68	53	34	26	16	14	12	8	5	3	26	5	A-1-a(0)	GM-GC
100	99	89	82	77	68	60	53	38	19	9	36	10	A-4(5)	ML-CL
--------	100	98	93	91	85	74	66	49	25	14	30	6	A-4(8)	ML-CL
100	98	94	76	64	37	23	19	15	8	4	23	5	A-1-b(0)	SM-SC
100	79	63	38	30	18	14	12	9	5	3	29	7	A-2-4(0)	GM-GC
100	99	98	97	95	94	90	80	58	25	11	45	11	A-7-5(10)	ML
--------	100	97	86	78	68	60	52	34	16	10	30	10	A-4(5)	ML-CL
100	96	92	77	66	50	40	38	22	8	5	21	6	A-4(1)	SM-SC
96	92	87	71	61	50	44	39	30	15	11	26	9	A-4(2)	GC
100	98	94	86	82	75	49	43	28	9	3	23	3	A-4(3)	SM
100	97	94	89	85	77	47	40	22	8	5	17	3	A-4(2)	SM
100	94	88	80	77	69	44	37	21	11	8	20	2	A-4(2)	SM
100	98	95	90	87	81	58	50	32	16	12	19	5	A-4(5)	ML-CL
--------	100	99	96	94	91	75	66	45	19	12	19	5	A-4(8)	ML-CL
100	97	95	90	87	77	53	46	31	10	4	25	4	A-4(4)	ML-CL
100	99	98	96	93	85	57	49	30	11	5	18	2	A-4(4)	ML
100	99	97	95	91	81	49	42	25	11	7	17	3	A-4(3)	SM
100	98	97	94	93	88	68	60	42	21	14	21	5	A-4(7)	ML-CL
--------	100	98	96	95	92	71	62	40	19	13	19	6	A-4(7)	ML-CL
100	93	91	86	84	81	77	68	48	18	8	31	6	A-4(8)	ML—CL
94	93	90	84	82	80	75	68	51	24	12	26	5	A-4(8)	ML-CL
100	95	93	91	90	89	85	78	62	37	23	27	9	A-4(8)	CL
96	84	78	72	69	67	62	58	48	28	18	30	10	A-4(5)	CL
100	94	88	80	77	75	73	68	56	32	22	31	14	A-6(10)	CL

TABLE 4.—*Engineering*

Soil name and location	Parent material	Report No. S67NY-8	Depth from surface	Moisture-density data[1]: Maximum dry density	Moisture-density data[1]: Optimum moisture	Moisture-density data[1]: In-place moisture content	Moisture-density data[1]: In-place density	Lineal shrinkage	Reaction	Organic matter[2]	Percolation rate
			In.	*Lb. per cu. ft.*	*Percent*	*Percent*	*Lb. per cu. ft.*	*Percent*	*pH*	*Percent*	*Min. per in.*
Lansing gravelly silt loam: Town of Veteran, quarter mile east of Ridge Road, 50 feet north of Dann Boulevard.	Slightly acid, multiple deposits of medium-textured and moderately fine textured glacial till.	4-1	0-8	103	19	17	82	4.2	6.8	3.87	---
		4-2	8-13	117	14	14	---	2.8	6.0	1.73	---
		4-3	13-24	119	13	13	109	3.0	5.4	1.35	35.0
		4-4	24-38	122	12	10	111	2.6	5.1	---	---
		4-5	38-56	124	12	11	111	3.2	5.6	---	---
		4-6	56-69	121	14	15	112	5.0	6.2	---	---
Mardin channery silt loam: Town of Veteran, quarter mile south of Dann Boulevard, 500 feet east of Ridge Road.	Glacial till derived mainly from gray siltstone, sandstone, and shale.	1-1	0-9	111	14	16	88	4.6	6.6	3.29	---
		1-2	9-16	122	12	9	104	3.2	5.3	.87	---
		1-3	16-28	121	12	10	108	4.0	5.0	.45	35.0
		1-4	28-38	126	11	12	112	6.2	5.6	.33	---
		1-5	38-51	122	13	11	---	6.4	6.6	---	---
Phelps gravelly loam: Town of Big Flats, 500 feet south of junction of Kahler and Sing Sing Roads, 200 feet east of Kahler Road.	Calcareous glacial outwash derived from sandstone, shale, and limestone.	12-1	0-7	108	15	17	83	5.6	6.8	4.70	---
		12-2	7-14	125	11	11	108	3.0	7.0	1.79	---
		12-3	14-28	125	11	8	107	4.8	6.6	1.27	3.2
		12-4	28-39	131	9	10	105	4.2	7.3	1.47	---
		12-5	39-57	134	8	9	---	3.6	---	---	.1
Tioga fine sandy loam: Town of Big Flats, Plant Materials Center, 1,300 feet south of State Highway 352, and 900 feet west of County Route 10.	Alluvial silts and fine sands.	10-1	0-11	111	15	12	87	1.8	6.2	2.23	---
		10-2	11-16	118	13	10	---	.2	7.2	1.21	---
		10-3	16-29	117	12	9	89	.4	7.4	---	1.3
		10-4	29-38	116	13	13	92	1.4	7.2	---	---
		10-5	38-49	109	15	6	88	.0	6.7	---	---
		10-6	49-56	114	14	17	94	2.6	6.6	---	1.5
Unadilla silt loam: Town of Big Flats, Plant Materials Center 1,300 feet north of State Highway 352, and 500 feet west of Railroad Pass.	Silty stream terrace material over gravel.	9-1	0-10	101	19	23	73	3.6	5.4	4.74	---
		9-2	10-24	114	15	19	94	2.8	5.4	.81	---
		9-3	24-38	113	14	18	99	2.2	5.0	---	28.0
		9-4	38-58	112	14	21	103	.8	5.1	---	---
		9-5	58-75	130	9	10	---	2.0	---	---	---
Valois gravelly loam: Town of Catlin, 1,000 feet east of junction of DeMunn Road and Sturdivent Road, 800 feet south of Sturdivent Road.	Ablation or lateral moraine glacial till derived mainly from sandstone, siltstone, and shale.	16-1	0-7	111	14	20	82	3.6	4.6	5.69	---
		16-2	7-41	127	10	10	122	1.8	5.2	.75	55.0
		16-3	41-47	131	9	13	---	2.0	5.2	.64	---
		16-4	47-60	130	9	11	---	5.2	6.1	---	---
Volusia channery silt loam: Town of Catlin, 150 feet southwest of junction of Chambers and Kimble Roads.	Slightly acid glacial till derived from sandstone, shale, and siltstone.	18-1	0-5	96	21	31	---	6.2	6.6	5.34	---
		18-2	5-10	107	18	20	---	3.0	5.5	2.45	---
		18-3	10-16	117	14	17	109	4.0	5.1	.98	63.0
		18-4	16-45	124	12	12	120	5.0	6.4	.97	---
Wallington silt loam, gravelly substratum: Town of Big Flats, 300 feet north of State Highway 17 on Plant Materials Center.	Silty stream terrace material 50 inches thick over gravel.	7-1	0-9	98	22	20	80	4.4	5.7	2.97	---
		7-2	9-11	---	---	---	---	---	---	---	---
		7-3	11-50	114	15	18	110	2.8	6.0	.40	37.5
		7-4	50-56	133	8	15	---	3.6	---	---	>120.0

[1] Maximum dry density and optimum moisture based on AASHO Designation T99-57, Method C (*2*). In-place moisture content based on A.S.T.M. Designation D2216-66 (*4*). In-place density based on A.S.T.M. Designation D1556-64 (*3*).

[2] Wet combustion method is based on 1942 Cornell University agronomy test procedure modified by the Bureau of Soil Mechanics.

[3] Mechanical analysis according to the AASHO Designation T88 (*2*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than

test data—Continued

Mechanical analysis[3]													Classification	
Percentage passing sieve—							Percentage smaller than—				Liquid limit	Plasticity index	AASHO[4]	Unified
3 in.	1½ in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	*Percent*			
100	97	92	81	75	66	50	44	29	10	4	28	2	A-4(3)	ML
--------	100	98	92	87	79	63	55	38	15	6	20	1	A-4(6)	ML
96	92	89	83	80	74	60	52	36	16	10	19	4	A-4(5)	ML-CL
100	91	86	78	74	67	51	44	29	13	7	19	5	A-4(3)	ML-CL
100	93	85	70	63	52	41	36	27	14	9	22	6	A-4(1)	SM-SC
98	98	95	88	82	76	63	55	42	25	18	25	10	A-4(6)	CL
100	98	94	85	79	72	56	49	31	12	5	30	4	A-4(4)	ML
100	96	93	84	79	72	56	49	32	15	8	19	3	A-4(4)	ML
100	94	88	81	76	68	54	46	30	17	11	22	6	A-4(4)	ML-CL
92	91	84	76	71	63	50	46	33	19	13	26	8	A-4(3)	CL
95	85	80	71	65	57	47	42	30	16	9	24	6	A-4(2)	GM-GC
100	97	87	68	62	52	46	41	29	12	5	33	2	A-4(2)	GM
100	99	82	54	46	34	28	26	17	8	4	24	3	A-2-4(0)	GM
--------	100	92	65	53	26	17	15	10	8	6	30	10	A-2-4(0)	SC
100	90	76	53	45	23	14	11	7	4	3	22	5	A-1-a(0)	GM-GC
100	87	66	36	24	13	8	------	------	------	------	20	1	A-1-a(0)	GP-GM
--------	--------	--------	100	100	92	40	33	15	5	2	------	(5)	A-4(1)	SM
--------	--------	--------	100	100	87	38	31	14	5	2	------	(5)	A-4(1)	SM
--------	--------	--------	100	100	91	40	32	14	5	2	------	(5)	A-4(1)	SM
--------	--------	--------	100	100	96	48	38	14	6	4	------	(5)	A-4(3)	SM
--------	--------	--------	100	100	89	14	12	5	1	4	------	(5)	A-2-4(0)	SM
--------	--------	--------	--------	100	98	46	36	15	6	4	------	----	A-4(2)	SM
--------	--------	--------	100	100	97	81	71	42	18	9	27	3	A-4(8)	ML
--------	--------	--------	100	100	99	81	70	39	18	12	22	5	A-4(8)	ML-CL
--------	--------	--------	--------	100	100	79	64	24	7	5	------	(5)	A-4(8)	ML
--------	--------	--------	--------	100	100	57	50	31	15	10	------	(5)	A-4(4)	ML
100	88	67	32	25	17	7	------	------	------	------	------	(5)	A-1-a(0)	GP-GM
100	88	81	62	53	43	33	28	17	5	2	32	3	A-2-4(0)	GM
92	80	72	60	54	44	33	27	16	5	2	17	1	A-2-4(0)	GM
--------	100	90	74	63	47	34	28	17	5	2	17	1	A-2-4(0)	SM
87	74	63	47	40	29	20	18	12	6	4	22	7	A-2-4(0)	GC-GM
100	98	95	89	88	85	82	73	49	21	10	39	10	A-4(8)	ML
100	98	95	89	86	82	77	67	43	19	10	28	6	A-4(8)	ML-CL
100	96	92	84	78	71	67	62	48	25	16	29	8	A-4(6)	ML-CL
100	84	76	65	57	46	41	38	32	18	12	29	8	A-4(1)	GM-GC
--------	--------	--------	100	98	88	75	66	47	21	10	32	8	A-4(8)	ML-CL
--------	--------	--------	100	100	97	90	73	35	15	8	23	2	A-4(8)	ML
95	76	58	36	31	11	5	------	------	------	------	19	3	A-1-a(0)	GW-GM

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 is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soil. No hydrometer analysis was performed on sands that had less than 10 percent passing the No. 200 sieve.

[4] Based on AASHO Designation M145–49.

[5] Nonplastic.

462-773—73——3

TABLE 5.—*Estimated physical*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. Because these in the first column. Alluvial land, Made land, and Muck have properties too variable to be estimated. The sign >

Soil series and mapping symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface	Classification: USDA texture	Classification: Unified
	Feet	*Feet*	*Inches*		
Arnot: ArB	1–1½	1–1½	0–6	Channery silt loam	GM or SM; ML or CL
			6–17	Very channery silt loam	GM or GC
			17	Fine-grained sandstone or siltstone bedrock.	
Atherton: At	6+	0–½	0–8	Mucky silt loam	OL or ML or CL
			8–31	Silt loam	SM or SC; ML or CL
			31–48	Very gravelly sandy loam	GM or GC
			48–54	Stratified gravel and sand, variable.	
Chenango: CeB	6+	>4	0–28	Channery silt loam	GM or SM; ML or CL
			28–50	Very channery loam	GM or GC
Chippewa: ChA, ChB, ChC	5+	0–½	0–6	Silt loam	ML or CL or OL
			6–18	Channery silt loam	ML; GC or CL
			18–50	Channery silt loam (fragipan)	GC; ML or CL; SM or SC
Collamer: CoA, CoB	6+	1½–2	0–18	Silt loam	ML or CL; SM or SC
			18–64	Silt loam	ML or CL
Homer: Hm	6+	½–1½	0–14	Silt loam	ML or CL
			14–28	Gravelly sandy clay loam	GM or GC; SM or SC
			28–36	Very gravelly sandy loam	GM; GW or GP
			36–57	Stratified gravel and sand, variable.	
Howard: HoA, HoB, HoC, HoD, HoE	6+	>4	0–9	Gravelly silt loam	GM or GC; ML or CL
			9–22	Gravelly fine sandy loam	GM or GC
			22–42	Very gravelly silt loam	GM; GW or GP
			42–52	Very gravelly clay loam	GM; GW or GP
			52–60	Stratified gravel and sand, variable.	
Hudson, gravelly substratum: HsB, HtC3, HtE3.	6+	1½–2	0–13	Silt loam	ML or CL
			13–56	Silty clay loam	ML or CL
			56–70	Stratified gravel and sand, variable.	

See footnotes at end of table.

and chemical properties

soils may have different properties and limitations, it is necessary to follow carefully the instructions for referring to other series that appear
means more than and the sign < means less than. Absence of entry indicates that properties are too variable to rate]

Classification—Continued	Percent passing sieve—							
AASHO	Coarse fraction greater than 3 inches	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction
	Percent					*In. per hr.*	*In. per in. of soil*	*pH*
A-4	0-5	55-70	50-65	45-65	35-55	0. 63-2. 0	0. 10-0. 13	<5. 5
A-4 or A-2	0-5	40-60	35-55	30-50	25-45	0. 63-6. 3	0. 07-0. 11	<5. 5
A-5	0-5	80-95	75-95	65-95	55-90	0. 63-2. 0	0. 13-0. 19	5. 6-6. 5
A-4	0-5	70-100	65-95	60-95	40-95	0. 63-2. 0	0. 11-0. 19	6. 1-7. 6
A-1	2-10	40-55	35-50	20-35	10-20	>2. 0	--------------	7. 6
A-4 or A-2	5-10	50-80	45-80	40-65	30-60	0. 63-6. 3	0. 09-0. 14	4. 5-5. 5
A-1 or A-2	5-15	30-40	20-30	10-20	10-20	>2. 0	0. 03-0. 05	5. 6-6. 5
A-4 or A-7	0-5	80-100	75-95	70-95	65-90	0. 63-2. 0	0. 13-0. 18	4. 5-6. 5
A-4	5-10	80-90	70-80	60-80	40-70	0. 63-2. 0	0. 09-0. 13	4. 5-6. 5
A-4 or A-2	5-10	60-75	50-65	40-65	30-60	<0. 20	--------------	5. 6-7. 3
A-4	0	85-100	80-100	70-95	45-85	0. 63-2. 0	0. 15-0. 20	5. 6-7. 3
A-4	0	95-100	90-100	85-95	65-90	<0. 63	0. 18-0. 20	6. 1-7. 6
A-4	0-5	80-95	75-90	80-95	50-75	0. 63-2. 0	0. 15-0. 17	6. 1-7. 3
A-2 or A-4	5-10	55-70	50-65	40-60	25-40	0. 20-0. 63	0. 04-0. 07	6. 6-7. 6
A-1	5-10	50-60	45-55	30-40	15-25	>2. 0	--------------	7. 6+
A-2 or A-4	0-5	65-75	60-70	40-65	25-55	0. 63-6. 3	0. 07-0. 10	6. 1-6. 5
A-4 or A-2	5-10	55-65	50-60	40-60	25-50	2. 0-6. 3	0. 05-0. 08	6. 1-6. 5
A-2 or A-4	5-10	40-55	35-50	30-50	25-45	0. 63-2. 0	0. 04-0. 05	6. 1-7. 3
A-1	5-10	35-45	30-40	25-40	20-30	0. 63-2. 0	0. 03-0. 04	6. 6-7. 3
A-4	0-2	85-100	80-100	80-100	70-90	0. 63-2. 0	0. 16-0. 20	5. 0-7. 3
A-4 or A-6	0-2	75-100	70-100	70-100	65-95	<0. 20	0. 12-0. 17	5. 0-7. 6+

TABLE 5.—*Estimated physical*

Soil series and mapping symbols	Depth to—		Depth from surface	Classification	
	Bedrock	Seasonal high water table		USDA texture	Unified
	Feet	*Feet*	*Inches*		
Lansing: LbB, LbC, LbD	6+	2–2½	0–15	Gravelly silt loam	ML
			15–56	Gravelly heavy silt loam	ML or CL; SM or SC; GM or GC
*Lordstown: LnB, LnC, LnD, LoE, LoF. For the Arnot part of units LoE and LoF, see the Arnot series.	1½–3½	>2½	0–26	Channery silt loam	SM or SC; ML or CL; GM or GC
			26–30	Very channery silt loam	GM or GC
			30	Sandstone or siltstone bedrock.	
Madalin, gravelly substratum: Ma	6+	0–½	0–18	Silt loam	ML or CL
			18–42	Silty clay loam and silt loam	ML or CL
			42–54	Shaly and silty fine gravel, variable.	
Mardin: MdB, MdC, MdD	6+	1½–2	0–18	Channery silt loam	ML or CL; SM or SC
			18–42	Channery silt loam (fragipan)	ML or CL; GM or GC
			42–72	Very channery silt loam till	GM or GC; ML or CL
Middlebury: Me [1]	6+	1–1½	0–40	Silt loam	SM or SC; ML or CL
			40–50	Very fine sandy loam to fine sandy loam containing lenses of sand and gravel, variable.	
Papakating: Pg [1]	6+	0–½	0–10	Silt loam or mucky silt loam	ML or CL or OL
			10–50	Silt loam to silty clay loam	ML or CL
Phelps: PhA	6+	1½–2	0–8	Gravelly loam	ML or CL; GM or GC; SM or SC
			8–29	Very gravelly loam	GM or GC; SM or SC
			29–40	Very gravelly sandy loam	GM or GC; SM or SC
			40–60	Stratified sand and gravel, variable.	
Rhinebeck: RhA, RhB	6+	½–1½	0–12	Silt loam	ML or CL
			12–48	Silty clay to silty clay loam	CL or ML
			48–60	Stratified sand and gravel, variable.	

See footnotes at end of table.

and chemical properties—Continued

Classification—Continued	Percent passing sieve—							
AASHO	Coarse fraction greater than 3 inches	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction
	Percent					*In. per hr.*	*In. per in. of soil*	*pH*
A–4	0–5	75–90	70–85	65–85	50–70	0. 63–2. 0	0. 14–0. 17	5. 1–6. 5
A–4	0–5	60–85	55–80	50–75	40–65	<0. 63	0. 11–0. 17	5. 6–7. 6+
A–4	3–10	60–70	55–65	45–65	35–55	0. 63–2. 0	0. 09–0. 13	4. 5–5. 5
A–2 or A–4	5–15	35–50	30–45	25–45	20–35	0. 63–2. 0	0. 05–0. 09	4. 5–5. 5
A–4	0–2	95–100	95–100	85–100	65–90	0. 63–2. 0	0. 19–0. 20	5. 6–7. 3
A–4	0–2	95–100	90–100	80–100	70–95	<0. 20	0. 15–0. 20	6. 6–7. 6+
A–4	5–10	70–85	65–80	60–75	45–70	0. 63–2. 0	0. 09–0. 16	4. 5–5. 5
A–4	5–10	60–80	55–75	50–70	40–60	<0. 20	----------	5. 1–6. 0
A–4	5–15	55–75	50–70	45–60	35–55	<0. 20	----------	5. 6–6. 5
A–4	----------	85–100	85–100	60–95	35–80	0. 63–6. 3	0. 17–0. 20	5. 6–6. 5
A–4 or A–7	0	100	100	90–100	75–90	0. 63–2. 0	0. 20	5. 1–6. 0
A–4	0–2	90–100	90–100	80–100	70–90	0. 20–2. 0	0. 15–0. 20	5. 6–7. 3
A–4	0–5	60–75	55–70	45–60	40–55	0. 63–6. 3	0. 09–0. 14	6. 1–7. 3
A–2	0–5	55–65	45–55	25–45	15–35	0. 63–6. 3	0. 08–0. 11	6. 1–7. 3
A–1	0–5	50–60	40–50	20–30	10–20	>2. 0	0. 06–0. 07	7. 6+
A–4 or A–6	0	95–100	95–100	85–100	70–90	0. 20–0. 63	0. 19–0. 20	6. 1–7. 3
A–6 or A–7	0	100	100	95–100	85–95	<0. 20	0. 14–0. 17	6. 6–7. 3

TABLE 5.—*Estimated physical*

Soil series and mapping symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface	Classification: USDA texture	Classification: Unified
	Feet	*Feet*	*Inches*		
Tioga: Tf, Tg, Th [1]	6+	>2	0–50	Silt loam or fine sandy loam	SM or SC; ML or CL
Tuller: TuB	1–1½	½–1½	0–15	Channery silt loam	GM or GC; ML or CL
			15	Sandstone and siltstone bedrock.	
Unadilla: UnA	6+	>3	0–42	Silt loam to very fine sandy loam	ML or CL
			42–60	Stratified sand and gravel	GM or SM; GW or GP; SP or SW
Valois: VaB, VaC, VaD, VaE	6+	>3	0–47	Gravelly loam to gravelly silt loam.	GM or SM
			47–60	Very gravelly sandy loam containing pockets of gravelly clay loam.	GM or GC
Volusia: VoB, VoC, VoD	5+	½–1½	0–17	Channery silt loam	ML or CL
			17–48	Channery silt loam (fragipan)	GM or GC; SM or SC; ML or CL
			48–60	Very channery silt loam	GM or GC; ML or CL
Wallington, gravelly substratum: WaA, WaB.	6+	½–1½	0–13	Silt loam	ML or CL
			13–50	Silt loam (fragipan)	ML or CL
			50–65	Very gravelly sandy loam	GW or GP; GM or GC
Williamson, gravelly substratum: WlA, WlB.	6+	1½–2	0–21	Silt loam	ML or CL
			21–41	Silt loam (fragipan)	ML or CL
			41–50	Silts	ML or CL
			50–72	Stratified sand, gravel and silt, variable.	------------

[1] Subject to flooding.

and chemical properties—Continued

Classification—Continued	Percent passing sieve—							
AASHO	Coarse fraction greater than 3 inches	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction
	Percent					*In. per hr.*	*In. per in. of soil*	*pH*
A–4	0	100	100	80–95	35–80	[2] 0. 63–2. 0	0. 16–0. 20	5. 1–7. 3
A–4	5–15	60–80	55–75	45–75	35–65	0. 63–2. 0	0. 11–0. 15	4. 5–6. 0
A–4	0	100	100	95–100	55–85	0. 63–6. 3	0. 17–0. 20	5. 1–6. 0
A–1 or A–2	5–15	30–70	20–60	15–55	5–30	>6. 3	--------------	5. 6–7. 6+
A–2 or A–4	5–10	55–65	50–60	40–50	30–40	0. 63–2. 0	0. 08–0. 12	4. 5–6. 0
A–2	5–15	40–50	35–45	25–35	15–25	>0. 63	--------------	5. 6–7. 6
A–4	5–10	75–90	70–90	65–85	55–85	0. 63–2. 0	0. 12–0. 18	5. 1–6. 0
A–4	5–15	65–85	55–75	45–70	40–55	<0. 20	--------------	5. 1–6. 0
A–4	5–15	55–65	50–60	40–60	35–55	<0. 20	--------------	5. 6–7. 6
A–4	0	100	95–100	85–95	70–80	0. 63–2. 0	0. 19–0. 20	4. 5–6. 0
A–4	0	100	95–100	90–100	80–95	<0. 63	--------------	4. 5–6. 0
A–1–a	5–10	30–40	25–35	10–30	0–10	>6. 3	--------------	5. 6–7. 6+
A–4	0	95–100	90–100	75–95	50–85	0. 63–2. 0	0. 15–0. 20	5. 1–6. 0
A–4	0	100	100	90–100	55–85	<0. 63	--------------	5. 1–6. 0
A–4	0	100	100	85–100	50–95	<0. 63	--------------	5. 1–6. 0
--------------	5–10	------------	------------	------------	------------	>2. 0	--------------	5. 6–7. 6+

[2] Permeability is 0.63–2.0 inches per hour in the top 40 inches. In places, it ranges from 0.63–6.3+ inches per hour in layers at a depth below 40 inches.

TABLE 6.—*Interpretations*

[Made land has properties

Soil series and map symbols	Suitability as source of— Topsoil	Granular material	Fill material	Soil features affecting— Highway location	Embankment foundations
Alluvial land: Ab	Variable; in places wet in natural state; very gravelly and cobbly in places.	Generally unsuitable, good in places.	Extremely variable: wet in natural state in places.	Floods frequently; high water table.	Variable strength; contains compressible soil layers in places.
Arnot: ArB	Unsuitable	Unsuitable	Good: low yield per acre; less than 20 inches thick over bedrock; high stone content in places.	Bedrock at a depth of less than 20 inches; extensive flat areas; seepage through rock strata; some possibility of differential frost heaving.	Adequate strength for high embankments.
Atherton: At	Surface layer good to poor: contains gravel in places; wet in natural state.	Generally good in the substratum; requires underwater excavation; contains shaly material in places.	Surface layer unsuitable, substratum good: requires underwater excavation.	Prolonged high water table at a depth of 6 inches or less; subject to differential frost heaving; trafficability seasonally poor.	Generally adequate strength for low embankments; surface layer unsuitable; underlain by compressible layers in places.
Chenango: CeB	Poor: contains channery fragments; low moisture capacity.	Fair to poor; angular siltstone and shale fragments; excessive fines in places.	Generally good	Water table at a depth below 4 feet in places; subject to differential frost heaving.	Generally adequate strength for moderately high embankments.

See footnote at end of table.

of engineering properties

too variable to be rated]

Soil features affecting—Continued						
Foundations for low buildings [1]	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoirs	Embankments				
Floods frequently; high water table; variable strength.	Variable permeability; floods frequently.	Variable material; wet in natural state in places.	Floods frequently; variable permeability, texture, and depth to water table; outlets inadequate in places.	Soil features extremely variable; floods frequently.	Level relief	Floods frequently; variable texture and drainage; level relief.
High bearing capacity; bedrock in excavations at a depth of 10 to 20 inches.	Not applicable; less than 20 inches thick over bedrock.	Less than 20 inches thick over bedrock; low yield; high stone content in places.	Less than 20 inches thick over bedrock.	Very low to low available water capacity; less than 20 inches thick over bedrock.	Less than 20 inches thick over bedrock.	Less than 20 inches thick over bedrock.
Prolonged high water table at a depth of 6 inches or less; variable compressibility.	Prolonged high water table at a depth of 6 inches or less; permeability moderately rapid or rapid at a depth below about 30 inches.	Surface layer has high organic-matter content; stability of subsurface materials fair to poor when mixed and compacted; permeable in places; gravelly and sandy substratum.	Prolonged high water table at a depth of 6 inches or less; contains sand lenses in places; subject to piping; permeability moderately rapid or rapid at a depth below about 30 inches; natural outlets inadequate in places.	Prolonged high water table; generally not irrigated.	Prolonged high water table; nearly level or depressional topography.	Prolonged high water table; sand and gravel at a depth below about 30 inches; poor and very poor drainage; level relief.
Generally adequate strength; compressible under vibratory loads; water table at a depth below 4 feet in places.	Moderately rapid to rapid permeability at a depth below about 28 inches.	Fair to good stability; moderately pervious to highly pervious; many channery fragments.	Well drained to somewhat excessively drained.	Moderate to high water-intake rate; moderate available water capacity.	Moderately rapid to rapid permeability at a depth below about 28 inches; many channery fragments; difficult to establish and maintain vegetative cover.	Many channery fragments; difficult to establish and maintain vegetative cover.

TABLE 6.—*Interpretation*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundations
Chippewa: ChA, ChB, ChC	Poor to fair: contains excessive amount of channery fragments in places; wet for long periods.	Unsuitable	Generally good in fragipan and substratum; wet in some places; highly organic surface layer; some large stones.	Prolonged high water table at a depth of 6 inches or less; slowly permeable fragipan at a depth of about 18 inches; seepage above pan; trafficability is seasonally very poor.	Generally adequate strength for high embankments.
Collamer: CoA, CoB	Good to fair: gravel in some places.	Unsuitable	Poor to fair; highly erodible silts and very fine sands.	Seasonal high water table at a depth of about 1½ to 2 feet; cut slopes highly erodible; subject to sloughing and seepage; trafficability is seasonally poor.	Generally adequate strength for moderately high embankments; underlain by wet, compressible materials in places.
Homer: Hm	Poor to fair in surface layer: contains gravel.	Generally good in substratum; wet in some places.	Good: wet in some places.	Seasonal high water table at a depth of 6 to 18 inches; outlets not generally available; subject to differential frost heaving; trafficability is seasonally poor.	Generally adequate strength for moderately high embankments.
Howard: HoA, HoB, HoC, HoD, HoE.	Poor: too gravelly and droughty.	Generally good: requires washing in places.	Good	Water table at a depth below 4 feet in some places; subject to differential frost heaving. HoD and HoE have moderately steep and steep slopes.	Generally adequate strength for moderately high or high embankments. HoD and HoE have moderately steep and steep slopes.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings [1]	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoirs	Embankments				
Generally adequate strength; prolonged high water table at a depth of 6 inches or less; slow permeability at a depth below 18 inches.	Slow permeability at a depth below about 18 inches; prolonged high water table. ChC has moderate slopes.	Highly organic surface layer; good stability; slow permeability if compacted; some large stones in places.	Slow permeability in fragipan at a depth of 18 inches; prolonged high water table at a depth of 6 inches or less. ChC has moderate slopes.	Moderate water-intake rate; low to moderate available water capacity; shallow root zone over fragipan; ChC has moderate slopes, is subject to erosion, and has a prolonged high water table at a depth of 6 inches or less.	Slow permeability in fragipan at a depth of about 18 inches; seepage.	Poorly drained; seepage.
Generally adequate strength; low to moderate bearing capacity; moderate to high compressibility; seasonal high water table.	Moderately slow permeability to moderate permeability; sandy layers subject to excess seepage.	Fair to poor stability; highly erodible.	Cut slopes unstable; subject to piping.	Moderate water-intake rate; moderate to high available water capacity; seasonal high water table at a depth of 1½ to 2 feet.	Highly erodible; subject to siltation.	Highly erodible; subject to siltation; moderately well drained.
Generally adequate strength; seasonal high water table at a depth of 6 to 18 inches; drainage outlets not generally available.	Moderately rapid or rapid permeability at a depth below 28 inches.	Good stability; variable permeability.	Seasonal high water table at a depth of 6 to 18 inches; sandy layers subject to piping.	Moderate water-intake rate; moderate available water capacity; seasonal high water table at a depth of 6 to 18 inches.	Nearly level relief.	Somewhat poorly drained; subject to prolonged flow; nearly level relief.
Generally adequate strength; moderately high to high bearing capacity; compressible under vibratory loads. HoD and HoE have moderately steep and steep slopes.	Rapid permeability at a depth below 36 to 50 inches. HoC, HoD, and HoE are moderately sloping to steep.	Good stability and shear strength; pervious; 5 to 10 percent cobblestones.	Well drained to somewhat excessively drained.	Moderate to rapid water-intake rate; low to moderate available water capacity. HoC, HoD, and HoE are moderately sloping to steep.	Moderately rapid permeability at a depth above 22 inches; rolling or hilly topography in places; HoD and HoE are moderately steep and steep.	Well drained; low to moderate available water capacity; gravelly and cobbly; rolling or hilly topography. HoD and HoE are moderately steep and steep.

TABLE 6.—*Interpretation*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundations
Hudson: HsB, HtC3, HtE3	HsB surface layer good to fair; high clay content in places. HtC3 and HtE3 poor: high clay content.	Lacustrine surficial deposits unsuitable to depths of 4 to 6 feet; gravelly substratum good; substratum wet in some places, lacking in places.	Lacustrine surficial deposits poor to depths of 4 to 6 feet; gravelly substratum good; substratum wet in some places.	Seasonal high water table at a depth of 1½ to 2 feet; lacustrine material has poor stability to depths of 4 to 6 feet; seepage and sloughing occur; highly erodible; subject to differential frost heaving where gravel is in grade cuts; poor trafficability when wet. HtE3 has steep slopes.	HsB and HtC3 generally have adequate strength for moderately high embankments. HtE3 has steep slopes; generally adequate strength for low embankments, but subject to shear failures.
Lansing: LbB, LbC, LbD	Poor: gravelly	Unsuitable	Good: a few large stones in some places.	In places seasonally perched water table at depth of 2 to 2½ feet; seepage problems in places; generally stable. LbD is moderately steep; in some places stratified material in deep cuts; differential frost heaving likely where stratification occurs.	Generally adequate strength for moderate to high embankments; these soils underlain by good to poor foundation soils. LbD is moderately steep.
Lordstown: LnB, LnC, LnD.	Poor to unsuitable; many channery fragments.	Unsuitable	Fair: 20 to 40 inches of soil over bedrock; low yield per acre; some large stones.	20 to 40 inches thick over sandstone, siltstone, or shale bedrock; cuts in rock required; seepage above rock surface. LnD is moderately steep, has some trafficability problems in places.	Adequate strength for high embankments. LnD has moderately steep slopes that cause shear failures in places.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings [1]	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoirs	Embankments				
HsB and HtC3 generally have adequate strength; seasonal high water table at a depth of 1½ to 2 feet. HtE3 is steep and subject to shear failures.	Slow permeability to depths of 4 to 6 feet in the lacustrine silt and clay; rapid permeability in the gravelly substratum; seasonal high water table at a depth of 1½ to 2 feet. HtC3 and HtD3 have moderate to steep slopes.	Upper 4 to 6 feet of lacustrine silt and clay have poor stability, low shear strength, poor compactability, slow permeability; gravelly substratum has good stability, but is pervious.	Slow permeability at a depth between 13 inches and 4 to 6 feet; seasonal high water table at a depth of 1½ to 2 feet; cut slopes unstable. HtC3 and HtE3 have adverse topography.	Moderate to high available water capacity; moderate to slow water-intake rate; seasonal high water table at a depth of 1½ to 2 feet. HtC3 and HtE3 have moderate to steep slopes, severe hazard of erosion.	Slow permeability at a depth below about 13 inches; poor workability; highly erodible; HsB is undulating in many places. HtC3 has moderate slopes, rolling topography in some places. HtE3 has steep slopes.	Highly erodible; moderately well drained. HtC3 and HtE3 are moderately steep to steep, rolling or hilly in places.
Generally adequate strength; seasonally perched water table at a depth of 2 to 2½ feet. LbD is moderately steep.	Moderately slow or slow permeability below a depth of about 13 inches. LbC has moderate slopes. LbD has moderately steep slopes.	Good stability and shear strength; slow permeability when compacted; few large stones in some places.	Well drained.	Moderate to high available water capacity; moderate water-intake rate; moderately slow or slow permeability at a depth below about 15 inches. LbC and LbD have moderate and moderately steep slopes; moderate to severe hazard of erosion.	Moderately slow or slow permeability at a depth below about 15 inches. LbD has moderately steep slopes.	LbD: moderately steep and erodible.
High bearing capacity; 20 to 40 inches thick over bedrock. LnD is moderately steep.	Bedrock at a depth of 20 to 40 inches. LnC and LnD are moderately sloping and moderately steep.	Good stability, low yield; some large stones; moderately slow to slow permeability when compacted.	Well drained.	Moderate available water capacity and water-intake rate. LnC and LnD have moderate and moderately steep slopes and are erodible.	Bedrock at a depth of 20 to 40 inches. LnD has moderately steep slopes.	Bedrock at a depth of 20 to 40 inches; well drained; many channery fragments. LnD is moderately steep and erodible.

TABLE 6.—*Interpretation*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundations
Lordstown—Continued					
LoE, LoF	Unsuitable	Unsuitable: underlying rock variable.	Poor: bedrock and many bedrock outcrops, mostly blasted rock; less than 10 to 40 inches of soil over bedrock.	Steep and very steep slopes; unusable by wheeled vehicles; cuts in rock required; seepage above rock surface.	Generally adequate strength, but steep and very steep slopes cause shear failures in places.
Madalin: Ma	Fair to good in surface layer, clayey and wet in places.	Lacustrine veneer 42 to 60 inches thick is unsuitable; gravelly substratum is good: under water in places.	Lacustrine veneer of silt and clay poor; gravelly substratum good: under water in some places.	Highly organic surface layer; prolonged high water table at a depth of 6 inches or less; flat or depressional relief; poor trafficability when wet; cut slopes in lacustrine veneer unstable; possibility of differential frost heaving where gravelly substratum is in cuts.	Generally adequate strength for moderately high fills.
Mardin: MdB, MdC, MdD	Poor: many channery fragments.	Unsuitable	Generally good: some large stones.	Seasonal high water table at a depth of 1½ to 2 feet; fragipan at a depth of 18 to 25 inches; seepage above pan; subject to sloughing; bedrock in deep cuts. MdD is moderately steep.	Generally adequate strength for high embankments. MdD has moderately steep slopes that cause some shear failures.
Middlebury: Me	Generally good: wet in places; gravelly in deep substratum in some places; channery fragments in places.	Unsuitable	Poor: too wet and poorly graded in places; highly erodible.	Subject to flooding; high water table at a depth of 12 to 18 inches; poor trafficability when wet.	Generally adequate strength for low embankments; variable compressibility.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings [1]	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoirs	Embankments				
Not generally feasible because of the steep and very steep slopes and shallow depth to bedrock.	Steep and very steep slopes; many bedrock outcrops; less than 10 to 40 inches of soil over rock.	Generally many large stones; very low yield.	Steep and very steep slopes; well drained to moderately well drained.	Steep and very steep slopes.	Steep and very steep slopes.	Steep and very steep slopes; less than 10 to 40 inches of soil over bedrock.
Generally adequate strength; prolonged high water table at a depth of 6 inches or less.	Prolonged high water table at a depth of 6 inches or less; slow permeability in the 42 to 60 inches of lacustrine veneer; rapidly permeable in the gravelly substratum.	Upper 42 to 60 inches of lacustrine silt and clay have poor stability; low shear strength; poor compactability; slow permeability when compacted; gravelly substratum has good stability, but is pervious.	Slow permeability at depths between about 18 inches to 42 to 60 inches; rapid permeability below; prolonged high water table at a depth of 6 inches or less; cut slopes unstable.	Prolonged high water table at a depth of 6 inches or less; generally not irrigated.	Depressional relief.	Depressional relief; prolonged flow.
Generally high bearing capacity and low compressibility; seasonal high water table at a depth of 1½ to 2 feet. MdD is moderately steep.	Slow permeability to a depth of 18 to 25 inches; seasonal high water table at depths of 1½ to 2 feet. MdC and MdD are moderately sloping and moderately steep.	Good stability; slow permeability when compacted; some large stones.	Slowly permeable fragipan at a depth of 18 to 25 inches; seasonal high water table at a depth of 1½ to 2 feet. MdC and MdD are moderately sloping and moderately steep.	Low to moderate available water capacity; moderate water-intake rate; seasonal high water table at a depth of ½ to 2 feet; rooting is at a depth of 18 to 25 inches. MdC and MdD are moderately sloping and moderately steep and erodible.	Slowly permeable fragipan at a depth of 18 to 25 inches; some seepage; difficult to vegetate in places. MdD is moderately steep.	Slowly permeable fragipan at 18 to 25 inches; moderately well drained. MdC and MdD are moderately sloping and moderately steep and have erodible slopes; difficult to vegetate.
Not recommended; subject to flooding; high water table; variable compressibility.	Seasonal high water table; variable permeability.	Poor stability; subject to piping.	Annual flooding; cut slopes unstable; outlets inadequate.	High available water capacity; moderate water-intake rate; seasonal high water table 12 to 18 inches; rooting zone is about 24 to 36 inches.	Level relief.	Level relief.

TABLE 6.—*Interpretation*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundations
Muck: Mu	Poor: possible to use as an amendment to mineral soils.	Unsuitable	Unsuitable	Prolonged high water table; compressible material; very poor trafficability.	Wet, compressible material 2 to 10 feet thick over variable mineral soils.
Papakating: Pg	Good: prolonged wetness.	Generally unsuitable: deep substratum: fair in places.	Poor: highly organic in surface layer; wet in natural state; silty material highly erodible.	Frequent flooding; prolonged high water table at or near the surface; very poor trafficability.	Variable strength depending on underlying material.
Phelps: PhA	Poor: gravelly	Generally good: excessive fines in places.	Good	Seasonal high water table at a depth of 1½ to 2 feet; cut slopes subject to seepage and sloughing and differential frost heaving.	Generally adequate strength for moderately high embankments.
Rhinebeck: RhA, RhB	Surface layer fair to poor: high in clay.	Lacustrine surficial deposits 42 to 72 inches thick unsuitable; gravelly substratum good: substratum wet in some areas, lacking in places.	Lacustrine surficial deposits 42 to 72 inches thick poor; gravelly substratum good: substratum wet in places, lacking in places.	Seasonal high water table at a depth of 6 to 18 inches; lacustrine material has poor stability; subject to seepage and sloughing; highly erodible; subject to differential frost heaving where grade has gravel; poor trafficability for long periods.	Generally adequate strength for moderately high fills.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings [1]	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoirs	Embankments				
Prolonged high water table; wet, compressible material, 2 to 10 feet thick over variable mineral soil.	Muck or peat about 2 to 10 feet thick over variable mineral soils.	Muck or peat about 2 to 10 feet thick over variable mineral soils.	Not generally applicable; very high shrinkage if drained; 2 to about 10 feet of muck or peat over variable mineral soils.	Not generally applicable; high water-intake rate; variable available water capacity.	Level relief	Level relief.
Frequent flooding: prolonged high water table at or near the surface.	Frequent flooding; variable permeability at a depth below about 10 inches; prolonged high water table at or near the surface.	Poorly graded silty material in many places; prolonged wetness; highly erodible; highly organic surface layer.	Frequent flooding; prolonged high water table at or near the surface; unstable ditch banks; inadequate outlets.	Prolonged high water table at or near the surface; frequent flooding.	Level relief	Level relief.
Seasonal high water table at a depth of 1½ to 2 feet; generally adequate strength; generally moderately high to high bearing capacity; compressible under vibratory loads.	Rapid permeability in substratum; seasonal high water table at a depth of 1½ to 2 feet.	Good stability and shear strength; permeability variable when compacted; pervious in places.	Seasonal high water table at a depth of 1½ to 2 feet; sandy strata subject to piping.	Moderate to high water-intake rate; low to moderate available water capacity in the upper 24 inches which is the main rooting zone; seasonal high water table at a depth of 1½ to 2 feet.	Not generally applicable; permeability ranges from moderate to rapid.	Erodible sandy strata; moderately well drained; subject to seepage; difficult to vegetate in places.
Generally adequate strength; variable compressibility; seasonal high water table at a depth of 6 to 18 inches.	Slow permeability in the lacustrine silt and clay; rapid permeability in the gravelly substratum; seasonal high water table at a depth of 6 to 18 inches.	Poor stability in lacustrine silt and clay; low shear strength; difficult to compact; slow permeability if compacted; gravelly substratum has good stability; pervious.	Slow permeability at depths between about 12 inches and 42 to 72 inches; rapid permeability below; cut slopes unstable.	High available water capacity in the upper 24 inches which is the main rooting zone; seasonal high water table at a depth of 6 to 18 inches.	Slow permeability below about 12 inches; poor workability; highly erodible.	Highly erodible; somewhat poorly drained.

TABLE 6.—*Interpretation*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundations
Tioga: Tf, Tg, Th	Generally good in surface layer and subsoil: stone fragments in some places.	Poor in surface layer and subsoil, fair in deep substratum, but wet in places.	Generally poor: highly erodible silty and sandy material; wet substratum in some places.	Subject to flooding; water table at a depth below 2 feet in some places.	Generally adequate strength for moderately high embankments, but variable in places, depending on underlying materials.
Tuller: TuB	Poor: contains many channery fragments.	Unsuitable	Good: low yield; less than 20 inches thick over shale and siltstone bedrock; high stone content in places.	Bedrock at a depth of less than 20 inches; extensive flat area; seepage above and through rock strata; seasonal high water table at a depth of 6 to 18 inches; trafficability good except when wet.	Adequate strength for high embankments.
Unadilla: UnA	Good in surface layer and subsoil.	Poor in surface layer and subsoil, underlying material good in some places.	Poor to fair: soils dominately silty; highly erodible.	Cut slopes very unstable and erodible; material becomes stratified with depth in places; subject to differential frost heaving; water table at a depth below 3 feet.	Generally adequate strength for moderately high fills.
Valois: VaB, VaC, VaD, VaE	Poor: gravelly	Generally unsuitable.	Good: contains some large stones.	Water table at a depth below 3 feet in places; stratified pockets subject to differential frost heaving. VaD and VaE have moderately steep and steep slopes.	Generally adequate strength for moderately high to high embankments. VaD and VaE have moderately steep and steep slopes causing some shear failures in places.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings [1]	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoirs	Embankments				
Subject to flooding; water table at a depth below 2 feet in places; variable strength.	Subject to flooding; variable permeability; water table at a depth below 2 feet in places.	Poorly graded in many places; seasonally wet in substratum; silty and fine sandy material highly erodible; permeability variable in compacted soil; subject to piping.	Subject to flooding, but drainage generally not needed; water table at a depth below 2 feet for brief periods.	Moderate to high water intake rate; high available water capacity; rooting depths of 30 inches or more; subject to spring flooding but rarely floods during the growing season. Th less subject to flooding than Tf and Tg.	Level relief	Level relief.
High bearing capacity; bedrock in excavations; seasonal high water table at a depth of 6 to 18 inches.	Not applicable; less than 20 inches thick over bedrock.	Less than 20 inches thick over bedrock; low yield; high stone content in places.	Less than 20 inches thick over bedrock; seasonal high water table at a depth of 6 to 18 inches.	Moderate water-intake rate; very low to low available water capacity; less than 20 inches thick over bedrock limits depth of rooting; seasonal high water table at a depth of 6 to 18 inches.	Less than 20 inches thick over bedrock.	Less than 20 inches thick over bedrock.
Generally adequate strength; generally moderately high bearing capacity; compressible under vibratory loads.	Excessive seepage.	Variable; poorly graded in many places; highly erodible; subject to piping.	Cut slopes very unstable.	Moderate to high water-intake rate; high available water capacity; no rooting depth restrictions.	Level relief	Highly erodible; subject to siltation; level relief.
Generally adequate strength; generally moderately high bearing capacity; compressible under vibratory loads. VaD and VaE have moderately steep and steep slopes.	Subject to excess seepage. VaC, VaD and VaE have moderate to steep slopes.	Good stability and shear strength; permeability variable when compacted; contains some large stones.	Well drained	Moderate to high water-intake rate; moderate available water capacity; no rooting depth restrictions. VaC, VaD, VaE: moderately to steeply sloping and erodible.	Subject to seepage. VaD, VaE: moderately steep and steep slopes; irregular topography in places.	Well drained; irregular topography in places. VaD and VaE have moderately steep and steep slopes and are erodible.

TABLE 6.—*Interpretation*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundations
Volusia: VoB, VoC, VoD	Poor: many channery fragments.	Unsuitable	Good: wet; some large stones.	Seasonal high water table at a depth of 6 to 18 inches; dense fragipan at a depth of about 17 inches; seepage above the pan; subject to sloughing; bedrock in deep cuts. VoD: moderately steep; trafficability is variable.	Generally adequate strength for high embankments. VoD has moderately steep slopes, causing shearing in places.
Wallington: WaA, WaB	Good in surface layer and upper part of subsoil; seasonally wet.	Lacustrine silt and very fine sand 36 to 60 inches thick is unsuitable; gravelly substratum good: substratum generally wet and is lacking in places.	Lacustrine silt and very fine sand 36 to 60 inches thick is poor; gravelly substratum good: highly erodible; substratum lacking in places.	Seasonal high water table at a depth of 6 to 18 inches; seepage and sloughing; highly erodible; cuts in gravelly substratum subject to differential frost heaving; trafficability is seasonally poor.	Generally adequate strength for moderately high embankments.
Williamson: WlA, WlB	Good in surface layer and upper part of subsoil	Lacustrine silt and very fine sand 42 to 60 inches thick is unsuitable; gravelly substratum is good: substratum lacking in places.	Lacustrine silt and very fine sand 42 to 60 inches thick is poor; highly erodible; gravelly substratum good; substratum lacking in places.	Seasonal high water table at a depth of 1½ to 2 feet; seepage and sloughing; highly erodible; cuts in gravelly substratum subject to differential frost heaving; trafficability is seasonally poor.	Generally adequate strength for moderately high embankments.

[1] Engineers and others should not apply specific values to the estimates given for bearing capacity of the soils.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings [1]	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoirs	Embankments				
Generally high bearing capacity and low compressibility; seasonal high water table at a depth of 6 to 18 inches. VoD: moderately steep.	Slow permeability in fragipan at a depth below about 17 inches; seasonal high water table at a depth of 6 to 18 inches. VoC and VoD are moderately sloping and moderately steep.	Good stability and shear strength; slow permeability when compacted; some large stones.	Slow permeability in fragipan at a depth below about 17 inches; prolonged seepage above the pan. Voc and VoD are moderately sloping and moderately steep.	Moderate water-intake rate; low to moderate available water capacity in the 17 inch rooting zone above the fragipan. VoC and VoD are moderately sloping and moderately steep and erodible.	Slow permeability in fragipan below about 17 inches; prolonged seepage above the pan. VoD: moderately steep.	Somewhat poorly drained prolonged seepage. VoD is moderately steep and erodible.
Seasonal high water table at a depth of 6 to 18 inches; generally adequate shear strength.	Permeability moderately slow or slow between depths of about 13 inches and 36 to 60 inches; moderately rapid to rapid permeability in gravelly substratum; seasonal high water table at a depth of 6 to 18 inches.	Variable; silty mantle 36 to 60 inches thick is poorly graded in many places; seasonally wet; highly erodible; gravelly substratum is stable; pervious in places when compacted.	Moderately slow or slow permeability in fragipan at a depth of about 13 inches; seasonal high water table at a depth of 6 to 18 inches; cut slopes unstable; subject to siltation and piping.	Moderate water-intake rate; moderate available water capacity; rooting depth is mainly in zone above the fragipan, usually 18 inches or less thick; seasonal high water table at a depth of 6 to 18 inches.	Seasonal high water table at a depth of 6 to 18 inches; subject to seepage and siltation; highly erodible.	Seasonal high water table at a depth of 6 to 18 inches; highly erodible; subject to siltation.
Seasonal high water table at a depth of 1½ to 2 feet; generally adequate strength.	Permeability moderately slow or slow between depth of about 21 inches and 42 to 60 inches; moderately rapid to rapid permeability in gravelly substratum; seasonal high water table at a depth of 1½ to 2 feet.	Variable; silty mantle 42 to 60 inches thick; poorly graded in many places; highly erodible; gravelly substratum is stable, but in places is pervious when compacted.	Moderately slow or slow permeability in fragipan at a depth of about 21 inches; seasonal high water table at a depth of 1½ to 2 feet; cut slopes; unstable; subject to siltation and piping.	Moderate water-intake rate; moderate to high available water capacity; rooting is mainly in the upper 24 inches above the fragipan; seasonal high water table at a depth of 1½ to 2 feet.	Seasonal high water table at a depth of 1½ to 2 feet; subject to seepage and siltation; highly erodible.	Seasonal high water table at a depth of 1½ to 2 feet; highly erodible; subject to siltation.

Available water capacity: The available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most plants.

Reaction: pH ranges given in this column represent a summary of the many field pH determinations taken during the survey on each of the soils in the county.

The following paragraphs briefly describe the columns in table 6:

Suitability as a source of topsoil: The thickness, texture, and inherent fertility of the surface layer determine suitability of a soil for use as a topdressing for road banks and embankments and areas where vegetation is to be established. Only the surface layer of the soil is considered in this rating, except as noted.

Granular material: This column gives information about the soils as a possible source of sand and gravel for construction purposes. It should not be assumed that where a soil is rated "good" that all areas of that soil can be used for commercial development of sand or gravel. A soil rated good has better possibilities for clean sand or gravel than soils rated poor or fair.

Fill material: This material is used to build embankments. The ratings indicate performance of soil material moved from borrow areas for these purposes.

Highway locations: Soil features that limit highway location include shallow depths to rock, high water tables, steep slopes, sliding, and flood hazard.

Embankment foundations: Soil features that affect embankment foundations are compressibility, shrink-swell potential, permeability, shear strength, and slope.

Foundations for low buildings: The soil features that affect its capacity to support low buildings that have normal foundation loads are listed for undisturbed soil. Specific values of bearing strength are not assigned.

Farm ponds: Under the "Reservoir" subheading, consideration is given primarily to the soil properties of undisturbed soils that affect the seepage rate. In addition, shallowness to bedrock and the susceptibility to overflow in the flood plains are also noted. Under the "Embankment" subheading, the soils are rated according to the stability and permeability of the materials when used in the construction of pond embankments. The permeability noted in this column is for the soil material when compacted at optimum moisture. The information in this column is also pertinent for dikes and levees.

Agricultural drainage: The soil features are described relative to their natural drainage, their in-place permeability, and the occurrence of a high seasonal water table or seepage.

Irrigation: Irrigation is affected by the relative ease with which water normally infiltrates into, percolates through, and drains from the soil and by the available moisture capacity.

Terraces and Diversions: The slope of the land and the relative erodibility of the soil materials are the main considerations in terracing. Other soil features considered are depth to rock and the presence of seasonal high water tables. Nearly level soils need no terracing; steep soils are not well adapted to terracing. Highly erodible soils require special care in the construction of terraces and diversions.

Waterways: Slope of the land and erodibility of the soil materials are the main considerations in planning waterways. Depth to rock, seepage, and prolonged water flow are noted where applicable.

Engineering significance of geologic deposits and bedrock

Soils of the county formed in materials deposited as a result of several different geologic processes. Some of these deposits are well-graded mixtures of various textures and others are single grained. Some are very loose; others are extremely compact. Some support heavy loads with negligible settlement or deformation; others require extensive treatment to support even light fills or light buildings.

The following geologic deposits occur in Chemung County: glacial till, lacustrine sediments, glacial outwash, alluvial deposits, and organic deposits. Each geologic unit is described in the following paragraphs, and the broad engineering significance is given.

DEEP GLACIAL TILL

Glacial till deposits formed from soil and rock fragments that were picked up, transported, abraded, mixed, and deposited by the action of glacial ice. The resulting deposits are highly variable assortments of soil and rock material in which particle size ranges from pieces of ledge and large boulders to clay. In general no stratification occurs, but in some areas there are inclusions of interstratified sands and gravels or pockets of silt and clay. Where ice advanced in waves, there are layers of till deposits. The contiguous beds that have different textures show a degree of pseudo-stratification.

Most of the till deposits of the county are very dense because they have been subjected to the compacting weight of overriding ice. The deposits laid down during ablation stages of glaciation are generally not dense because they were not overridden.

In addition to ice contact, till deposits described in this report have been subjected to slumping, frost heaving, and sloughing. In this report deep tills are where the soils are more than 3½ feet thick over bedrock. This is in contrast to "shallow" glacial till where the soils are less than 3½ feet thick over bedrock.

Soils formed in deep glacial till occupy about 113,390 acres, or approximately 44 percent of the county. Very few of the soils are on flat areas. They have gentle to very steep slopes. The till terrains usually involve cut and fill earthwork. In the well-drained soils formed in tills, properly designed cuts are fairly stable and subgrades are usually satisfactory. Sloughing occurs on cut slopes, however, during frost withdrawal or where fairly long slopes receive large amounts of runoff. Deep cuts are limited in places by bedrock, especially in areas of deep till that are adjacent to shallow till areas.

Results from a limited number of tests show that in-place densities of the substratum of soils formed in deep till range from 111 to 129 pounds per cubic foot. Maximum densities range from 120 to 133 pounds per cubic foot. Natural moisture content ranges from 7 to 16 percent, and optimum moisture content for compaction ranges from 8.4 to 16.4 percent. Test results are from samples taken at relatively shallow depths.

In Chemung County till deposits are not sources of granular materials. The soils are poor to fair as sources of topsoil because they are too stony. They also lack some plant nutrients and are mostly strongly or very strongly acid in reaction. The plant nutrient levels and the pH can be modified by additions of fertilizer and lime.

Soils that formed in deep glacial till are good embankment sites and the source of fill materials for embankments. The compact condition of most of the soils impedes run-in, and runoff causes severe sloughing. Large stones, boulders, and ledgey pieces are in some areas of the county. The large stone fragments interfere with fill placement in thin lifts.

For residential developments, the sloping topography involves considerable grading in places. The compact, impervious till substratum limits the use of these soils for septic tanks. The compact subsoil limits rooting depth. The stone content is high. Lawns and athletic fields on stony soils are hazardous for mowing equipment and for other uses.

Soils formed in deep glacial till are Mardin channery silt loam, Volusia channery silt loam, Chippewa silt loam, Lansing gravelly silt loam, and Valois gravelly loam.

SHALLOW GLACIAL TILL

Soils formed in shallow glacial till occupy about 36 percent of the county. These ice-laid deposits are similar in texture to the deep till deposits. They differ from them principally in that they are generally less than 3½ feet thick over the underlying bedrock. These soils are principally on uplands on old plateau remnants.

Soils formed in shallow till furnish satisfactory embankment foundations for highway fills because they are so thin that little soil settlement can occur. Some of the soils, however, are so steep that shear keys are necessary to prevent fills from sliding.

These shallow soils have limitations for residential use. Basement seepage is a concern, and underlying bedrock limits basement excavations and installation of sewage systems and water and gas lines. Special design may be necessary for septic tank systems.

Part of the soils that formed in shallow glacial till deposits occupy relatively flat landscapes. In these soils a moderately elevated grade line may eliminate the need for blasting the underlying bedrock for drainage ditches.

Where highway cuts and fills are made there is a definite need for transition sections. Some highway cuts involve a combination of soil and rock cuts; and the slope in soil must generally be less than in the rock. Sloughing at the soil-rock interface is common. Cuts in soils that have high rock content may require special design, depending on the rock structure and its weathering characteristics.

Limited existing data show that in-place densities of the substratum of the soils that formed in shallow till are about the same as those that formed in thick till.

These soils are not sources of granular materials, nor are the underlying rocks good sources of coarse aggregate. Topsoils are generally stony and very acid.

Soils formed in shallow glacial till are Arnot channery silt loam, Lordstown channery silt loam, Lordstown and Arnot very rocky soils, and Tuller channery silt loam.

LACUSTRINE SEDIMENTS

For a considerable period of time, glacial lakes of various elevations occupied the lowlands in the Chemung River Valley. For a shorter period of time, during the building of the Valley Heads Moraine north of Horseheads in Catharine Creek Valley, temporary lakes were formed. These lakes were the depository for sediments carried by melt-water streams. Whenever fast flowing streams entered the lake waters, the coarser part of their load was dropped in the lake at the mouth of the stream and the finer load was carried farther into the lake. The coarse materials formed stratified, granular delta deposits; the finer particles formed lacustrine sediments. The finer particles consist of very fine sands and coarse silts and fine silts and clays.

Lacustrine very fine sands and coarse silts

These deposits are interstratified. In places they are underlain by or interbedded with the lacustrine silts and clays. In some places the deposits are channel fillings in granular outwash terraces. The materials are loose, in contrast to the compact glacial till deposits that cover most of the county. A water table is more likely to occur with depth.

Lacustrine fine silts and clays

These deposits are not exposed on the surface in very much of Chemung Valley (*5*). They form a large proportion of the sediments that fill the valley, however, and they are overlain by thick outwash gravels, sloughed glacial till, and alluvium. North of Horseheads the lacustrine sediments occur as shallow surface deposits, underlain by gravel. In either of these valleys subsurface evaluation is requisite to any engineering work that imposes concentrated loads.

The silt and clay deposits are varved. In the Chemung Valley they are below the water table. Since they are not exposed, they are not generally used for borrow. They are, however, weak, soft, and compressible. The lacustrine sediments are generally poor for foundations for embankments. This is generally not the case in Catharine Creek Valley, however, because of the thinness of the silts and clays over better foundation soils. In Catharine Creek Valley silts and clays generally do not have a permanent water table; they have a seasonal perched water table. These soils are fair sources of fill material when dry, but early in spring and after very long periods of rainfall, they are too wet.

The suitability for topsoils is variable, depending on clay content and, in places, on stone content.

The soils that formed in very fine sand and silt deposits are Collamer silt loam; Wallington silt loam, gravelly substratum; and Williamson silt loam, gravelly substratum. Also included is Unadilla silt loam, which mainly formed in old glacial stream terrace deposits, as did some of the Williamson and Wallington soils. The soils that formed in silt and clay deposits are: Madalin silt loam, gravelly substratum; Hudson silt loam, gravelly substratum; and Rhinebeck silt loam, gravelly substratum.

The in-place dry densities of the very fine sands and silts range from 93 to 123 pounds per cubic foot. Maximum densities range from 108 to 124 pounds per cubic foot, and the in-place dry densities for the silty and clayey textured sediments range from 93 to 127 pounds per cubic foot. Natural moisture contents of sampled soils range from 10 to 27 percent, and optimum moisture contents for maximum density range from 10 to 19 percent.

Where engineering use is concerned, the following general criteria apply:

1. The soils are difficult to work when wet, particularly the silty and clayey parts.
2. The soils generally have low to moderate bearing capacity; and sites for even moderately high fills (5 feet to 15 feet) must be evaluated by subsurface investigations and engineering analysis.
3. The soils are generally compressible. In some areas even low fills (up to 5 feet) settle.
4. It is difficult to compact highway subgrades on the silts and clays.
5. Some of the soils are wet and difficult to drain.
6. The soils that are wet for long periods dry with difficulty. They are a poor source of borrow, because control of moisture is necessary to obtain properly compacted fills.
7. Cut slopes must be flat or they will be unstable, but poor drainage makes cuts impractical on some flat landscapes. Temporary excavations generally have unstable slopes that need shoring or sheeting.
8. The imposition of heavy highway fills on these soils requires the use of berms for stability purposes in some places. Structures that impose concentrated loads on these soils can settle. These soils present the most difficulties of any in the county except for some alluvial soils and muck deposits. No concentrated loads should be imposed on any lacustrine sediment without subsurface exploration and a thorough engineering evaluation of the capability of the site to sustain the proposed loads. If the soils are not evaluated, the underlying soils may shear and displace, and longtime settlement of fills or foundations may occur. This can be detrimental to a bridge, approach fill, pavement, dam, building, or any other structure.
9. Excavations may encounter a water table and can be constructed, but there are limitations. Excavations may encounter a water table and foundation design may involve hydrostatic uplift. Basements generally require waterproofing. If properly done this is costly. Sewage disposal fills may be necessary. Municipal system installations may need sewerline supports, sheeting excavations, lowering of the water table during construction, granular pipe bedding material, concrete cradles, and a pile support for major structures.

GLACIAL OUTWASH

These deposits consist of sorted sand and gravel. They include true outwash deposits, deltas, and bars and beaches. In general, the mapping does not separate the deposits in accordance with their mode of deposition. Outwash terraces occur where streams have deposited stratified sand and gravel on soil. Delta deposits are built into water and are underlain in places by wet, weak, soft, compressible lacustrine sediments.

The soils formed in outwash deposits are suitable for most engineering and other uses, because they are generally well drained. Some areas have steep topography and some are wet. A water table generally occurs, and excavations are increasingly likely to encounter water with depth. In some places these deposits are a veneer over another geologic deposit. For example, the delta deposits can generally be expected to overlie lacustrine sediments.

Where available, and depending on soundness, plasticity, and gradation, the granular outwash deposits can be used for the following purposes:

1. Fill material for highway embankments.
2. Fill material for parking areas and developments.
3. Fill material to decrease stress on underlying soils and facilitate construction operations.
4. Subbase for pavements.
5. Wearing surfaces for driveways, parking lots, and low-class roads.
6. Material for highway shoulders.
7. Granular backfill for structures and pipes.
8. Outside shells of impounding dams. These materials are unsuitable for use as fill material for the impervious parts of dams.
9. Abrasives for snow and ice control on highways.
10. Slope protection blankets to drain some wet slopes.
11. Granular blanket to prevent pumping under concrete pavements.
12. A source of aggregates for concrete.

Their general usefulness and the ease with which they can be handled, even during wet weather, makes the drier soils, such as the Howard soils, excellent material for highway and other embankments. The soundness of the outwash deposits is variable, and suitability for most uses requires testing and evaluation. Where these materials are dominantly sandy, they are rapidly erodible by wind and water and, hence, side slopes of sandy cuts and fills and ditch inverts require positive control of runoff.

The flat areas of these deposits where the soils are well drained furnish excellent locations for highways and other developments. The subgrade in cuts in these materials is generally susceptible to differential frost heaving. To prevent this defect either uniform materials or insulation to prevent frost penetration must be used. Cuts in these soils can encounter silt strata that impede drainage and cause seepage.

Soils formed in glacial outwash are Howard gravelly silt loam, Homer silt loam, Phelps gravelly loam, Atherton mucky silt loam, and Chenango channery silt loam, fans.

ALLUVIAL DEPOSITS

These stratified, variously textured sediments were deposited on the flood plains of existing streams.

The soils that formed in alluvial deposits have a fluctuating, but generally shallow, water table and are subject to annual, or sometimes more frequent, periods of overflow.

In places these areas are underlain by soft, wet, compressible lacustrine sediments.

Even light cuts will encounter a water table, therefore cuts are generally not practical. Since the areas are subject to overflow, the gradeline should be above flood elevation.

Foundation conditions are generally poor on alluvial areas. Thorough investigation, and, in some locations, special analysis and design are required before foundations for bridges and high embankments are constructed on these soils.

Alluvial deposits are subject to hazards of flooding and should be avoided as building sites. The possibility of flooding and the elevation of the water table must be carefully evaluated before these areas are considered for any building purposes. Sewage disposal by septic tank methods can be a problem on alluvium.

Alluvial deposits are potential sources of good topsoil.

Soils formed in alluvial sediments are Tioga silt loam, Tioga fine sandy loam, Middlebury silt loam, and Papakating silt loam. The miscellaneous land type Alluvial land is also included in this category.

ORGANIC DEPOSITS

The only organic soil in this county is Muck. These accumulations of plant and animal remains are in poorly drained areas.

Organic deposits are entirely unsuitable for highway or other embankment sites because they are highly compressible and unstable. Generally, organic deposits and any other unsuitable material underlying them should be removed and replaced with suitable backfill. At highway sites, after unsuitable materials have been removed, backfill below the water table should be made with suitable broken rock or granular material. It must be recognized that no method of construction will entirely eliminate post-construction settlement on organic soils. The gradeline on these areas must be above the high water level. Organic soils can be used to amend the adverse moisture-holding qualities and poor physical condition of some mineral soils.

MISCELLANEOUS AREAS

Part of Chemung County was mapped as Made land, a miscellaneous land type. Made land, as well as cemeteries, gravel pits, and quarries, are in one or more of the geologic categories described. Onsite investigation is necessary properly to evaluate these miscellaneous areas.

BEDROCK

The bedrock of the entire county consists of a series of interbedded fine-grained sandstone, siltstone, and shale. For design purposes, preliminary evaluation of each proposed rock cut is necessary because the rock types change abruptly. Seepage is common along joint plains and can cause fractures along exposed cuts during periods of freezing and thawing.

Soils and engineering construction

Highways, dams, bridges, buildings, drainage installations, and other engineering structures are founded on, and often partly constructed of, soil material or rock, and the design of such structures should reflect the nature and physical properties of the soil and rock. Some features of engineering works are highly dependent on soil conditions. The following paragraphs describe the effects of general soil conditions on engineering structures for soil and water conservation work, on roads, winter embankment construction, and structure foundations. They also describe the effect of frost action on soils and the use of topsoil.

SOIL FEATURES AFFECTING HIGHWAY LOCATION

Highway location can be influenced by many soil features. This applies to location on the landscape, the selection of the gradeline, and to the ultimate performance of the engineering work.

In Chemung County the dominant soils are those formed in deposits of deep and shallow glacial tills, such as those of the Volusia and Lordstown series. These form mostly sloping landscapes where longitudinal cuts and fills and sidehill cuts and fills are numerous and the location of the gradeline is generally not critical. Where till deposits flank the Chemung Valley lowland some of the soils, such as the Volusia and Mardin soils, that formed in sloughed tills behave like colluvium. These soils are underlain at not very great depths by weaker dissimilar materials, such as lacustrine sediments. Some of the soils that formed in till deposits, such as those of the Valois series, soils that formed in outwash deposits, and soils on kames and moraines, such as the Howard soils, are on steeply sloping landscapes. In these areas seepage and erosion occurs. Occasionally, difficulty is encountered in "daylighting" cut slopes. Soils, such as those of the Arnot and Tuller series, are shallow over bedrock. Where this condition is extensive and the areas are flat, an elevated gradeline eliminates rock blasting for drainage.

Lacustrine sediments occur as surface deposits north of Horseheads. The Hudson, Rhinebeck, and Madalin soils formed in these sediments. In most places the silts and clays are underlain by gravelly and sandy deposits. Where the silts and clays are deep, cuts encounter a water table and borrow areas are generally ponded for long periods of the year. On the dissected edges of lacustrine terraces, stability of cut slopes can be a matter of concern. A water table generally occurs in the Wallington soils that formed in sandy and silty sediments. Where drainage cannot be effected, cuts are not recommended. In the level to slightly sloping Madalin soils that formed in silty and clayey sediments, practically all cuts encounter a water table and layers that have an adversely high moisture content. Cuts are generally difficult to make, and subgrade trafficability problems will be encountered during construction. Pavements constructed on these wet, poorly drained soils tend to be slightly uneven.

Cuts within the zone of frost penetration in soils formed in stratified granular material, such as the Phelps and Homer soils, are affected by differential frost heaving (7). This problem can be eliminated by draining, undercutting, backfilling, or employing a moderately high gradeline. Plastic foam insulation has been experimentally used to prevent frost penetration of the subgrade. If this proves to be successful, it will eliminate the need for undercutting. Emphasis is placed on a need to evaluate the cost of undercutting and backfilling versus using a low fill. Some of the soils that formed in outwash deposits are not very deep over other materials, and many cuts encounter a water table. Cuts are impractical unless they can be drained.

Erosion is a hazard on all cuts or fills, especially cuts and fills on sandy and silty soils such as those of the Unadilla and Collamer series. Runoff must be collected and disposal systems constructed, possibly including ditch paving, to carry off the water. The soil slope is important. On extensive areas of nearly level Chippewa soils, for example, runoff is slow and generally run-in is impeded and drainage is diffiult to effect. This is particularly so of the Madalin soils formed in silty and clayey sediment deposits. Steeply sloping soil generally implies a need for heavy grading. Slopes of more than 15 percent can be considered adverse for building sites and reservoir areas. This degree of slope is adverse for farm drainage lines and irrigation systems. Diversion ditches and waterways on 15 to 20 percent slopes are difficult to build and maintain.

In some of the undisturbed natural soils, such as those of the Howard, Phelps, and Homer series, the texture of the surface layer and subsoil contrasts considerably with that of the substratum. Consequently, these layers have different drainage capabilities. Soils such as those of the Volusia and Mardin series, are less dense in the surface layer and upper part of the subsoil than in the underlying fragipan or substratum. When light cuts are made, the grade may intersect these nonuniform layers, causing nonuniformity of support and drainage. The varying drainage conditions are particularly important for frost effects. Very light fills are similarly influenced by nonuniform conditions.

High embankments and heavy structures impose concentrated loads on the supporting soils or bedrock. The best supporting soils in the county are those that are shallow over bedrock. Soils in this category are those of the Lordstown, Arnot, and Tuller series. The poorest support is given by the alluvial soils, such as those of the Tioga, Middlebury, and Papakating series and Muck and soils formed in lacustrine sediments, such as those of the Hudson, Rhinebeck, and Madalin series. In Chemung County, soils that formed in outwash deposits, such as those of the Howard and Phelps series, are variable. In places they are underlain by soft, compressible materials. Soils that formed in glacial till, such as those of the Volusia and Mardin series, furnish good support and have a negligible amount of setttlement except where slopes are very steep. In places adjacent to old glacial lake shores, soils that formed in till material, such as the Valois soils, are loose.

All soils in Chemung County are affected by freezing and thawing. Measures to combat frost damage are generally needed for all types of engineering construction.

There are two types of frost heaving, uniform heaving and differential heaving. Uniform heaving occurs if the soil is uniform in texture and ground-water conditions, as are the Collamer soils that formed in silty lacustrine deposits.

Differential heaving occurs if the soil texture varies in contiguous strata; or, in cut and fill transitions, if an available source of ground water is close to the surface; or if soils contain varying sized rock fragments in the frost zone, especially fragments more than 10 inches in size. Differential heaving also occurs where lateral drains, culverts, and approach fills to bridges and overpasses break the uniformity of subgrade conditions. Differential heaving is most serious in nonuniform, stratified, gravelly outwash deposits where such soils as those of the Howard, Phelps, and Chenango series were formed. Large rock fragments that cause so-called "boulder heaves" are most commonly found in such soils as the Mardin and Volusia soils, which formed in glacial till deposits on uplands.

Differential frost heaving, in contrast to uniform heaving, causes more pavement stress and surface roughness.

On all soils in the county freezing and thawing causes deterioration of thin pavements and unpaved roads as well as loss of density in the supporting soils. On cut slopes freezing and thawing causes displacement of cobblestones and stones and soil creep. It also causes the weathering and dislodging of rocks in rock cuts. During periods of thawing, there is a loss of subgrade support and drainage is restricted by the still unthawed layer.

WINTER EMBANKMENT CONSTRUCTION

During freezing weather, much greater compactive effort is required to obtain the minimum acceptable degree of compaction of soils. As the temperature falls below 20° to 25° F., it becomes virtually impossible to attain a satisfactory degree of densification with standard compaction equipment, even when working with relatively clean sand and gravel. Highway embankments constructed during freezing temperatures generally settle unevenly; consequently, the pavement is rough. Winter work on construction of embankments should be limited to the placement of rockfills. The surface of partly constructed embankments that are left exposed during the winter months should be crowned and rolled smooth to shed water and prevent infiltration.

In the construction of earth embankments, no fill should be placed on a frozen surface, nor should snow, ice, or frozen material be incorporated in the embankment.

SOIL AND WATER CONSERVATION

Farm drainage and irrigation systems, farm ponds, dikes and levees, diversions, and waterways are used to conserve soil and water and provide for excess water disposal.

Most of the soils derived from glaciai till, such as the Mardin, Volusia, and Chippewa soils, are underlain by a compact fragipan and a platy substratum that retard the movement of water. Seepage along the tops of these layers causes wet spots and may require the use of interception drains of both the surface and subsurface types. Before irrigation systems are installed in these soils and in soils that are shallow to bedrock, such as the Arnot soils, careful investigation needs to be made at the site because depth of rooting is limited.

Most soils that formed in deep glacial till have impeded permeability and are suitable for the construction of farm ponds. Some soils, however, such as those of the Valois series, contain sandy lenses that cause excessive seepage from the reservoir and also cause piping and instability in drainage structures.

Soils that formed in lacustrine sediments, such as the Hudson, Rhinebeck, Williamson, and Collamer soils, have extremely variable engineering properties and require careful investigation for most uses.

Soils derived from glacial outwash and alluvium, such as the Howard and Tioga soils, are generally more permeable than those derived from glacial till. If farm ponds for storing water above ground are built in these soils, a sealing agent is generally needed to prevent excessive seepage from the reservoir. Ponds that store water below the surface have been successful in areas where the water table is close to the surface. If open ditches or subsurface drains are installed, layers of poorly graded silt, fine sand, or sand are subject to erosion, sloughing, and slumping. Subsurface drainage systems installed in such layers must be protected against plugging with silt and fine sand. The fact that some gravelly and sandy outwash soils are droughty and have moderate to low water-holding capacity should be considered when planning an irrigation system.

Town and Country Planning

This subsection is of special interest to developers, planners, and others who are concerned with the population and industrial expansion taking place in Chemung County. It is also of interest to those concerned with the encroachment of this urban expansion on good farm land.

Table 7 gives limitations on the use of soils for homesites, septic tank filter fields, picnic and extensive play areas, campsites, and other community developments and recreation. The table lists the soils in the county and the soil features that are most limiting and gives the estimated degree of limitation.

The major properties that affect the nonfarm uses of soils are: slope, drainage or depth to seasonal high water table, permeability, stoniness, surface texture, the occurrence of hard bedrock that generally requires blasting before it can be removed, the occurrence of soft bedrock that generally can be removed with power tools, and the hazards of flooding and ponding.

The limitations of the soils in the county are rated slight, moderate, or severe. If the limitations are rated moderate or severe, the main limitation or limitations for the use specified are listed. A rating of *slight* indicates that the soil has few or no limitations and is considered desirable for the use named. A rating of *moderate* indicates that a moderate limitation is recognized that can be overcome or corrected. A rating of *severe* indicates that the use of the soil is seriously limited by hazards or restrictions that are difficult to overcome. A rating of severe does not imply that the soil cannot be used. Large scale cuts or fills in an area can alter the natural soil so much that a rating given in the table will no longer apply.

No one particular property equally restricts all types of nonfarm uses. For example, a seasonally high water table that is a moderate limitation for many uses can severely limit the use of the soil for the disposal of septic tank effluent.

Soils are generally rated to a depth of about 4 to 6 feet. Each mapping unit contains small inclusions of other soils that may differ considerably from the named soil for which the ratings have been made. Onsite investigation of specific sites is, therefore, essential for many of the uses.

Following are explanations for the uses rated in table 7.

Homesites.—Soils are rated for homes or other buildings of three stories or less that have basements. Considered in rating are depth to seasonal or prolonged high water table, slope, depth to bedrock, stoniness, and hazard of flooding. For buildings without basements, depth to rock and water table are less restrictive. Slope is considered primarily for subdivision development. It is less restricting for isolated buildings.

Specific location of buildings usually requires on-site investigation. Sewage disposal, water supply, vegetative cover, or access road are not considered in making the rating. Other engineering properties of soils that are pertinent, such as compressibility and bearing capacity, are referred to in the engineering section of this survey.

Streets and parking lots.—Soil requirements for streets and parking lots are similar to those for highways. In rating the soils, the main features considered are depth to seasonal or prolonged high water table, slope, depth to bedrock, stoniness, and hazard of flooding.

Tables 6 and 7 and the text of the subsection "Engineering Uses of the Soils" provide other pertinent information, such as stability of cut slopes, subgrade conditions, and source of fill material. Specific layouts require onsite investigation.

Sanitary land fills.—Disposal of trash and garbage is assumed to be by the trench method or on an area where some soil has been stripped. No importation of fill or cover material is considered in the ratings.

Among the features affecting the use of soils for sanitary land fill are depth to seasonal high water table, risk of free flow of potential pollutants to ground water, slope, texture, depth to bedrock, and the hazard of flooding.

In general, soils that are deep, well drained, not stony, not too permeable, not plastic and sticky, not flooded and level or gently sloping are suitable for sanitary land fill. Rapidly permeable, gravelly and sandy soils are easy to manipulate, but there is a severe hazard of pollution of nearby wells, lakes, and streams.

Septic tank filter fields.—It is assumed that these soils are to be used as drainage fields for disposal of effluent from adequately designed and installed septic tank systems. Source of water supply, whether from individual or community systems, is not a consideration in the ratings, although if there is a possible hazard of pollution to wells, springs, or lakes, footnotes are shown. Specific location of drainage fields for disposal of effluent requires onsite investigation.

Among the major soil properties influencing their use are permeability, depth to seasonal or prolonged high water table, depth to bedrock, slope, stoniness, and the hazard of flooding or ponding.

Lawns and fairways.—Among the soil properties that determine the suitability of soils for lawns and golf fairways are depth to seasonal or prolonged high water table, slope, depth to bedrock, surface texture, stoniness, and hazard of flooding. No imported fill or topsoil is considered in the ratings, and traps or roughs are not considered a part of the fairway. Deep, well drained or moderately well drained soils that have a medium-textured or moderately coarse textured surface layer and are no more than moderately sloping, are well suited to these uses.

TABLE 7.—*Limitation of soils*

[Made land is too variable to be

Soil	Homesites	Streets and parking lots	Sanitary land fills [1]	Septic tank filter fields
Alluvial land	Severe: flooding; seasonally high water table.	Severe: flooding; seasonally high water table.	Severe: flooding; seasonally high water table.	Severe: flooding; seasonally high water table.
Arnot channery silt loam, 2 to 8 percent slopes.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.
Atherton mucky silt loam	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.
Chenango channery silt loam, fans, 0 to 8 percent slopes.	Slight	Slight to moderate: slope.	Severe: pollution hazard.	Slight: pollution hazard.
Chippewa silt loam, 0 to 3 percent slopes.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability.
Chippewa silt loam, 3 to 8 percent slopes.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less.
Chippewa silt loam, 8 to 15 percent slopes.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slope.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less.
Collamer silt loam, 0 to 3 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Severe: seasonally high water table at a depth of 1½ to 2 feet.	Severe: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.
Collamer silt loam, 3 to 8 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slope.	Severe: seasonally high water table at a depth of 1½ to 2 feet.	Severe: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.
Homer silt loam	Severe: seasonally high water table at a depth of 6 to 18 inches for extended periods.	Moderate: seasonally high water table at a depth of 6 to 18 inches for extended periods.	Severe: seasonally high water table at a depth of 6 to 18 inches for extended periods; pollution hazard.	Severe: seasonally high water table at a depth of 6 to 18 inches for extended periods; pollution hazard.
Howard gravelly silt loam, 0 to 3 percent slopes.	Slight	Slight	Severe: pollution hazard.	Slight: severe pollution hazard.
Howard gravelly silt loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Severe: pollution hazard.	Slight: pollution hazard.
Howard gravelly silt loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Severe: pollution hazard.	Moderate: slope; severe pollution hazard.

See footnote at end of table.

for town and country planning

rated and is not shown in this table]

Lawns and fairways	Campsites	Play areas and picnic areas (extensive use)	Athletic fields	Paths and trails
Severe: flooding; seasonally high water table.	Severe: flooding; seasonally high water table.	Severe: flooding; seasonally high water table.	Severe: flooding; seasonally high water table.	Severe: flooding; seasonally high water table.
Severe: bedrock at a depth of 10 to 20 inches; channery surface layer.	Severe: bedrock at a depth of 10 to 20 inches; channery surface layer.	Severe: bedrock at a depth of 10 to 20 inches; channery surface layer.	Severe: bedrock at a depth of 10 to 20 inches; channery surface layer.	Moderate: channery surface layer.
Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.
Moderate: channery surface layer.	Moderate: channery surface layer.	Moderate: channery surface layer.	Severe: channery surface layer.	Moderate: channery surface layer.
Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability.	Severe: prolonged high water table at a depth of 6 inches or less.
Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability.	Severe: prolonged high water table at a depth of 6 inches or less.
Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability.	Severe: prolonged high water table at a depth of 6 inches or less.	Severe: prolonged high water table at a depth of 6 inches or less; slope.	Severe: prolonged high water table at a depth of 6 inches or less.
Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.	Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.	Slight.
Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.	Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability; slope.	Slight.
Moderate: seasonally high water table at a depth of 6 to 18 inches for extended periods.	Severe: seasonally high water table at a depth of 6 to 18 inches for extended periods.	Moderate: seasonally high water table at a depth of 6 to 18 inches for extended periods.	Severe: seasonally high water table at a depth of 6 to 18 inches for extended periods.	Moderate: seasonally high water table at a depth of 6 to 18 inches for extended periods.
Moderate: gravelly surface layer; few cobblestones.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Moderate: gravelly surface layer.
Moderate: gravelly surface layer; few cobblestones.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Moderate: gravelly surface layer.
Moderate: gravelly surface layer; few cobblestones; slope.	Moderate: slope; gravelly surface layer.	Moderate: slope; gravelly surface layer.	Severe: gravelly surface layer; slope.	Moderate: gravelly surface layer.

TABLE 7.—*Limitations of soils*

Soil	Homesites	Streets and parking lots	Sanitary land fills [1]	Septic tank filter fields
Howard gravelly silt loam, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope; pollution hazard.	Severe: slope; severe pollution hazard.
Howard gravelly loam, 25 to 45 percent slopes.	Severe: slope	Severe: slope	Severe: slope; pollution hazard.	Severe: slope; severe pollution hazard.
Hudson silt loam, gravelly substratum, 2 to 8 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slope.	Severe: seasonally high water table at a depth of 1½ to 2 feet; pollution hazard.	Severe: seasonally high water table at a depth of 1½ to 2 feet; slow permeability; pollution hazard in lower part of substratum.
Hudson silty clay loam, gravelly substratum, 8 to 20 percent slopes, eroded.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slope.	Severe: slope	Severe: seasonally high water table at a depth of 1½ to 2 feet; slope; pollution hazard.	Severe: seasonally high water table at a depth of 1½ to 2 feet; slope; slow permeability; pollution hazard in lower part of substratum.
Hudson silty clay loam, gravelly substratum, 20 to 40 percent slopes, eroded.	Severe: slope	Severe: slope	Severe: seasonally high water table at a depth of 1½ to 2 feet; pollution hazard.	Severe: slow permeability; slope; pollution hazard in lower part of substratum.
Lansing gravelly silt loam, 2 to 8 percent slopes.	Moderate: seasonally high water table at a depth of 2 to 2½ feet.	Moderate: seasonally high water table at a depth of 2 to 2½ feet; slope.	Slight	Severe: moderately slow or slow permeability.
Lansing gravelly silt loam, 8 to 15 percent slopes.	Moderate: seasonally high water table at a depth of 2 to 2½ feet; slope.	Severe: slope	Moderate: slope	Severe: moderately slow or slow permeability.
Lansing gravelly silt loam, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: moderately slow or slow permeability; slope.
Lordstown channery silt loam, 2 to 8 percent slopes.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
Lordstown channery silt loam, 8 to 15 percent slopes.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
Lordstown channery silt loam, 15 to 25 percent slopes.	Severe: bedrock at a depth of 20 to 40 inches; slope.	Severe: bedrock at a depth of 20 to 40 inches; slope.	Severe: bedrock at a depth of 20 to 40 inches; slope.	Severe: bedrock at a depth of 20 to 40 inches; slope.
Lordstown and Arnot very rocky soils, 25 to 35 percent slopes.	Severe: bedrock at a depth of less than 40 inches; frequent outcrops; slope.	Severe: bedrock at a depth of less than 40 inches; frequent outcrops; slope.	Severe: bedrock at a depth of less than 40 inches; slope.	Severe: bedrock at a depth of less than 40 inches; slope.
Lordstown and Arnot very rocky soils, 35 to 70 percent slopes.	Severe: bedrock at a depth of less than 40 inches frequent outcrops; slope.	Severe: bedrock at a depth of less than 40 inches; frequent outcrops; slope.	Severe: bedrock at a depth of less than 40 inches; slope.	Severe: bedrock at a depth of less than 40 inches; slope.

See footnote at end of table.

for town and country planning—Continued

Lawns and fairways	Campsites	Play areas and picnic areas (extensive use)	Athletic fields	Paths and trails
Severe: slope	Severe: slope; gravelly surface layer.	Severe: slope	Severe: gravelly surface layer; slope.	Moderate: gravelly surface layer; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: gravelly surface layer; slope.	Severe: slope.
Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slow permeability.	Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slow permeability; slope.	Slight.
Moderate: silty clay loam surface layer; slope.	Moderate: slow permeability; silty clay loam surface layer; slope.	Moderate: silty clay loam surface layer; slope.	Severe: slope	Moderate: silty clay loam surface layer; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Moderate: gravelly surface layer.
Moderate: gravelly surface layer; slope.	Moderate: gravelly surface layer; slope.	Moderate: gravelly surface layer; slope.	Severe: gravelly surface layer; slope.	Moderate: gravelly surface layer.
Severe: gravelly surface layer; slope.	Severe: slope	Severe: slope	Severe: gravelly surface layer; slope.	Moderate: gravelly surface layer; slope.
Moderate: bedrock at a depth of 20 to 40 inches; channery surface layer.	Moderate: channery surface layer.	Moderate: channery surface layer.	Severe: bedrock at a depth of 20 to 40 inches; channery surface layer	Moderate: channery surface layer.
Moderate: bedrock at a depth of 20 to 40 inches; slope; channery surface layer.	Moderate: channery surface layer; slope.	Moderate: channery surface layer; slope.	Severe: bedrock at a depth of 20 to 40 inches; channery surface layer; slope.	Moderate: channery surface layer.
Severe: channery surface layer; bedrock at a depth of 20 to 40 inches; slope.	Severe: slope	Severe: slope	Severe: bedrock at a depth of 20 to 40 inches; channery surface layer; slope.	Moderate: channery surface layer; slope.
Severe: bedrock at a depth of less than 40 inches; frequent outcrops; slope.	Severe: slope	Severe: slope	Severe: bedrock at a depth of less than 40 inches; frequent outcrops; slope.	Severe: slope.
Severe: bedrock at a depth of less than 40 inches; frequent outcrops.	Severe: slope	Severe: slope	Severe: bedrock at a depth of less than 40 inches; frequent outcrops; slope.	Severe: slope.

TABLE 7.—*Limitations of soils*

Soil	Homesites	Streets and parking lots	Sanitary land fills [1]	Septic tank filter fields
Madalin silt loam, gravelly substratum.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding; pollution hazard.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability; some ponding.
Mardin channery silt loam, 2 to 8 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Moderate: seasonally high water table at at depth of 1½ to 2 feet; slope.	Severe: seasonally high water table at a depth of 1½ to 2 feet.	Severe: slow permeability.
Mardin channery silt loam, 8 to 15 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slope.	Severe: slope	Severe: seasonally high water table at a depth of 1½ to 2 feet.	Severe: slow permeability.
Mardin channery silt loam, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: seasonally high water table at a depth of 1½ to 2 feet; slope.	Severe: slow permeability; slope.
Middlebury silt loam	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Muck	Severe: permanently wet; ponding or water table at surface.	Severe: permanently wet; ponding or water table at surface.	Severe: permanently wet; ponding or water table at surface.	Severe: permanently wet; ponding or water table at surface.
Papakating silt loam	Severe: flooding; prolonged high water table at a depth of 6 inches or less.	Severe: flooding; prolonged high water table at a depth of 6 inches or less.	Severe: flooding; prolonged high water table at a depth of 6 inches or less.	Severe: flooding; prolonged high water table at a depth of 6 inches or less.
Phelps gravelly loam, 0 to 4 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Severe: pollution hazard.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; pollution hazard.
Rhinebeck silt loam, gravelly substratum, 0 to 3 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches.	Moderate: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; pollution hazard.	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability; pollution hazard in deep substratum.
Rhinebeck silt loam, gravelly substratum, 3 to 8 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches.	Moderate: seasonally high water table at a depth of 6 to 18 inches; slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches; pollution hazard.	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability; pollution hazard in deep substratum.
Tioga fine sandy loam	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Tioga silt loam	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding

See footnote at end of table.

for town and country planning—Continued

Lawns and fairways	Campsites	Play areas and picnic areas (extensive use)	Athletic fields	Paths and trails
Severe: prolonged high water table at a depth of 6 inches or less; some ponding; pollution hazard in deep substratum.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; slow permeability; some ponding.	Severe: prolonged high water table at a depth of 6 inches or less; some ponding.
Moderate: channery surface layer.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slow permeability; channery surface layer.	Moderate: channery surface layer.	Severe: channery surface layer.	Moderate: channery surface layer.
Moderate: channery surface layer; slope.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slow permeability; slope; channery surface layer.	Moderate: channery surface layer; slope.	Severe: channery surface layer; slope.	Moderate: channery surface layer.
Severe: channery surface layer; slope.	Severe: slope	Severe: slope	Severe: channery surface layer; slope.	Moderate: channery surface layer; slope.
Moderate to slight: flooding.	Moderate to severe: flooding.	Moderate: flooding	Moderate: flooding	Slight.
Severe: permanently wet; ponding or water table at surface.	Severe: permanently wet; ponding or water table at surface.	Severe: permanently wet; ponding or water table at surface.	Severe: permanently wet; ponding or water table at surface.	Severe: permanently wet; ponding or water table at surface.
Severe: flooding; prolonged high water table at a depth of 6 inches or less.	Severe: flooding; prolonged high water table at a depth of 6 inches or less.	Severe: flooding; prolonged high water table at a depth of 6 inches or less.	Severe: flooding; prolonged high water table at a depth of 6 inches or less.	Severe: flooding; prolonged high water table at a depth of 6 inches or less.
Moderate: gravelly surface layer.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Moderate: gravelly surface layer.
Moderate: seasonally high water table at a depth of 6 to 18 inches.	Moderate: seasonally high water table usually at a depth below 1½ feet during season of use; slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.
Moderate: seasonally high water table at a depth of 6 to 18 inches.	Moderate: seasonally high water table usually at a depth below 1½ feet during season of use; slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.
Moderate to slight: flooding.	Moderate: flooding	Slight to moderate: flooding.	Moderate: flooding	Slight.
Moderate to slight: flooding.	Moderate: flooding	Slight to moderate: flooding.	Moderate: flooding	Slight.

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TABLE 7.—*Limitations of soils*

Soil	Homesites	Streets and parking lots	Sanitary land fills [1]	Septic tank filter fields
Tioga silt loam, high bottom	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Tuller channery silt loam, 0 to 8 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches; bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; bedrock at a depth of 10 to 20 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; bedrock at a depth of 10 to 20 inches.
Unadilla silt loam, 0 to 3 percent slopes.	Slight	Slight	Severe: pollution hazard.	Slight: pollution hazard.
Valois gravelly loam, 2 to 8 percent slopes.	Slight	Moderate: slope	Moderate: moderately rapid to rapid permeability; pollution hazard.	Slight
Valois gravelly loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: moderately rapid to rapid permeability; pollution hazard; slope.	Moderate: slope
Valois gravelly loam, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Valois gravelly loam, 25 to 40 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Volusia channery silt loam, 2 to 8 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches.	Moderate: seasonally high water table at a depth of 6 to 18 inches; slope.	Severe: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability.
Volusia channery silt loam, 8 to 15 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches.	Severe: slope	Severe: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches.
Volusia channery silt loam, 15 to 25 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches; slope.	Severe: slope	Severe: seasonally high water table at a depth of 6 to 18 inches; slope.	Severe: seasonally high water table at a depth of 6 to 18 inches; slope.
Wallington silt loam, gravelly substratum, 0 to 3 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches.	Moderate: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; pollution hazard.	Severe: seasonally high water table at a depth of 6 to 18 inches; moderately slow or slow permeability; pollution hazard.
Wallington silt loam, gravelly substratum, 3 to 8 percent slopes.	Severe: seasonally high water table at a depth of 6 to 18 inches.	Moderate: seasonally high water table at a depth of 6 to 18 inches; slope.	Severe: seasonally high water table at a depth of 6 to 18 inches; pollution hazard.	Severe: seasonally high water table at a depth of 6 to 18 inches; moderately slow or slow permeability; pollution hazard.

See footnote at end of table.

for town and country planning—Continued

Lawns and fairways	Campsites	Play areas and picnic areas (extensive use)	Athletic fields	Paths and trails
Slight	Moderate: occasional flooding, but rarely during season of use.	Slight	Slight	Slight.
Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; bedrock at a depth of 10 to 20 inches; channery surface layer.	Moderate: seasonally high water table at a depth of 6 to 18 inches; channery surface layer.
Slight	Slight	Slight	Slight	Slight.
Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Moderate: gravelly surface layer.
Moderate: gravelly surface layer; slope.	Moderate: gravelly surface layer; slope.	Moderate: gravelly surface layer; slope.	Severe: gravelly surface layer; slope.	Moderate: gravelly surface layer.
Severe: gravelly surface layer; slope.	Severe: slope	Severe: slope	Severe: gravelly surface layer; slope.	Moderate: gravelly surface layer; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: gravelly surface layer; slope.	Severe: slope.
Moderate: seasonally high water table at a depth of 6 to 18 inches; channery surface layer.	Moderate: water table usually at a depth below 1½ feet during season of use; slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches; channery surface layer.	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability; channery surface layer.	Moderate: seasonally high water table at a depth of 6 to 18 inches; channery surface layer.
Moderate: seasonally high water table at a depth of 6 to 18 inches; slope; channery surface layer.	Moderate: water table usually at a depth below 1½ feet during season of use; slope.	Moderate: seasonally high water table at a depth of 6 to 18 inches; slope; channery surface layer.	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability; channery surface layer; slope.	Moderate: seasonally high water table at a depth of 6 to 18 inches; channery surface layer.
Severe: slope	Severe: slope	Severe: slope	Severe: seasonally high water table at a depth of 6 to 18 inches; slow permeability; channery surface layer; slope.	Moderate: seasonally high water table at a depth of 6 to 18 inches; slope; channery surface layer.
Moderate: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; moderately slow or slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; moderately slow or slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.
Moderate: seasonally high water table at a depth of 6 to 18 inches.	Moderate: water table usually below 1½ feet during season of use; moderately slow or slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.	Severe: seasonally high water table at a depth of 6 to 18 inches; moderately slow or slow permeability.	Moderate: seasonally high water table at a depth of 6 to 18 inches.

TABLE 7.—*Limitations of soils*

Soil	Homesites	Streets and parking lots	Sanitary land fills [1]	Septic tank filter fields
Williamson silt loam, gravelly substratum, 0 to 3 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Severe: seasonally high water table at a depth of 1½ to 2 feet; pollution hazard.	Severe: moderately slow or slow permeability; pollution hazard.
Williamson silt loam, gravelly substratum, 3 to 8 percent slopes.	Moderate: seasonally high water table at a depth of 1½ to 2 feet.	Moderate: seasonally high water table at a depth of 1½ to 2 feet; slope.	Severe: seasonally high water table at a depth of 1½ to 2 feet; pollution hazard.	Severe: moderately slow or slow permeability; pollution hazard.

[1] Onsite deep studies of the underlying strata, water tables, and hazards of aquifer pollution and drainage into ground water need to be

Campsites.—Soils are rated for use as tent or small trailer campsites for large numbers of people. During the camping season there is assumed to be heavy pedestrian and vehicular traffic. Sewage disposal, water supply, and access roads are not considered in making these ratings. The major soil properties considered are depth to seasonal high water table, permeability, slope, stoniness, surface texture, and hazard of flooding or ponding during the period of frequent use.

Play areas and picnic areas (extensive use).—Soils are rated for play areas to be used mainly by children and for picnic areas that have tables and fireplaces and are to be used by large numbers of people. These areas are essentially in their natural state. Water supply and sewage disposal are not considered in making the rating. The soil properties considered are depth to seasonal high water table, slope, depth to bedrock, surface stoniness, texture of the surface layer, and the hazard of flooding during the period of heavy use.

Athletic fields.—Soils are rated for intensive use for baseball, football, tennis, and similar sports. Areas selected must be nearly level, have good drainage, and have a surface layer of favorable texture. Imported fill material or topsoil is not considered in the ratings.

Paths and trails.—Soils, left in their natural state, are rated for hiking or riding trails. The main features influencing the use of these soils are depth to seasonal or prolonged high water table, slope, surface texture, stoniness or rockiness, and hazard of flooding or ponding.

Descriptions of the Soils

In this section the soils of Chemung County are described in detail and their use and management are discussed. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit tells about the use and suitability of the soil described and something about management needs.

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

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

The acreage and proportionate extent of each mapping unit are shown in table 8. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*11*).

Alluvial Land

Alluvial land (Ab) consists of unconsolidated alluvium that is frequently changed as a result of stream overflow. These soils occur adjacent to streams and small remnants of terraces channeled by flowing or abandoned streams. There is a considerable range of textures within short distances. Some areas are stony or gravelly; others are free of stones. Drainage ranges from good to very poor.

Areas of this soil commonly lie between bottom lands or terraces and the streams. Some areas, however, are

for town and country planning—Continued

Lawns and fairways	Campsites	Play areas and picnic areas (extensive use)	Athletic fields	Paths and trails
Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.	Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.	Slight.
Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet; moderately slow or slow permeability.	Slight	Moderate: seasonally high water table at a depth of 1½ to 2 feet: moderately slow or slow permeability; slope.	Slight.

made for land fills deeper than 5 or 6 feet.

long, narrow strips of intermingled wet and dry soil material that occupy the major part of narrow valleys on uplands. Other areas are in the main Chemung Valley; they consist of flooded gravelly or sandy soil adjacent to the Chemung River, Seeley Creek, and other large tributaries of the Chemung River.

Frequent flooding and, in places, poor drainage limit the use of these soils for farming. Much of the acreage is in brush, weeds, or water-tolerant trees, such as sycamore and willow. A considerable acreage is in permanent pasture, which, in places, is a suitable use. (Capability unit Vw-1; not in a woodland suitability group)

Arnot Series

The Arnot series consists of shallow, medium-textured, well drained and moderately well drained soils that developed in thin glacial till or, in places, in residual rock material. This rock material is derived mainly from underlying shale; from siltstone; or from thin-bedded, fine-grained, sandstone bedrock. The soils are nearly level to very steep. They occupy ridges and hilltops or are adjacent to moderately deep, steep and very steep, Lordstown soils that border the principal valleys of the county.

In a typical profile the surface layer is dark grayish-brown, channery silt loam about 6 inches thick. Just below the surface layer is a friable to firm, very channery silt loam subsoil that is strongly acid. It is yellowish brown in the upper part and light olive brown at a depth below about 13 inches. It rests on thin-bedded gray sandstone bedrock at a depth of about 17 inches.

Good drainage is the dominant feature of Arnot soils, but during wet periods the water table is just above the bedrock in places. The bedrock commonly is shattered and highly jointed, permitting rapid infiltration of free water. Depth of rooting is mainly limited to the 10 to 20 inches above bedrock. Available water capacity is low or very low. The supply of available nitrogen, potassium, and phosphorus is medium. Unlimed, the soil is very strongly acid to strongly acid.

Typical profile of Arnot channery silt loam, 2 to 8 percent slopes, in a cultivated area 50 feet east of Nobles Hill Road and 1 mile north of State Highway 224, in the town of Van Etten:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) channery silt loam; weak, fine, granular structure; friable; many fine roots; 30 to 35 percent coarse fragments; very strongly acid; abrupt, smooth boundary.

B21—6 to 13 inches, yellowish-brown (10YR 5/4) very channery silt loam; moderate, medium, subangular blocky structure; friable to firm; many fine roots; 35 to 45 percent coarse fragments; strongly acid; smooth, clear boundary.

B22—13 to 17 inches, light olive-brown (2.5Y 5/4) very channery silt loam; weak, medium, subangular blocky structure; friable; many fine roots; 40 to 50 percent coarse fragments; strongly acid; abrupt, smooth boundary.

R—17 inches+, gray, thin-bedded, fine-grained sandstone bedrock; shattered and fractured in the top 4 to 6 inches.

Thickness of the soil above bedrock ranges from 10 to 20 inches. Channery fragments of sandstone and siltstone are dominant, but in some areas fragments are large enough to be classed as flagstones.

Hue of the Ap horizon ranges from 10YR to 2.5Y, value is 3 or 4, and chroma is 2 or 3. The B21 horizon ranges in hue from 10YR to 2.5Y, value is 5 or 6, and chroma is 3 or 4. Few to common mottles that have a chroma of 3 or more are in the material immediately above the bedrock in some profiles. The underlying bedrock is thin fissile shale, siltstone, and fine-grained sandstone. The reaction of the solum is strongly acid to very strongly acid.

Arnot soils are commonly adjacent to somewhat poorly drained to poorly drained, shallow Tuller soils and the moderately deep Lordstown soils that formed in similar materials. Arnot soils are also near the moderately well drained Mardin soils and the somewhat poorly drained Volusia soils that also formed in similar materials. The Mardin and Volusia soils, however, are deep and have a fragipan.

Arnot channery silt loam, 2 to 8 percent slopes (ArB).—This soil is mostly in long, relatively narrow areas on ridgetops and gentle upper slopes just below the summits. Individual areas range in size from a few acres to more than 100 acres.

Included in mapping were areas of moderately deep Lordstown soils, small areas of Arnot soils that have slopes of 8 to 15 percent, and small areas of the similar, but somewhat poorly drained to poorly drained, Tuller soils.

This soil can be used for crops, pasture, or hay but is poorly suited to these uses because it is strongly acid and has a low or very low available water capacity. There is a slight hazard of erosion if the soil is cultivated and not protected. This soil is at the highest elevations

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

Soil	Acres	Percent	Soil	Acres	Percent
Alluvial land	6, 640	2. 5	Mardin channery silt loam, 2 to 8 percent slopes	6, 395	2. 4
Arnot channery silt loam, 2 to 8 percent slopes	11, 940	4. 5	Mardin channery silt loam, 8 to 15 percent slopes	15, 110	5. 7
Atherton mucky silt loam	280	. 1	Mardin channery silt loam, 15 to 25 percent slopes	7, 120	2. 7
Chenango channery silt loam, fans, 0 to 8 percent slopes	5, 370	2. 0	Middlebury silt loam	2, 870	1. 1
Chippewa silt loam, 0 to 3 percent slopes	1, 000	. 4	Muck	325	. 1
Chippewa silt loam, 3 to 8 percent slopes	2, 510	1. 0	Papakating silt loam	3, 075	1. 1
Chippewa silt loam, 8 to 15 percent slopes	2, 205	. 8	Phelps gravelly loam, 0 to 4 percent slopes	490	. 2
Collamer silt loam, 0 to 3 percent slopes	295	. 1	Rhinebeck silt loam, gravelly substratum, 0 to 3 percent slopes	125	. 1
Collamer silt loam, 3 to 8 percent slopes	335	. 1	Rhinebeck silt loam, gravelly substratum, 3 to 8 percent slopes	450	. 2
Homer silt loam	235	. 1	Tioga fine sandy loam	1, 535	. 6
Howard gravelly silt loam, 0 to 3 percent slopes	11, 160	4. 2	Tioga silt loam	3, 140	1. 2
Howard gravelly silt loam, 3 to 8 percent slopes	2, 800	1. 1	Tioga silt loam, high bottom	865	. 3
Howard gravelly silt loam, 8 to 15 percent slopes	995	. 4	Tuller channery silt loam, 0 to 8 percent slopes	345	. 1
Howard gravelly silt loam, 15 to 25 percent slopes	190	. 1	Unadilla silt loam, 0 to 3 percent slopes	3, 395	1. 3
Howard gravelly silt loam, 25 to 45 percent slopes	1, 220	. 5	Valois gravelly loam, 2 to 8 percent slopes	815	. 3
Hudson silt loam, gravelly substratum, 2 to 8 percent slopes	1, 825	. 7	Valois gravelly loam, 8 to 15 percent slopes	1, 470	. 6
Hudson silty clay loam, gravelly substratum, 8 to 20 percent slopes, eroded	1, 480	. 6	Valois gravelly loam, 15 to 25 percent slopes	880	. 3
Hudson silty clay loam, gravelly substratum, 20 to 40 percent slopes, eroded	815	. 3	Valois gravelly loam, 25 to 40 percent slopes	1, 620	. 6
Lansing gravelly silt loam, 2 to 8 percent slopes	495	. 2	Volusia channery silt loam, 2 to 8 percent slopes	21, 840	8. 3
Lansing gravelly silt loam, 8 to 15 percent slopes	540	. 2	Volusia channery silt loam, 8 to 15 percent slopes	47, 200	17. 9
Lansing gravelly silt loam, 15 to 25 percent slopes	225	. 1	Volusia channery silt loam, 15 to 25 percent slopes	7, 135	2. 7
Lordstown channery silt loam, 2 to 8 percent slopes	7, 165	2. 7	Wallington silt loam, gravelly substratum, 0 to 3 percent slopes	795	. 3
Lordstown channery silt loam, 8 to 15 percent slopes	15, 010	5. 7	Wallington silt loam, gravelly substratum, 3 to 8 percent slopes	370	. 1
Lordstown channery silt loam, 15 to 25 percent slopes	18, 975	7. 2	Williamson silt loam, gravelly substratum, 0 to 3 percent slopes	315	. 1
Lordstown and Arnot very rocky soils, 25 to 35 percent slopes	31, 120	11. 8	Williamson silt loam, gravelly substratum, 3 to 8 percent slopes	150	. 1
Lordstown and Arnot very rocky soils, 35 to 70 percent slopes	8, 005	3. 0	Water surface	930	. 4
Madalin silt loam, gravelly substratum	355	. 1	Cemeteries	205	. 1
Made land	1, 190	. 5	Gravel pits and quarries	340	. 1
			Total	263, 680	100. 0

in the county, and the growing season is 1 to 2 weeks shorter than in adjacent valleys. Generally, this soil is better suited to woodland or wildlife habitat than to other uses. (Capability unit IIIe-4; woodland suitability group 4d1)

Atherton Series

The Atherton series includes deep, poorly drained and very poorly drained soils. These soils developed in glacial outwash materials, derived mainly from shale and sandstone. They contain small amounts of limestone in some places. They occupy level to depressional areas of outwash plains and stream terraces.

In a typical profile in a cultivated field, the plow layer is black mucky silt loam about 8 inches thick. It contains a few pebbles. The subsoil is mottled, dark-gray to light-gray, friable loam or silt loam that is medium acid to slightly acid and contains some gravel. The substratum is at a depth below 31 inches. It is neutral to moderately alkaline, and becomes calcareous with depth. It is mottled, dark grayish-brown very gravelly sandy loam in the upper part and grayish-brown gravel and sand at a depth of about 48 inches.

The water table is at or near the surface most of the year. The high water table is due in part to ground water fluctuating in permeable soil layers and in part to impervious silty layers deep in the substratum. Unless this soil is drained, rooting is confined mainly to the top 10 to 15 inches. As the water table recedes, a few roots extend below these depths. The available water capacity for this zone is low to moderate, but normally there is more than enough moisture for plant growth. The supply of available potassium and phosphorus is medium. The total nitrogen content is high, but it is released very slowly when the soils are wet and cold. Applications of nitrogen are usually needed to foster good plant growth in spring. Unlimed, the surface layer is medium acid to slightly acid.

Typical profile of Atherton mucky silt loam in an idle area, 500 feet northeast of junction of State Highway 17 and Kahler Road, 200 feet east of Kahler Road, in the town of Big Flats:

Ap—0 to 8 inches, black (10YR 2/1) mucky silt loam; moderate, fine, granular structure; friable; many fine roots; less than 5 percent gravel; slightly acid; abrupt, smooth boundary.

B21g—8 to 13 inches, dark-gray (5Y 4/1) loam or silt loam; few to common, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium and fine, subangular blocky structure; friable; few fine roots; 5 percent gravel; medium acid; clear, wavy boundary.

B22g—13 to 31 inches, gray to light-gray (5Y 6/1) silt loam; common, fine, distinct, olive (5Y 5/6) mottles and few, fine, faint, gray (5Y 5/1) mottles; weak, thick, platy structure within moderate, coarse, prismatic structure; friable; few fine roots; 5 to 10 percent gravel; slightly acid; clear, smooth boundary.

IIC1—31 to 48 inches, dark grayish-brown (2.5Y 4/2) very gravelly sandy loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; friable; 35 to 40 percent gravel; neutral to mildly alkaline; weakly calcareous with increasing depth; clear, wavy boundary.

IIC2—48 to 54 inches, grayish-brown (10YR 5/2) gravel and sand; mildly to moderately alkaline; calcareous.

The solum ranges in thickness from 30 to 44 inches. Pebbles and cobblestones, mainly of sandstone, siltstone, and shale, range from 2 to 50 percent by volume of some subhorizons, but average less than 35 percent to a depth of 40 inches. The A horizon ranges from black (10YR 2/1) to very dark grayish brown (2.5Y 3/2). The B2 horizon ranges from dark gray (10YR 4/1) to light olive gray (5Y 6/2), and has few to common yellowish-brown or dark yellowish-brown to olive mottles. Texture of the B horizon ranges from silt loam or loam to gravelly silt loam or gravelly loam. The C horizon is not well defined in some profiles. Reaction ranges from medium to slightly acid in the A and B21 horizons and from slightly acid to moderately alkaline in the B22 and C horizons. The lower part of the B22 and C horizons are calcareous in some profiles.

Gray colors are more prominent to a depth of more than 30 inches which is deeper than in the defined range for the series, but this difference does not alter the usefulness and behavior of these soils.

The Atherton soils are commonly in depressions adjacent to the well-drained to somewhat excessively drained Howard soils, the moderately well drained Phelps soils, and the somewhat poorly drained Homer soils that have formed in similar materials.

Atherton mucky silt loam (At).—This soil occupies flat or depressed areas on terraces or benches. Slope ranges from 0 to 3 percent. Most areas are relatively small, seldom exceeding 20 acres in size. They are usually long and narrow and have the same trend as the valley or the stream flowing through the valley.

Included in mapping were areas of soils that have a coarser texture than is typical. Drainage, which determines the use of these areas, is the same, however. Also included were small areas of similar but somewhat poorly drained Homer soils.

This soil is too wet to be used for crops unless it is artificially drained. Undrained, it is suitable for permanent pasture; and some areas can be grazed late in summer and in fall. The areas are too wet for tree species commonly available for planting. (Capability unit IVw-2; woodland suitability group 4w1)

Chenango Series

The Chenango series consists of deep, well-drained and somewhat excessively drained, medium-textured soils. These soils developed in channery and gravelly materials on old alluvial fans. They are nearly level to gently sloping.

In a typical profile in a cultivated area, the plow layer is very dark grayish-brown channery silt loam about 8 inches thick. The subsoil extends to a depth of about 28 inches. It is friable, olive-brown to light olive-brown channery silt loam that is strongly acid. The underlying material is friable, dark grayish-brown very channery loam that is medium acid to strongly acid.

The water table is controlled by the general level of ground water in the valleys. It is normally at a depth of more than 4 feet. The rooting depth of plants is not restricted; however, most roots are in the topmost 3 feet of soil where most of the fine material occurs. Available moisture capacity is moderate. These soils have a medium supply of available phosphorus, potassium, and nitrogen. Unlimed, they are strongly acid to very strongly acid. The high content of flat, angular channery fragments slightly interferes with tillage operations.

Typical profile of Chenango channery silt loam, fans, 0 to 8 percent slopes, in a cultivated area 150 feet west of Barnes Hill Road, one-half mile north of junction of Sing Sing and Barnes Hill Roads, in the town of Big Flats:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) channery silt loam; weak, medium to fine, granular structure; very friable; many fine roots; 15 to 20 percent coarse fragments of thin, flat pieces of local shale and sandstone rock; medium acid; abrupt, smooth boundary.

B21—8 to 18 inches, olive-brown (2.5Y 4/4) channery silt loam; weak, medium to fine, subangular blocky structure; friable; few fine roots; 15 to 25 percent flat stone fragments; strongly acid; clear, wavy boundary.

B22—18 to 28 inches, light olive-brown (2.5Y 5/4) channery silt loam; moderate to weak, medium, subangular blocky structure; friable; few fine roots; 25 to 35 percent flat stone fragments; strongly acid; diffuse, wavy boundary.

IIC—28 to 50 inches, dark grayish-brown (10YR 4/2) very channery loam; single grain; friable; tops of channery fragments have coatings of gray silt; few fine roots; 50 to 60 percent flat stone fragments, all horizontally oriented; medium acid to strongly acid.

The solum ranges in thickness from 24 to 33 inches. Coarse, mainly flat fragments of local sandstone and siltstone are 5 to 20 percent of the Ap horizon, 15 to 50 percent of the B horizon, and 50 to 70 percent of the C horizon. The Ap horizon ranges from 10YR to 2.5Y in hue, from 3 to 5 in value, and is 2 or 3 in chroma. Unlimed, the Ap horizon ranges from strongly acid to very strongly acid. The B horizon has a hue of 10YR or 2.5Y, is 4 or 5 in value, and is 3 to 6 in chroma. Texture of the B2 horizon ranges from silt loam to loam in the fine earth fraction. The C horizon is mainly flat stone and has some gravel and loam as the fine earth. The coarse fragments are normally horizontally oriented.

Chenango soils on old alluvial fans are similar to Howard soils that occupy nearby gravelly terraces. Chenango soils contain many flat stone fragments in contrast to the rounded pebbles in Howard soils. They also lack the limestone that is present in Howard soils. Chenango soils are commonly adjacent to wet areas of Papakating soils and well-drained Tioga soils that formed in alluvial sediment. In places Chenango soils are near silty soils on stream terraces. These are the well-drained Unadilla soils, the moderately well drained Williamson soils, and the somewhat poorly drained Wallington soils.

Chenango channery silt loam, fans, 0 to 8 percent slopes (CeB).—This nearly level to gently sloping soil occupies old alluvial fans built up by postglacial side streams that deposited channery and gravelly material on the floors of the major valleys (fig. 9). These fan-shaped areas range in size from less than 5 acres to more than 100 acres.

Figure 9.—**Cayuta Valley with Chenango channery silt loam, fans, 0 to 8 percent slopes, in foreground.**

Included in mapping were many elongated areas on low terraces or high bottom lands that parallel the small streams that flood occasionally. These areas, like the fans, contain large amounts of horizontally oriented channery fragments and flagstones derived from local rocks.

This soil is suitable for crops, pasture, or forest. It tends to be droughty, and the more sloping areas are subject to erosion if cultivated and not protected. This soil is suited to all crops commonly grown in this region, such as alfalfa, corn, and oats. The mild relief, good drainage, and accessibility of the area between Horseheads and Big Flats has resulted in its being used for residential development. (Capability unit IIs-1; woodland suitability group 3o1)

Chippewa Series

The Chippewa series consists of deep, poorly drained, medium-textured soils that developed in glacial till derived mainly from local shale and fine-grained, thin-bedded, sandstone bedrock. The soils are nearly level to moderately sloping. They are in depressions, drainageways, and seeps on uplands.

In a typical profile in an undisturbed area, 3 inches of black organic material overlies a surface layer of very dark grayish-brown silt loam about 3 inches thick. Just below is a layer of faintly mottled, dark-gray, friable silt loam that grades to prominently mottled, light-gray, firm channery silt loam at a depth of 6 inches. This layer is strongly acid and extends to a depth of about 18 inches. Below this, the subsoil is a very firm and brittle fragipan of channery silt loam. It is grayish brown, prominently mottled with brownish yellow to a depth of about 30 inches. Below this, it is light olive brown and has faint light-gray and prominent yellowish-brown motttles. The fragipan is medium acid and has large prisms surrounded by thin silty streaks of light brownish gray and gray that pinch out at a depth of about 40 inches. Below this, the substratum is very firm, mottled, grayish-brown channery silt loam till that is slightly acid.

In spring and in wet periods, the water table is at or near the surface of Chippewa soils. It is perched on the slowly permeable fragipan. Plant roots do not penetrate the fragipan except along the sides of prisms. Available water capacity of the rooting zone is low to moderate. Plants are rarely affected by lack of water, however, because the soils are usually saturated in spring, and water from adjacent areas seeps into them long after periods of rainfall. Total nitrogen content is high, but it is released slowly in spring when the soils are cold and wet. These soils have a medium supply of available phosphorus and potassium. Unlimed, they are very strongly acid to slightly acid.

Typical profile of Chippewa silt loam, 0 to 3 percent slopes, in an idle area 500 feet north of Cayuta Road and 1,000 feet west of the Schuyler County line, in the town of Erin:

01—3 inches to 0, black (5Y 2/2) fibrous root mass; very strongly acid; abrupt, smooth boundary.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; 5/1); very firm, brittle; 25 percent coarse fragments; very strongly acid; clear, smooth boundary.

A21g—3 to 6 inches, dark-gray (10YR 4/1) silt loam; few, faint mottles of grayish brown (10YR 5/2); moderate, coarse, granular structure and weak, fine, subangular blocky structure; friable; common fine roots; 15 percent coarse fragments; very strongly acid; gradual, wavy boundary.

A22g—6 to 18 inches, light-gray (2.5Y 7/2) channery silt loam; many, coarse, prominent mottles of brownish yellow (10YR 6/6); moderate, medium, angular blocky structure; firm, slightly sticky; few fine roots; 15 to 20 percent coarse fragments; strongly acid; clear, wavy boundary.

Bx1g—18 to 30 inches, grayish-brown (2.5Y 5/2) channery silt loam; many, coarse, prominent mottles of brownish yellow (10YR 6/8); strong, very coarse prisms 4 to 8 inches across that have coatings of light brownish-gray (2.5Y 6/2) silt; very firm, brittle; 20 to 30 percent coarse fragments; medium acid; diffuse, wavy boundary.

Bx2—30 to 40 inches, light olive-brown (2.5Y 5/4) channery silt loam; common, faint, light-gray (2.5Y 7/2) mottles and few, medium, prominent mottles of yellowish brown (10YR 5/6); moderate, very coarse prisms 8 to 20 inches across that have coatings of gray (5Y 5/1); very firm, brittle; 25 percent coarse fragments; medium acid; diffuse, wavy boundary.

C—40 to 50 inches, grayish-brown (2.5Y 5/2) channery silt loam; common, faint, light-gray (2.5Y 7/2) mottles along cleavage planes; moderate, thick, platy structure; very firm; 30 percent coarse fragments; slightly acid.

The solum ranges in thickness from 40 to 58 inches. Bedrock commonly is deeper than 5 feet, but in places it is only 40 inches below the surface. The percentage of coarse fragments ranges from 10 to 30 percent. The size and number of fragments increase as depth increases.

Hue of the A horizon of cultivated or pastured soil is dominantly 10YR or 2.5Y, value is 3 or 4, and chroma is 2 to 4. Structure is weak to moderate. The A2g horizon ranges from 10YR to 5Y in hue, from 4 to 7 in value, and is 1 or 2 in chroma. Texture ranges from loam to silt loam or from channery loam to channery silt loam; clay content is 18 to 27 percent. Reaction is very strongly acid to slightly acid. The Bx horizon ranges from 4 to 5 in value; from 1 to 4 in chroma, and from 5Y to 10YR in hue. It has few to many mottles. This horizon is loam to silt loam in texture, and the content of coarse fragments ranges from 10 to 30 percent. The structure is coarse, prismatic parting to weak, coarse, subangular blocky. Reaction ranges from strongly acid to slightly acid. The C horizon is grayish-brown or dark grayish-brown channery to flaggy or stony silt loam or loam glacial till. Reaction ranges from medium acid to neutral. Some profiles are calcareous at a depth of 5 to 6 feet. The C horizon is massive or structure ranges from weak to moderate platy or blocky.

Chippewa soils are generally adjacent to somewhat poorly drained Volusia soils and moderately well drained Mardin soils. All these soils developed in the same kind of parent material, and occur throughout upland sections of the county. Chippewa soils occupy flat or depressed areas; Volusia soils lie on level or slightly concave, long, smooth slopes; and Mardin soils are on rounded, somewhat convex landforms. Other soils that are near Chippewa soils are Lordstown, Arnot, and Tuller soils. These are better drained than Chippewa soils; they lack a fragipan, and they formed in moderately deep or shallow deposits of till over sandstone, siltstone, or shale bedrock.

Chippewa silt loam, 0 to 3 percent slopes (ChA).—This soil has the profile described as typical for the series. It is nearly level or slightly depressed, and occurs in areas between the valley floors and the hilltops in all parts of the county. The individual areas of this wet, seepy soil are irregular in shape and range in size from less than 2 acres to more than 100 acres.

Small spots of better drained Volusia and Tuller soils were included in mapping. Also included were a few very poorly drained spots and some areas along drainageways and in depressions that contain a thin alluvial deposit. Chippewa soils are acid, but a few small areas that are neutral in reaction were included in mapping. These areas are mostly near Sullivanville in the town of Veteran.

Unless drained, this soil is too wet to be suitable for crops, but it is suitable for pasture, forest, or wildlife habitat. Drainage outlets are often difficult to locate. A large area of the soil is forested. Most of the cleared land is in permanent pasture.

Many areas are good sites for ponds that can be used for wildlife habitat or for recreation. (Capability unit IVw-1; woodland suitability group 5w1)

Chippewa silt loam, 3 to 8 percent slopes (ChB).—This gently sloping soil has a profile similar to the one described as typical, except that the upper part of the subsurface layer usually contains some yellowish-brown mottles. This soil occupies foot slopes, areas below seeps, and areas along drainageways on uplands where runoff water accumulates. Individual areas are irregular in shape and range in size from 2 acres to more than 50 acres. Most areas, however, are less than 6 acres in size.

Small areas of better drained Volusia soils were included in mapping. In the vicinity of Sullivanville, areas of soils that are less acid than typical were also included.

If this soil is to be cropped, some form of artificial drainage is needed. Drainage is usually easier to establish on this gently sloping soil than on the nearly level Chippewa soil. There is a hazard of erosion if this soil is cultivated and not protected.

Practically none of this soil has been improved by supplemental drainage. Most areas that are formed are used for pasture. Much of this soil, however, has never been cleared of forest. (Capability unit IVw-1; woodland suitability group 5w1)

Chippewa silt loam, 8 to 15 percent slopes (ChC).—This soil has a profile similar to that described as typical, but the surface layer usually contains more channery rock fragments. It lies in seepy areas and along drainageways on uplands. Individual areas range in size from 2 acres to 40 or 50 acres, but most areas are near the lower limits of this range.

Included in mapping were small spots of better drained Volusia and Mardin soils and shallow Tuller soils.

Slope and the hazard of erosion are greater limitations to farming this soil than to farming the gently sloping Chippewa soils, but otherwise their use is much the same. (Capability unit IVw-1; woodland suitability group 5w1)

Collamer Series

The Collamer series consists of deep, moderately well drained, medium-textured soils that developed in lake-laid silts and very fine sands. These nearly level to gently sloping soils are on glacial lake deposits along the major valleys of the county.

In a typical profile in a cultivated area, the plow layer is dark grayish-brown silt loam about 9 inches thick. It is underlain by a leached layer of thin, slightly acid, friable, yellowish-brown silt loam. This layer gradually merges with the slightly acid subsoil at a depth of about 12 inches. The upper part of the subsoil is firm, brown to dark-brown silt loam that extends to a depth of about 18 inches. Below this, the main part of the subsoil is dark grayish-brown, firm heavy silt loam mottled with dark gray and yellowish brown. A calcareous substratum is at a depth of about 32 inches. It is firm, dark grayish-brown silt loam that has a few gray and yellowish-brown mottles.

Early in spring and during wet periods, the water table is at a depth of 1½ to 2 feet for short periods. The slowly permeable or moderately slowly permeable subsoil and substratum restrict the downward movement of water. Plant roots are confined mainly to the top 18 to 24 inches early in the season, but as the season progresses, a few go deeper. Available water capacity is moderate to high. Plants seldom show moisture stress except during prolonged dry periods. These soils have a medium supply of available nitrogen, potash, and phosphorus. Unlimed, Collamer soils are slightly acid to neutral in the upper part of the profile.

Typical profile of Collamer silt loam, 0 to 3 percent slopes, in a cultivated area 1,800 feet north of the junction of Hickory Grove Road and Colonial Drive, 20 feet east of Hickory Grove Road, in the town of Big Flats:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many fine roots; less than 2 percent coarse fragments; slightly acid; clear, wavy boundary.

A2—9 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, thick, platy structure; friable, many fine roots; less than 2 percent coarse fragments; slightly acid; clear, wavy boundary.

B&A—12 to 18 inches, brown to dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; firm; few fine roots; thin yellowish-brown (10YR 5/4) coatings on ped faces; less than 3 percent coarse fragments; slightly acid; clear, wavy boundary.

B2t—18 to 32 inches, dark grayish-brown (10YR 4/2) heavy silt loam; common, fine, faint, dark-gray (10YR 4/1) mottles and distinct, yellowish-brown (10YR 5/4) mottles; weak, medium and coarse, subangular blocky structure; firm; few fine roots; few pores with clay linings; distinct clay films on 5 to 10 percent of ped faces; no coarse fragments; slightly acid; gradual, wavy boundary.

C—32 to 64 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, faint, gray (5Y 5/1) mottles and dark yellowish-brown (10YR 4/4) mottles; very coarse prismatic peds coated with gray (5Y 5/1) silt ¼ to ¾ inch in thickness; borders of silt coatings are yellowish brown (10YR 5/6); firm; few fine roots along ped faces; mildly alkaline to moderately alkaline; calcareous.

The solum ranges in thickness from 24 to 40 inches. Free lime is at a depth of 22 to 60 inches. The reaction of the solum is slightly acid to neutral; alkalinity increases with depth. Coarse fragments less than 3 inches in diameter typically make up less than 5 percent of the solum, and many areas are free of stone and gravel. Bedrock is generally at a depth of more than 10 feet. The Ap horizon ranges from dark grayish brown to very dark grayish brown. The A2 horizon is dominantly 10YR in hue, 3 to 5 in value, and 3 and 4 in chroma. In some places, it is faintly mottled. The B2t horizon is 7.5YR or 10YR in hue. Mottles range from faint to distinct. Clay is 18 to 35 percent of the horizon, and sand coarser than very fine sand makes up less than 15 percent. The C horizon is generally silt loam or very fine sandy loam that has silty clay layers in places. Deep exposures show stratification in the substratum in many places.

These soils have dark-gray mottles in the B2t horizon that are lacking in the defined range for the series, but this difference does not alter their usefulness and behavior.

Collamer soils have a close geographical association with Howard soils. North of the town of Horseheads, Collamer soils merge with the heavier textured Hudson soils. Collamer soils formed in silt and very fine sand; Hudson soils, in silt and clay; and Howard soils, in bedded gravel and sand. Collamer soils are in the same general region as Williamson soils, but lack a well developed fragipan in the subsoil and are less acid in reaction throughout the profile.

Collamer silt loam, 0 to 3 percent slopes (CoA).—This soil has the profile described as typical for the series. It is nearly level and occupies areas on the glacial lake plain, mainly between the towns of Horseheads and Big Flats. Areas of this soil are irregular in shape and range from 3 to 20 acres in size.

Included in mapping were some areas of soils that are browner in the subsoil and lack the mottles. Small spots of the more acid Williamson soils and the finer textured Hudson soils were also included.

This soil is suited to crops, pasture, and woodland. The slight wetness in the spring can briefly delay planting and limit use of the soil for some varieties of alfalfa. It does not, however, interfere to any extent with the growth of corn or small grain. (Capability unit IIw-2; woodland suitability group 2o1)

Collamer silt loam, 3 to 8 percent slopes (CoB).—This gently sloping soil has a profile similar to the one described as typical, except that the subsurface layer is thinner. It occurs on glacial lake plains between Horseheads and Big Flats and north of Horseheads around the edges of the heavier textured Hudson soils. Areas of this soil are irregular in shape and 3 to 20 acres in size.

Included in mapping were small areas of soils that have better drainage, as well as small spots of more acid Williamson soils and finer textured Hudson soils.

This soil is suited to crops, pasture, and woodland. Erosion is a serious hazard if the soil is cultivated and not protected. Occasionally in spring, slight wetness delays planting. (Capability unit IIe-3; woodland suitability group 2o1)

Homer Series

The Homer series consists of deep, somewhat poorly drained, medium-textured soils that developed in glacial outwash materials derived from shale and sandstone. These soils contain a significant amount of limestone gravel. They are nearly level and occupy depressed areas in the glacial outwash plain.

In a typical profile in a cultivated area, the plow layer is dark grayish-brown silt loam that contains some gravel and is about 7 inches thick. It is underlain by a friable, leached layer of mottled, light olive-brown silt loam that contains some gravel and extends to a depth of about 14 inches. The subsoil is sticky, mottled, dark grayish-brown gravelly sandy clay loam to a depth of 28 inches, and slightly sticky, mottled, dark grayish-brown very gravelly sandy loam in the lower part. The subsoil also contains small splotches and streaks of clayey material that is dark gray. The reaction is slightly acid. The calcareous substratum is at a depth of about 36 inches. It consists of stratified gravel and sand that is brown, dark brown, and very dark grayish brown. This layer also contains a few partly weathered limestone pebbles that are yellowish brown.

In spring and during wet periods, the water table is less than 1½ feet below the surface. It is governed mainly by the natural ground-water level. Permeability is moderately slow in the upper part of the subsoil and moderately rapid or rapid in the lower part of the subsoil and in the substratum. Unless these soils are drained, the water table restricts rooting mainly to the upper 20 to 24 inches. These soils have a moderate available water capacity, which is generally sufficient for plants. Although they have a medium to high total nitrogen content, it is released slowly in spring and plants respond to applications of nitrogen. The supply of available potassium and phosphorus is medium. Unlimed, the surface layer is medium acid to neutral.

Typical profile of Homer silt loam, in a cultivated area 200 feet east of Kahler Road, and 500 feet south of its junction with Sing Sing Road, in the town of Big Flats:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium and fine, granular structure; very friable; many fine roots; 5 to 10 percent gravel; slightly acid; abrupt, smooth boundary.

A2—7 to 14 inches, light olive-brown (2.5Y 5/4) silt loam; few, fine, faint mottles of light olive brown (2.5Y 5/6); weak, fine and medium, granular structure; friable; common fine roots; 5 to 10 percent gravel; medium acid; clear, wavy boundary.

B2t—14 to 28 inches, dark grayish-brown (2.5Y 4/2) gravelly sandy clay loam; common, fine, faint, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, granular structure; sticky; few fine roots; patchy clay films on gravel and ped surfaces; 25 to 35 percent gravel; slightly acid; gradual, wavy boundary.

B3—28 to 36 inches, dark grayish-brown (2.5Y 4/2) very gravelly sandy loam; coarse, faint, dark yellowish-brown (10YR 4/4) mottles; narrow streaks and small splotches of dark-gray (5Y 4/1) clayey material; weak, medium and fine, granular structure; slightly sticky; few fine roots; few, brown, partially weathered limestone pebbles; 35 to 40 percent fine and medium gravel; 1 percent cobblestones that are 3 inches or more in diameter; slightly acid; gradual, wavy boundary.

IIC—36 to 57 inches, brown to dark-brown (10YR 4/3) and very dark grayish-brown (10YR 3/2) stratified gravel and sand and a few yellowish-brown (10YR 5/8), partially weathered limestone pebbles; single grain; loose; very few roots in the upper part; mildly alkaline to moderately alkaline; calcareous.

The solum ranges in thickness from 32 to 38 inches. The depth to carbonates corresponds to the depth of the solum. Coarse fragments are 5 to 35 percent of the solum and 45 to 65 percent of the IIC horizon. Some subhorizons contain more than 35 percent coarse fragments, but the average for the solum is less than 35 percent. It is mostly gravel and a few, flat, angular, sandstone fragments.

The Ap horizon ranges in color from dark grayish brown to very dark grayish brown. The A2 horizon ranges from 10YR to 5Y in hue, from 4 to 6 in value, and from 2 to 4 in chroma. Mottles are gray or light olive brown. Texture ranges from sandy loam to silt loam in the fine earth fraction. Structure is weak to moderate. Reaction ranges from medium acid to neutral. The B horizon ranges from 10YR to 2.5Y in hue, from 4 to 6 in value, and from 2 to 4 in chroma. Mottles are faint to prominent. They are 10YR or 2.5Y in hue, 4 in value, and 1 to 4 in chroma. Structure is weak or moderate. Reaction ranges from slightly acid to neutral or mildly alkaline. Texture of the B2t horizon ranges from gravelly silt loam to gravelly sandy clay loam. The IIC horizon is dark gray to brown gravel and sand. Stratification is variable and layers are frequently silty.

The very gravelly B3 horizon is thicker than the defined range for the series, but this difference does not alter soil behavior.

Homer soils are closely associated with the well-drained to somewhat excessively drained Howard soils, the moderately well drained Phelps soils, and the poorly drained and very poorly drained Atherton soils that developed in similar materials. Homer soils are near the somewhat poorly drained Wallington soils, but lack the silty solum and fragipan.

Homer silt loam (Hm).—This nearly level soil occupies flat to slightly depressed areas that have slow runoff and often receive drainage water from the higher surrounding land. Slopes are less than 3 percent. Individual areas are irregular in shape and usually less than 5 to 10 acres in size.

Included in mapping were spots of the siltier Wallington soil and the wetter Atherton soils. Also included were small areas of soils that have a gravelly silt loam surface layer.

This soil is suited to crops, pasture, or woodland, but the choice of crop is restricted by the somewhat poor drainage. With adequate drainage it is well suited to the crops commonly grown. Its low position in the landscape makes artificial drainage difficult in places. Most areas are idle or in permanent pasture. Drainage is one of the principal management needs. (Capability unit IIIw-1; woodland suitability group 3w1)

Howard Series

The Howard series consists of deep, well-drained and somewhat excessively drained, medium-textured soils that developed in stratified glacial outwash deposits of sand and gravel. The soil material is derived mainly from shale, sandstone, and siltstone that includes a significant amount of limestone. It was deposited by glacial melt water as outwash plains, kames, stream terraces, or alluvial fans in the principal valleys of the county. Howard soils are nearly level to steep.

In a typical profile in a cultivated area, the plow layer is dark grayish-brown gravelly silt loam about 9 inches thick. It is underlain by a thick, leached layer of friable, slightly acid, dark yellowish-brown gravelly fine sandy loam. This layer merges gradually with the subsoil at a depth of about 22 inches. The subsoil is friable, dark-brown very gravelly silt loam to a depth of about 32 inches. Below this it is dark-brown very gravelly silt loam to light clay loam that has loose consistency. Reaction is slightly acid to neutral. The subsoil tongues irregularly into the calcareous substratum at a depth of about 52 inches. The substratum consists of loose yellowish-brown silty gravel and sand.

The water table is generally at a depth of more than 4 feet.

Permeability is moderate to moderately rapid in the solum and rapid in the substratum. Excess water is not a limitation to use of these soils for farming. Most plant roots are in the upper 3 feet of soil, where a large part of the material is finer than gravel; however, alfalfa roots generally grow in calcareous sand and gravel at a depth of 6 feet or more. Available water capacity is low to moderate in the main zone of rooting. Plants reflect moisture stress after a week or 10 days without rain. The supply of available nitrogen, potassium, and phosphorus is medium. Applications of lime are usually necessary for successful establishment of legumes, such as alfalfa, but the roots of these crops quickly penetrate to lime in the lower part of the subsoil or the upper part of the substratum. Lack of available water can limit growth during extended dry periods. The high content of gravel causes excessive wear on farm machinery.

Typical profile of Howard gravelly silt loam, 0 to 3 percent slopes, in a cultivated area 200 feet north of Erie-Lackawanna railroad track, one-fourth mile west of Westinghouse plant, in the town of Horseheads:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; moderate, medium, granular structure; friable; many fine and medium roots; 25 percent gravel; slightly acid; abrupt, smooth boundary.

A2—9 to 22 inches, dark yellowish-brown (10YR 4/4) gravelly fine sandy loam; weak, medium, subangular blocky structure; friable; many roots; 35 percent gravel; slightly acid; gradual, irregular boundary.

B&A—22 to 32 inches, dark-brown (10YR 3/3) very gravelly silt loam; weak, medium, subangular blocky structure; friable; many roots; some dark yellowish-brown (10YR 4/4) silt films on tops of pebbles; 35 to 45 percent gravel; slightly acid to neutral; clear, irregular boundary.

B21t—32 to 42 inches, dark-brown (10YR 3/3) very gravelly heavy silt loam; massive; loose; common fine roots; tops of pebbles coated with films of silt and clay; 45 to 50 percent gravel; neutral; gradual, wavy boundary.

B22t—42 to 52 inches, dark-brown (10YR 3/3) very gravelly light clay loam; massive; loose; few fine roots; tops of pebbles and small interstices coated or filled with silt and clay films; 50 to 60 percent gravel; neutral; clear, irregular boundary.

C—52 to 60 inches, yellowish-brown (10YR 5/4) silty gravel and sand; single grain; loose; few fine roots; 50 to 70 percent gravel; silt coatings or precipitated lime on pebbles; mildly alkaline to moderately alkaline; calcareous.

Thickness of the solum ranges from 38 to 60 inches. Free lime is at a depth of 30 to 60 inches, and it usually is at the bottom of the B horizon. These gravel deposits are usually more than 8 feet deep and range in thickness from 6 feet to more than 100 feet.

Color of the Ap horizon is dominantly dark grayish brown or very dark grayish brown. The A2 horizon is usually 10YR in hue, 4 or 5 in value, and 3 to 5 in chroma. Texture ranges from gravelly fine sandy loam to gravelly silt loam. Gravel ranges from 15 to 35 percent and averages 20 to 25 percent. The B horizon ranges from 10YR to 7.5YR in hue, from 3 to 5 in value, and from 2 to 4 in chroma. The fine material ranges from silt loam or loam to light clay loam in texture and has considerable plasticity. It is massive in places or has weak, subangular blocky structure. Reaction is usually slightly acid or neutral. In places the B horizon is weakly calcareous in the lower part. Coarse fragments, consisting of either waterworn pebbles or flat pieces of local rock, range from 35 to more than 60 percent of the total volume. The coarse fragments usually have silty or clayey coatings on the upper sides. Precipitated lime occurs on the lower sides of the fragments in the lower part of the B horizon. The C horizon consists of gravel and sand. It usually is stratified and shows strong sorting, but in places, principally in the tributary valleys, it contains an unsorted mixture of silty sand and gravel from local rocks. Thick layers of clayey silt interbedded with coarse material are commonly at a depth of 10 to 30 feet.

Howard soils are generally adjacent to wetter Phelps, Homer, and Atherton soils that formed in similar glacial outwash deposits. They are also near Tioga, Unadilla, Chenango and Hudson soils in the larger valleys. They occupy terraces and kames above the Tioga soils that formed in alluvial sediments on adjacent flood plains. Howard soils are also adjacent to well-drained Unadilla soils in some places. Howard soils lack the gravel-free, silty solum of the Unadilla soils. Howard soils are near Chenango fans where smaller streams enter the major valleys from the uplands. The coarse fragments in the Howard soils are mainly rounded pebbles that contain some limestone, in contrast to the angular fragments of local sandstone and siltstone in the Chenango soils. Howard soils are near Hudson soils mainly where the glacial lake deposits of silt and clay are more than 40 inches thick over gravelly glacial outwash.

Howard gravelly silt loam, 0 to 3 percent slopes (HoA).—This level and nearly level soil has the profile described as typical for the series. It occupies part of the glacial outwash plain in the Chemung Valley and parts of stream terraces and glacial lake deltas in all parts of the county. Individual areas range from 4 acres to more than 100 acres in size, but most areas are more than 15 acres.

Included in mapping, where this soil adjoins Unadilla soil, were small amounts of this well-drained silty soil. Also included were small spots of similar, but wetter, Phelps, Homer, and Atherton soils in depressions and along valley fringes.

This soil is suitable for crops, pasture, and woodland. Most of the soil that is farmed is used for growing crops. Lack of moisture can be a limitation during dry periods.

This soil occupies readily accessible parts of the county and is in demand for residential and industrial developments, especially in the regions near Elmira and between Horseheads and Big Flats. (Capability unit IIs-1; woodland suitability group 2o1)

Howard gravelly silt loam, 3 to 8 percent slopes (HoB).—This gently sloping soil has a profile similar to the one described as typical for the series, except that it contains more gravel derived from shale and sandstone rocks. It also has more angular, thin, flat pieces of these rocks and fewer round, waterworn pieces, and there is less limestone in the underlying beds. More of this soil is associated with deltas or alluvial fans than the less sloping Howard soil, and the individual areas are smaller and more irregular. They range from 3 to 20 acres in size.

Included in mapping were small areas of similar Chenango soil, fan phase.

This soil is suited to crops, pasture, or woodland. Lack of moisture is more frequently a limiting factor than it is on the less sloping Howard soil. There is a slight hazard of erosion if this soil is cultivated and not protected. (Capability unit IIs-1; woodland suitability group 2o1)

Howard gravelly silt loam, 8 to 15 percent slopes (HoC).—This soil has a profile similar to that described as typical for the series, except that the content of gravel and stones is slightly higher in the surface layer and there has been some loss of the original surface layer through erosion. Individual areas are commonly long and narrow on the moderate slopes between terraces, or they are on rolling kames. Individual areas range in size from about 5 to 10 acres.

Included in mapping were small areas of similar Valois soils formed in glacial till.

Areas of this soil are suitable for crops, pasture, and woodland. Slopes make tillage operations difficult. Erosion is a hazard if this soil is cultivated and not protected. Because slopes are generally complex, contour measures are not feasible in many situations. In general, this soil is more acid and needs more liming than the less sloping Howard soil. The moisture available to growing crops is also less. (Capability unit IIIe-1; woodland suitability group 2o1)

Howard gravelly silt loam, 15 to 25 percent slopes (HoD).—This moderately steep or hilly soil occupies terraces and kames; the single slopes are on terraces, and the complex slopes are on kames. The soil profile is similar to that described as typical for the series, except that the surface layer is thinner in places as a result of erosion and has a somewhat greater amount of gravel. Individual areas are about 5 to 10 acres in size.

Included in mapping were small spots of similar Valois soils that developed in glacial till.

Areas of this soil are mostly idle or in permanent pasture or forest. It is possible to till the moderately steep areas, but cultivation is difficult and hazardous. Erosion is a serious hazard if this soil is cultivated and not protected. Because complex slopes are common, contour measures are not feasible in many places. Runoff is rapid, and lack of moisture is critical in many areas. (Capability unit IVe-1; woodland suitability group 2r4)

Howard gravelly silt loam, 25 to 45 percent slopes (HoE).—This steep soil has a profile similar to the one described as typical for the series, except that in places it is thinner and less well developed and the surface layer contains more gravel. It is on steep terrace fronts and hummocky or hilly areas in valleys. Areas are small and irregular in shape. Included in mapping were similar Valois soils that developed in glacial till.

This soil is suitable for pasture and forest. Most cleared areas are idle or in permanent pasture. A high proportion is in forest. Use of heavy machinery is extremely difficult or impossible because of the steep slopes. Runoff is very rapid, and little water is stored for plants. (Capability unit VIe-1; woodland suitability group 2r4)

Hudson Series

The Hudson series consists of deep, gently sloping to steep, moderately well drained and well drained soils that developed in lake-laid silt and clay. The sediments are high in content of lime, and in most places are underlain by stratified deposits of sand and gravel at a depth of 4 to 6 feet. In many places these soils occupy complex topography formed by geological erosion.

In a typical profile the plow layer is dark grayish-brown heavy silt loam about 8 inches thick. It is underlain by a thin, friable, slightly acid, leached layer of yellowish-brown silt loam. This layer merges with the subsoil at a depth of about 13 inches. The subsoil is brown to dark-brown silty clay loam that is slightly acid to neutral in reaction and is firm to very firm. Blocky structure is a prominent feature of the subsoil. At a depth of about 38 inches it gradually merges with the calcareous substratum. The substratum is firm, dark-brown to brown silty clay loam to a depth of about 56 inches. Below this, it is loose, stratified gravel and sand.

Hudson soils have a seasonal high water table at a depth of about 1½ to 2 feet. It is perched on the slowly permeable clayey subsoil and substratum.

Depth of rooting is somewhat restricted by the water table. Because of the dense, tight nature of the clayey subsoil, roots grow mainly in cleavage planes and cracks. Most roots grow in the upper 24 to 36 inches of soil, where the available water capacity is moderate to high. The supply of available nitrogen and phosphorus is medium, and the supply of available potassium is very high. Unlimed, the surface layer is strongly acid to neutral.

Typical profile of Hudson silt loam, gravelly substratum, 2 to 8 percent slopes, in a cultivated area 500 feet east of Vanderhoff Road, 1,000 feet north of Johnson Hollow Road, in the town of Catlin:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) heavy silt loam; moderate, medium, granular structure; friable; many fine roots; no coarse fragments; slightly acid; clear, smooth boundary.

A2—8 to 13 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; common fine roots; no coarse fragments; slightly acid; clear, smooth boundary.

B&A—13 to 21 inches, dark-brown to brown (10YR 4/3) silty clay loam; moderate, coarse, prismatic structure parting to moderate, medium and coarse, subangular blocky structure; firm; common fine roots; peds have coatings of yellowish-brown (10YR 5/4) silty material; less than 5 percent coarse fragments; slightly acid; clear, wavy boundary.

B21t—21 to 28 inches, brown (10YR 5/3) heavy silty clay loam; moderate, coarse, prismatic structure parting to moderate, coarse, angular blocky structure; firm; a few roots between peds and in ped interiors; patchy clay films on ped surfaces; no coarse fragments; neutral; gradual, wavy boundary.

B22t—28 to 38 inches, dark-brown to brown (7.5YR 4/4) heavy silty clay loam; strong, coarse, prismatic structure parting to strong, medium, angular blocky; very firm; few fine roots in joint plane cracks; distinct, continuous clay films on ped surfaces; no coarse fragments; neutral; gradual, wavy boundary.

C1—38 to 56 inches, dark-brown to brown (7.5YR 4/2) silty clay loam; strong, coarse, prismatic structure parting to moderate, coarse, angular blocky; firm; very few fine roots in cracks; no coarse fragments; mildly alkaline to moderately alkaline; calcareous; abrupt, smooth boundary.

IIC2—56 to 70 inches, stratified sand and gravel.

The solum ranges in thickness from 27 to 45 inches. Carbonates are at a depth of about 25 to 48 inches, and the average depth is about 36 inches. Reaction of the solum is strongly acid to neutral. Hudson soils are generally free of coarse fragments. In some places, gravel or channery fragments are 5 to 10 percent of the volume. Color of the Ap horizon is brown (10YR 5/3) or dark grayish brown (10YR 4/2). Texture is silt loam or silty clay loam. The A2 horizon is dominantly 10YR in hue. It is 4 or 5 in value and 3 or 4 in chroma. Texture is silt loam or silty clay loam. Structure is weak to moderate. The B horizon is 7.5YR or 10YR in hue, 4 or 5 in value, and ranges from 2 to 4 in chroma. In some places faint yellowish-brown and gray mottles are in the lower part of the B horizon. Clay content ranges from 35 to 50 percent. The upper part of the C horizon has varving of silt and clay. Stratified sand and gravel are below the lake-laid silts and clay at a depth below 40 inches.

Hudson soils are usually adjacent to the somewhat poorly drained Rhinebeck soils and the poorly to very poorly drained Madalin soils. They developed in the same lake-laid silts and clays. Intermingled with Hudson soils are areas of gravelly Howard soils that formed where the glacial outwash underlying the Hudson soils is exposed on the surface.

Hudson silt loam, gravelly substratum, 2 to 8 percent slopes (HsB).—This gently sloping soil has the profile described as typical for the series. It is on the glacial lake plain north of the town of Horseheads and on ridgetops and other flat areas that are erosional remnants of the lake plain in the valley of Catharine Creek. This is the only section of the county where Hudson soils were mapped. Individual areas have irregular shapes and range from 3 to 50 acres in size.

Included in mapping were small areas of somewhat poorly drained to very poorly drained Rhinebeck and Madalin soils that have the same silt and clay parent materials. Also included, on the southern fringe of areas of Hudson soils where they join soils developed in silty lake-laid material, were small areas of Collamer soils. Included also were areas that lack the gravelly substratum.

This soil is suited to crops, pasture, and woodland. It is eroded easily by runoff and needs intensive conservation measures to prevent serious soil losses, even on relatively gentle slopes. It clods and puddles readily if tilled at the wrong moisture content. This is a fertile soil that responds well to management. Planting often is delayed briefly in spring by slight wetness. This soil is used mainly to grow feed for dairy cows. Corn for silage, oats, and legumes and grasses for hay are crops commonly grown. (Capability unit IIe-3; woodland suitability group 2o1)

Hudson silty clay loam, gravelly substratum, 8 to 20 percent slopes, eroded (HtC3).—This moderately sloping to moderately steep soil has a profile similar to the one described as typical for the series, except for the texture of the surface layer, which is a result of erosion. It occupies valley walls, sides of ridgelike eroded landforms, and dissected areas having complex, irregular topography. Individual areas are irregular in shape and range from 3 to 6 acres in size.

Included in mapping were small spots of similar but somewhat poorly drained Rhinebeck soils and siltier Collamer soils. Also included were some sandy spots on delta faces and some soils that lack the gravelly substratum.

This soil has limited suitability for crops, pasture, and woodland. Runoff is rapid. The hazard of erosion is serious and continual if this soil is cultivated and not protected. Because slopes are commonly complex, contour measures for erosion control are not feasible in many areas. The moderately fine textured surface layer clods easily if this soil is tilled at the wrong moisture content. Cropping systems that favor long term grass-legume mixtures are most often used on this soil. This is a use to which it is well suited. (Capability unit IVe-4; woodland suitability group 2r1)

Hudson silty clay loam, gravelly substratum, 20 to 40 percent slopes, eroded (HtE3).—This steep to very steep soil has a profile similar to the one described as typical for the series, except that the surface layer is finer textured as a result of erosion. It is closely associated on the landscape with the less sloping Hudson soils. Individual areas are irregularly shaped and small.

Included in mapping were some fairly large areas of a similar, but more silty, soil. Also included were some severely eroded areas and areas that lack the gravelly substratum.

This soil is mainly in forest. The few areas not forested are idle and brushy or in permanent pasture of poor quality. Runoff is very rapid, and the hazard of erosion is severe if the vegetative cover is disturbed. This soil is too steep for cultivation and the use of heavy equipment. (Capability unit VIe-1; woodland suitability group 2r3)

Lansing Series

The Lansing series consists of deep, well-drained, medium-textured soils that developed in glacial till derived mainly from local shale and sandstone and a significant amount of limestone. Lansing soils are not extensive in Chemung County. These gently sloping to moderately steep soils are on areas of deep till in the valley between the towns of Horseheads and Big Flats and on lower slopes on uplands north of Horseheads.

In a typical profile in a forested area, the surface layer is medium acid, very dark grayish-brown gravelly silt loam about 5 inches thick. It is underlain by a leached layer of friable, brown and yellowish-brown, gravelly silt loam, about 19 inches thick, that is interspersed with the upper part of the subsoil at a depth below 15 inches. Reaction is strongly acid to medium acid. At a depth of about 24 inches the main part of the subsoil is firm, brown to dark-brown, gravelly heavy silt loam. The subsoil is slightly acid to neutral in reaction and extends to a depth of about 46 inches. The substratum is very firm, brown to dark-brown gravelly heavy silt loam till that is mildly alkaline in the upper part and weakly calcareous at a depth below about 52 inches.

Lansing soils are well drained. They are moderately permeable to a depth of about 15 inches. Below this depth they are moderately slowly permeable or slowly permeable. Lansing soils have a seasonal water table perched on the less pervious layers at a depth of about 2 to 2½ feet. This has little effect on the depth of rooting, which is mainly in the top 30 inches. The rooting zone has a moderate to high available water capacity. Under conditions of normal rainfall this amount is usually sufficient for good plant growth. The natural supply of available nitrogen and phosphorus is medium, and the supply of available potassium is high. Though these soils are medium in content of lime and contain free lime in the substratum, surface applications of lime are generally needed for good plant response.

Typical profile of Lansing gravelly silt loam, 2 to 8 percent slopes, in a forested area on Church Road, one-fourth mile west of its junction with Ridge Road, in the town of Veteran:

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam; moderate, medium, granular structure; friable; many fine roots; 15 to 20 percent gravel; medium acid; clear, smooth boundary.

A2—5 to 15 inches, brown (10YR 5/3) and yellowish-brown (10YR 5/4) gravelly silt loam; weak, medium and fine, subangular blocky structure; friable; many fine roots; 15 to 20 percent gravel; strongly acid; gradual, wavy boundary.

A&B—15 to 24 inches, yellowish-brown (10YR 5/6) heavy gravelly silt loam; moderate, medium, subangular structure; firm; few fine roots; few patchy clay films in pores; in upper part, thick, brown (10YR 5/3) ped coatings that become thinner with depth; 20 to 25 percent coarse fragments; medium acid; gradual, wavy boundary.

B2t—24 to 46 inches, brown to dark-brown (7.5YR 4/4) heavy gravelly silt loam; moderate, coarse, subangular blocky structure; firm; few fine roots in joint planes; thin clay films on most ped faces and in many pores; 20 to 25 percent coarse fragments, mostly pebbles; slightly acid in upper part to neutral in lower part; gradual, wavy boundary.

C—46 to 56 inches, brown to dark-brown (10YR 4/3) heavy gravelly silt loam; moderate, medium, platy structure; very firm; very few fine roots, all in joint planes; 20 to 30 percent coarse fragments, mostly gravel, but some large and small stones; mildly alkaline; weakly calcareous at a depth of 52 inches.

The solum ranges in thickness from 34 to 46 inches. Carbonates are at a depth of about 36 to 60 inches. Coarse fragments less than 3 inches in diameter make up 15 to 35 percent of the volume. Thickness of the Ap horizon ranges from 6 to 10 inches. It is 10YR in hue, ranges from 3 to 5 in value, and is 2 or 3 in chroma. The A2 horizon is dominantly 10YR in hue, 5 or 6 in value, and 3 or 4 in chroma. Structure is platy in places. Reaction is strongly acid to slightly acid.

The B2t horizon ranges in texture from heavy silt loam to loam in the fine earth fraction. The amount of clay ranges from 18 to 27 percent. The B2t horizon is dominantly 10YR or 7.5YR in hue, 4 or 5 in value, and 3 or 4 in chroma. Structure is dominantly moderate to strong and medium to coarse blocky; consistence is firm or hard. Reaction ranges from medium acid to neutral. The C horizon is firm, compact glacial till. It is derived mostly from shale and sandstone and some limestone. Texture is gravelly or very gravelly loam to silt loam that contains 20 to 45 percent coarse fragments. It ranges from neutral to moderately alkaline in reaction and becomes weakly to strongly calcareous with increasing depth.

Lansing soils are adjacent to Howard and Unadilla soils along the lower fringes of valley walls. Lansing soils that formed in firm basal till are above the gravelly Howard soils and silty Unadilla soils on glacial outwash or stream terraces. At higher elevations along the valley walls, Lansing soils are near Volusia, Mardin, and Valois soils. Lansing soils are less acid, better drained, and lack the fragipan that is a prominent feature of Mardin and Volusia soils. Lansing soils formed in firm basal till in contrast to the friable ablation till in which Valois soils have formed. Lansing soils are less permeable and contain more clay in the subsoil and substratum than the Valois soils, and they are generally less acid.

Lansing gravelly silt loam, 2 to 8 percent slopes (LbB).—This gently sloping soil has the profile described as typical for the series. It occupies rounded, slightly convex areas on uplands that have good surface drainage. Individual areas range from 5 to 25 acres in size.

Included in mapping were small areas of similar but moderately well to somewhat poorly drained soils. These areas occupy nearly level or slightly depressed topography and receive runoff and seepage from the surrounding higher land. These inclusions account for approximately 10 percent of the acreage.

This soil is suited to all crops grown in the area and to pasture or woodland. Response to management is good. There is a slight hazard of erosion if this soil is cultivated and not protected. (Capability unit IIe-1; woodland suitability group 2o1)

Lansing gravelly silt loam, 8 to 15 percent slopes (LbC).—This moderately sloping soil has a profile similar to the one described as typical, except that the subsurface layer is thinner in places. Individual areas are long and narrow and have a north-south trend. They range in size from about 3 to 15 acres.

Included in mapping were spots of similar, but more porous, Valois soil. Also included were some seepy spots of wetter soils that formed in similar material.

This soil is suited to crops, pasture, and woodland. With proper management and adequate erosion control measures, this soil is fairly well suited to all the crops commonly grown. There is a moderate to severe hazard of erosion if this soil is cultivated and not protected. (Capability unit IIIe-1; woodland suitability group 2o1)

Lansing gravelly silt loam, 15 to 25 percent slopes (LbD).—This soil has a profile similar to the one described as typical for the series, except that it is generally thinner. It is moderately steep and lies between the less sloping Lansing soils or adjacent to Mardin or Lordstown soils. Individual areas are long and narrow and about 4 to 6 acres in size.

Included in mapping were small spots of similar, but more porous, Valois soils.

A high percentage of the acreage is forested, and it is well suited to this use. Cleared areas are mostly idle or used for permanent pasture. Slope limits the use of this soil for crops. The use of machinery is difficult and hazardous. There is a serious hazard of erosion. Long-term meadows of mixed grasses and legumes are usually well suited. (Capability unit IVe-1; woodland suitability group 2r2)

Lordstown Series

The Lordstown series consists of moderately deep, well-drained, medium-textured soils formed in thin glacial till derived mainly from sandstone, siltstone, and shale bedrock. Bedrock is at a depth of 20 to 40 inches, and it controls the topography. These soils are gently sloping to very steep. They occupy ridges, hilltops, and steep side slopes in the main north-south valleys.

In a typical profile the surface layer is dark grayish-brown to dark yellowish-brown channery silt loam. It is very strongly acid and about 8 inches thick. The subsoil is very friable to friable, yellowish-brown channery silt loam. It is very strongly to strongly acid and extends to a depth of about 26 inches. The substratum is friable, light yellowish-brown very channery silt loam that is strongly acid. Gray sandstone bedrock is at a depth of 30 inches.

These soils are generally moderately deep over fractured and jointed bedrock that allows rapid infiltration of water. In some places, where the bedrock is massive, some mottling immediately above the bedrock indicates saturation for short periods. The rooting zone is determined by the depth to underlying rock, which is about 20 to 40 inches. Available water capacity for this zone is low to moderate. Plants normally show moisture stress after 7 to 10 days without precipitation. The supply of available nitrogen, potassium, and phosphorus is medium. Unlimed, these soils are strongly acid or very strongly acid and require heavy liming.

Typical profile of Lordstown channery silt loam, 2 to 8 percent slopes, in an idle area one-eighth mile west of the junction of Comfort Hill Road and Merriam Road, at the side of Comfort Hill Road, in the town of Ashland:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) channery silt loam; weak, medium, granular structure; very friable; many fine roots; 15 to 20 percent coarse fragments; very strongly acid; clear, smooth boundary.

B21—8 to 18 inches, yellowish-brown (10YR 5/6) channery silt loam; weak, fine, subangular blocky structure that crushes to weak, fine, granular structure; very friable; many fine roots; 20 to 25 percent coarse fragments; very strongly acid; gradual, wavy boundary.

B22—18 to 26 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, fine, subangular blocky structure; friable; common fine roots; many fine pores; 30 to 35 percent coarse fragments; very strongly acid; clear, wavy boundary.

C—26 to 30 inches, light yellowish-brown (10YR 6/4) very channery silt loam; weak, thick and very thick, platy structure; friable; few fine roots; 45 percent coarse fragments; strongly acid; clear, wavy boundary.

R—30 inches +, gray sandstone bedrock.

Thickness of the solum ranges from 20 to 29 inches. Bedrock is at a depth of about 20 to 40 inches. Coarse fragments are mainly thin, flat pieces of rock ranging from less than 3 inches in length to flagstones. They make up 15 to 35 percent of the volume.

The Ap horizon is 10YR or 2.5Y in hue, ranges from 3 to 5 in value, and is 2 or 3 in chroma. Consistence is friable or very friable. Reaction is strongly acid. The B2 horizon is 10YR or 2.5Y in hue, 4 or 5 in value, and 3 to 6 in chroma. Texture is channery loam or silt loam; structure is weak, fine to medium, subangular blocky; consistence is friable to very friable; and reaction is very strongly acid or strongly acid. The C horizon is 10YR or 2.5Y in hue, 4 to 6 in value, and 2 to 4 in chroma. In some profiles it has common faint mottles of yellowish brown and gray. This horizon is structureless in places. Consistence ranges from friable to firm. Bedrock is massive, thick or thin, fine-grained sandstone or fissile shale or thin-bedded shale and siltstone. It is highly fractured or has a smooth, flat, rock surface.

Lordstown soils are commonly adjacent to Arnot and Tuller soils on bedrock-controlled landscapes on uplands. These soils have all formed in the same thin till materials. Lordstown soils are moderately deep over bedrock and well drained; but Arnot and Tuller soils are shallow, Arnot soil is well drained to moderately well drained, and Tuller soil is somewhat poorly drained to poorly drained. Lordstown soils are also in the same general upland area as the deeper, somewhat poorly drained Volusia soils and the moderately well drained Mardin soils. Lordstown soils lack the fragipan that is a prominent feature of both the Volusia and Mardin soils.

Lordstown channery silt loam, 2 to 8 percent slopes (LnB).—This nearly level to gently sloping soil has the profile described as typical for the series. It occupies the tops of hills and ridges in all parts of the county. It is at the highest elevations in the county. Individual areas are longer than they are wide and conform to the configuration of the ridges. Most of these areas are larger than 10 acres in size; however, they range from 5 acres to more than 100 acres.

Included in mapping were spots of similar, but shallow, Arnot soils mostly in forested areas. Also included were small wet areas of shallow Tuller soils.

The soil is suitable for crops, pasture, and forest. Farming operations at these high elevations have been mostly abandoned, however, and much of this soil is now idle and reverting to forest. Soil that is farmed is used mostly for pasture. At these high elevations the growing season is 1 to 2 weeks shorter than in the valleys. If this soil is cropped, therefore, care needs to be taken to select seed varieties that are adapted to the climate. There is a slight hazard of erosion if this soil is cultivated and not protected. (Capability unit IIe-2; woodland suitability group 3o1)

Lordstown channery silt loam, 8 to 15 percent slopes (LnC).—This soil has a profile similar to the one described as typical, except that the depth to bedrock is more variable. It occupies upper slopes just below the nearly level to gently sloping soils on hilltops and ridgetops. Most areas of this soil are long and narrow to moderately wide, and they range from 5 to more than 100 acres in size.

Included in mapping were small areas of shallow Arnot soils. A few narrow ledges or outcrops of bedrock are in the areas delineated.

This soil is suitable for crops, pasture, and woodland. Its use and potential are much the same as described for the gently sloping Lordstown soil, but slope and the hazard of erosion are greater limitations. (Capability unit IIIe-2; woodland suitability group 3o1)

Lordstown channery silt loam, 15 to 25 percent slopes (LnD).—This soil is mainly on the sides of valleys in association with other Lordstown soils. It is between Volusia and Mardin soils on the lower slopes and adjacent to Arnot soils on hilltops and ridgetops. This soil has a profile similar to that described as typical for the series, except that it is deeper to bedrock in places. Individual areas are long and narrow to moderately wide. They range from 5 to more than 100 acres in size.

Included in mapping were areas of shallower Arnot soil and spots of deeper Mardin soils. Ledges and outcrops of shale and sandstone bedrock are common.

This soil can be used for crops, but only with difficulty because of the moderately steep slopes. Intertilled crops are grown with great difficulty and considerable danger of erosion. Of the part of this soil that is farmed, most is used for long-term hay or permanent pasture. A large acreage is in native forest, and many areas are idle or abandoned. Many kinds of trees that are available for planting are well suited. The steepest parts of this soil are better suited to forest and wildlife habitat than to crops. (Capability group IVe-2; woodland suitability group 3r1)

Lordstown and Arnot very rocky soils, 25 to 35 percent slopes (LoE).—Individual areas of this undifferentiated group consist of Lordstown soil, Arnot soil, or both. These soils have profiles similar to those described as typical for their respective series. The surface layer of both the Lordstown and Arnot soils ranges in texture from channery silt loam to stony silt loam. Scattered over the surface are many pieces of angular sandstone more than 6 inches across. Ledges and outcrops of bedrock are common. Individual areas are long and range from 40 to more than 100 acres in size.

Included in mapping were areas where bedrock ranges from a depth of a few inches to more than 40 inches within short distances. On most of these steep slopes, bedrock forms a series of wide steps that are covered with soil material to form a smooth slope (fig. 10). A thin covering of Arnot soil is at the edge of each bedrock step, and the deeper soil between the steps is mainly Lordstown soil. Included were areas of deeper Mardin soils and small spots of somewhat poorly drained to poorly drained Tuller soils.

These soils can be used for pasture or forest, but slope and rockiness limit their use for pasture. Most areas are unimproved and furnish very little forage. They are well suited to trees and are better used for forest than for farming. Very few areas are farmed at present. (Capability unit VIIs-1; woodland suitability group 3x1)

Figure 10.—Lordstown and Arnot very rocky soils, 25 to 35 percent slopes, along Cayuta Creek.

Lordstown and Arnot very rocky soils, 35 to 70 percent slopes (LoF).—This undifferentiated group is similar to Lordstown and Arnot very rocky soils, 25 to 35 percent slopes. It mainly occupies forested valley sides throughout the southern half of the county. A thin mantle of rocky soil covers most areas. Bedrock ledges crop out in many places, especially on slopes of more than 45 percent. Individual areas are long and generally 100 acres or more in size.

These soils are too steep and rocky for uses other than forest and recreational sites. (Capability unit VIIs-1; woodland suitability group 4x1)

Madalin Series

The Madalin series consists of deep, nearly level or depressional, poorly drained to very poorly drained soils that have medium-textured surface layers and moderately fine textured subsoils. These soils developed in lake-laid silts and clays that have a high lime content and are underlain by gravelly glacial outwash sediment. They occupy lake plains mostly in the valley that extends from north of Horseheads to near the Schuyler County line.

In a typical profile in a cultivated area, the plow layer is very dark gray silt loam. It is slightly acid, has a few light-brown mottles, and extends to a depth of about 8 inches. Just below is a leached layer, 10 inches thick, of firm, gray silt loam that has some faint, dark yellowish-brown mottles and is neutral. The subsoil is at a depth of about 18 inches. It is distinctly mottled, dark-gray silty clay loam that is firm to very firm and neutral. The calcareous substratum begins at a depth of about 32 inches. It is distinctly mottled, grayish-brown silt loam in the upper part. It is firm when moist and plastic and sticky when wet. At a depth below 42 inches the substratum consists of dark-gray layers of fine shaly gravel, silts, and sands.

The water table is at or near the surface of Madalin soils for long periods in spring and during wet spells. It is perched on the heavy subsoil that is slowly permeable to downward movement of water. The rooting zone is mainly in the upper 18 inches and is strongly influenced by the water table and by the dense character of the moderately fine textured subsoil. Most rooting below the surface horizon is in cracks and joints of the subsoil. These soils have a moderate to high available water capacity that is normally sufficient for good plant growth. The total nitrogen content is high, but it is released slowly in spring when the soil is cold and wet. Ability to supply potassium is very high, and to supply phosphorus is medium. Undrained, the poor to very poor natural drainage limits the use of these soils mainly to grasses. In their natural state these soils are neutral to medium acid.

Typical profile of Madalin silt loam, gravelly substratum, in an idle area, three-fourths mile south of junction of Westlake and Snake Hill Roads, and one-fourth mile west of Hickory Grove Road, in the town of Horseheads:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; few, fine, distinct, light-brown (7.5YR 6/4) mottles; moderate, medium, granular structure; friable, sticky; many fine roots; slightly acid; clear, smooth boundary.

A2g—8 to 18 inches, gray (10YR 5/1) silt loam; common, medium, faint mottles of dark-yellowish brown (10YR 4/4); moderate, medium, angular blocky structure; firm; common fine roots; neutral; gradual, wavy boundary.

B2tg—18 to 32 inches, dark-gray (10YR 4/1) silty clay loam; 35 percent has coarse, distinct, dark-brown to brown (7.5YR 4/4) mottles; moderate to strong, coarse, prismatic structure parting to coarse, angular blocky; firm to very firm, plastic; common fine roots mainly in joints and cracks; few pores that have clay linings; patchy clay films on peds; neutral; gradual, wavy boundary.

IIC1g—32 to 42 inches, grayish-brown (10YR 5/2) silt loam; many, fine, medium, distinct mottles of strong brown (7.5YR 5/8); massive to weak, coarse, angular blocky structure; firm, plastic and sticky; few fine roots; few pores; mildly alkaline; weakly calcareous; clear, smooth boundary.

IIIC2g—42 to 54 inches, dark-gray (N 4/0) layers of fine shaly gravel, sand, and silt; massive; friable and loose; mildly to moderately alkaline; calcareous.

Thickness of solum ranges from 24 to 38 inches. Carbonates are at a depth of 24 to 48 inches. Reaction of the solum ranges from medium acid to neutral, and acidity decreases with depth.

The Ap horizon is very dark gray (10YR 3/1) to black (10YR 2/1). The A2 horizon is 10YR or 2.5Y in hue, 4 or 5 in value, and 1 to 2 in chroma. Mottles range from few to common and are higher in chroma than the matrix. The B2tg horizon is 7.5YR or 10YR in hue, 4 in value, and 1 or 2 in chroma. Ped faces are mainly gray (N 5/0) or dark gray (10YR 4/1); less than 40 percent of the ped interiors have common to many mottles that are 10YR in hue and high in chroma. Textures are silty clay loam or silty clay. Consistence is very hard when dry. The upper part of the C horizon ranges from very fine sandy loam to silty clay loam. Between depths of 40 inches and 6 feet, the substratum generally contains strata of calcareous sand, silt, and gravel; but these are lacking in some profiles.

Madalin soils are poorly drained and very poorly drained. They are associated with the moderately well drained and well drained Hudson soils and the somewhat poorly drained Rhinebeck soils that formed in similar material. Madalin soils are also near the better drained Howard, Phelps, and Homer soils that formed where the gravelly glacial outwash underlying the Madalin soils is exposed on the surface.

Madalin silt loam, gravelly substratum (Ma).—This soil occupies level areas and depressions along drainageways within areas of better drained Rhinebeck and Hudson soils. Slopes range from 0 to 2 percent. Individual areas are small and elongated in shape.

Included in mapping were some small areas having very poor drainage and a mucky surface layer. Also included, adjacent to Collamer soils, were a few small areas that have a silt loam subsoil.

Undrained, areas of this soil are too wet for crops and are used mainly for pasture or forest. Even if artificially drained, this soil is better suited to hay crops than to cultivated crops. The dominant management need is improvement of drainage to allow surrounding areas to be tilled more advantageously. (Capability group IVw-2; woodland suitability group 5w1)

Made Land

Made land (Mc) consists of excavated areas, other than gravel pits and quarries, and areas modified by material dumped from a variety of sources. Some areas are filled with soil and rock material trucked to the site from excavated areas or dredged from stream channels. Some are filled with rubble, trash, or refuse; then covered with soil and leveled. Most areas are in the vicinity of the larger cities and villages or adjacent to cuts in the right-of-way of limited-access highways.

Made land has little potential for farming. Each area should have an onsite examination to determine whether it is adaptable to farm or nonfarm use. (Capability unit and woodland suitability group not assigned)

Mardin Series

The Mardin series consists of deep, moderately well drained, medium-textured soils. These soils developed in compact glacial till in which shale and sandstone rock are dominant. A strongly expressed fragipan at a depth of about 15 to 25 inches greatly impedes rooting and the movement of water. Mardin soils are on uplands, where they occupy rounded, slightly convex areas or long, smooth slopes that extend from the edge of the valley floor to the highest parts of the plateau. They are gently sloping to moderately steep.

In a typical profile in a cultivated area, the plow layer is brown to dark-brown channery silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 13 inches, is friable, yellowish-brown channery silt loam that is strongly acid. It is separated from the lower part by a leached, firm, strongly acid layer of light yellowish-brown channery silt loam mottled with light brownish gray. The lower part of the subsoil, which begins at a depth of about 18 inches, is a very firm and dense fragipan of channery silt loam. It is distinctly mottled, yellowish-brown and strongly acid material to a depth of about 26 inches. Below this, it is distinctly mottled, light olive brown, and medium acid. Vertical streaks of light-gray to pale-brown material surround coarse prisms in the fragipan. The substratum begins at a depth of about

42 inches. It is firm to very firm, light olive-brown, very channery silt loam glacial till that is medium acid in reaction.

Mardin soils are moderately well drained. In spring and during periods of heavy precipitation the water table is perched on the slowly permeable, dense fragipan and substratum at a depth of 1½ to 2 feet. Water tends to move laterally above the fragipan, and, in exposures, it can be observed seeping above the pan. Rooting is mainly in the zone above this impervious layer.

Available water capacity of this zone is low to moderate in the rooting zone. After 10 days to 2 weeks without precipitation, plants reflect moisture stress. Mardin soils have a medium supply of available nitrogen, potassium, and phosphorus. Unlimed, they are very strongly acid to strongly acid.

Typical profile of Mardin channery silt loam, 2 to 8 percent slopes, in a meadow one-half mile east of Staples Road, 50 feet north of State Highway 223, in the town of Erin:

Ap—0 to 8 inches, brown to dark-brown (10YR 4/3) channery silt loam, moderate, fine, granular structure; friable; many fine roots; 15 to 20 percent coarse fragments; very strongly acid; clear, smooth boundary.

B2—8 to 13 inches, yellowish-brown (10YR 5/6) channery silt loam; weak, medium and fine, subangular blocky structure; friable; many fine roots; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

A'2—13 to 18 inches, light yellowish-brown (10YR 6/4) channery silt loam; many, medium, distinct, light brownish-gray (2.5Y 6/2) mottles; massive to weak, medium, subangular blocky structure; firm; common fine roots; 15 percent coarse fragments; strongly acid; clear, wavy boundary.

B'x1—18 to 26 inches, yellowish-brown (10YR 5/4) channery silt loam; common, medium, distinct, dark grayish-brown (10YR 4/2) mottles; strong, very coarse prisms parting to weak, coarse, angular blocky structure; streaks with pale-brown (10YR 6/3) borders with common, medium, distinct yellowish-brown (10YR 5/4) mottles and light-gray (N 7/0) centers surround the prisms. These streaks are wider at the top and taper to very narrow at the bottom; very firm and brittle; few roots along prism faces; some pores with clay linings; 25 to 30 percent coarse fragments; strongly acid; diffuse, irregular boundary.

B'x2—26 to 42 inches, light olive-brown (2.5Y 5/4) channery silt loam; common, medium, distinct, brown to dark-brown mottles (10YR 4/3); strong, very coarse prisms 10 to 12 inches across parting to weak, coarse blocks; streaks surrounding prisms have pale-brown (10YR 6/3) centers and yellowish-brown (10YR 5/6) borders; very firm, very hard and brittle; roots lacking; 30 to 35 percent coarse fragments; medium acid; diffuse, irregular boundary.

C—42 to 72 inches, light olive-brown (2.5Y 5/4) very channery silt loam; massive; firm to very firm; 35 to 45 percent coarse fragments; medium acid.

Thickness of the solum ranges from 40 to 58 inches. Depth to bedrock ranges from 4 feet to more than 24 feet. The Bx horizon, or fragipan is at a depth of 15 to 25 inches. Coarse fragments of mainly flat stone make up 15 to 30 percent of the soil above the fragipan and 25 to 40 percent of the pan. The Ap horizon is 10YR in hue, 3 or 4 in value, and 2 or 3 in chroma. Unlimed, the reaction ranges from very strongly acid to strongly acid. The B horizon is 10YR in hue, 5 in value (7 when dry), and 4 to 6 in chroma. Texture ranges from channery silt loam to channery loam. The A'2 horizon is 2.5Y or 10YR in hue, 5 to 6 in value, and 2 to 4 in chroma. Texture ranges from channery fine sandy loam to channery silt loam. The Bx horizon is 10YR or 2.5Y in hue, 4 or 5 in value, 2 to 4 in chroma. Reaction ranges from strongly acid to medium acid. The C horizon is typically light olive-brown, firm glacial till that is over 30 percent coarse fragments. Texture ranges from channery to very channery loam or silt loam. Reaction ranges from medium acid to mildly alkaline. It becomes less acid with depth. Some profiles are weakly calcareous at a depth of 5 to 6 feet.

Mardin soils are commonly adjacent to the somewhat poorly drained Volusia soils, the poorly drained Chippewa soil, the moderately deep, well drained Lordstown soil, and the well drained to moderately well drained, shallow Arnot soils. All these soils have formed in similar glacial till derived mainly from sandstone, siltstone, and shale bedrock. Mardin soils are often above Volusia and Chippewa soil on convex landscapes and contributes runoff to these wetter soils. Mardin soils are interspersed with or below Lordstown and Arnot soils on bedrock-controlled landscapes.

Mardin channery silt loam, 2 to 8 percent slopes (MdB).—This gently sloping soil has the profile described as typical for the series. It occupies somewhat rounded or convex areas on uplands. These areas, 13 to 20 acres in extent, lie adjacent to larger areas of steeper Mardin soil or poorly drained Volusia soil.

Included in mapping were small areas of wetter Volusia soil that occupy the less sloping parts of the delineation and several hundred acres in the vicinity of Sullivanville that have a neutral to mildly alkaline subsoil. Also included were some small wet spots of Chippewa soil.

The soil is suited to crops, pasture, and woodland. A slight wetness in spring can briefly delay planting. Drainage of wet spots is desirable, allowing fields to be farmed uniformly. There is a slight to moderate hazard of erosion if this soil is cultivated and not protected. (Capability unit IIw-1; woodland suitability group 3o1)

Mardin channery silt loam, 8 to 15 percent slopes (MdC).—This moderately sloping soil has a profile similar to the one described as typical for the series, except that the surface layer contains more coarse fragments in places. This soil is on the sides of ridges that have a general north and south trend. Individual areas are elongated in shape and range from 5 acres to more than 100 acres in size.

Included in mapping were areas in which bedrock is at a depth of less than 40 inches. Small wet or seepy spots are in the unit. Mardin soil is generally strongly acid to very strongly acid, but in some areas of the county, mainly in the town of Veteran, areas were included that are less acid throughout the profile than the typical soil. Also included were small spots of wetter Volusia soils along foot slopes and in depressions.

This soil is suitable for crops, pasture, or woodland. Runoff is rapid, and there is a moderate to severe hazard of erosion if this soil is cultivated and not protected. With good management, it is moderately well suited to the crops commonly grown on the dairy farms of the county. These operating farms are mostly in the towns of Big Flats and Southport. In other parts of the county, farming has been discontinued to a considerable extent, leaving a large acreage idle. Many areas have been reforested, but much is brushy and abandoned. (Capability unit IIIe-3; woodland suitability group 3o1)

Mardin channery silt loam, 15 to 25 percent slopes (MdD).—This soil has a profile similar to the one described as typical for the series, except that the upper part of the subsoil is thinner in places. This soil is on upland landscapes adjacent to the less steep Mardin soils. It is more frequently at high elevations on the valley sides just below the shallower Lordstown and Arnot soils. Individual areas are long and relatively narrow, conforming to the trend of the ridges. They range in size from a few acres to more than 80 acres.

Included in mapping were areas of soil in which bedrock is at a depth of less than 40 inches and seepy spots and small wet areas. Also included were areas that lack the mottling in the fragipan.

This soil is suited to hay, pasture, or forest. Steep slopes make the use of machinery difficult and hazardous. Erosion is a serious hazard. Runoff is very rapid. Plants reflect the lack of moisture sooner than on the less steep Mardin soils. (Capability unit IVe-2; woodland suitability group 3r1)

Middlebury Series

The Middlebury series consists of deep, moderately well drained to somewhat poorly drained, medium-textured soils that developed in alluvial sediment. These soils are nearly level and occupy flood plains of rivers and streams throughout the county. They are subject to periodic flooding.

In a typical profile in a cultivated area, the plow layer is dark grayish-brown silt loam about 10 inches thick. Underlying this layer is the subsoil of medium acid silt loam. It is friable and faintly mottled with yellowish brown to a depth of about 20 inches. Below this, it is firm and light olive brown distinctly mottled with light brownish gray and yellowish brown. It gradually merges with the substratum at a depth of about 40 inches. The substratum is firm, faintly mottled, dark-gray very fine sandy loam to fine sandy loam that is slightly acid.

In the spring and during wet periods, a temporary high water table exists for short periods at a depth of 12 to 18 inches. Flooding sometimes occurs during spring runoff and at other times during periods of excessive precipitation. Excessive water, however, is seldom a limiting factor in farming these soils. Depth of rooting is controlled by the water table and is mainly in the top 24 inches. Available water capacity is high. Crops on these soils seldom show signs of moisture deficiency during the growing season. Nitrogen content is medium to high; but it is slowly released in spring, becoming readily available as the soil warms up. Ability to supply potassium and phosphorus is medium. Unlimed, these soils have a medium acid surface layer and usually become less acid with depth.

Typical profile of Middlebury silt loam in a sod area, 300 feet west of State Highway 34, 2 miles south of the town of Van Etten:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many fine roots; slightly acid; abrupt, smooth boundary.

B21—10 to 20 inches, yellowish-brown (10YR 5/4) silt loam; few, medium, faint, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; many fine roots; medium acid; clear, wavy boundary.

B22—20 to 40 inches, light olive-brown (2.5Y 5/4) silt loam; common, medium, distinct mottles of light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; firm; common fine roots; medium acid; gradual, wavy boundary.

IIC—40 to 50 inches, dark-gray (10YR 4/1) very fine sandy loam to fine sandy loam; common, medium, faint mottles of very dark grayish brown (10YR 3/2); massive; firm; no roots; slightly acid.

Thickness of the solum ranges from 24 to 40 inches. The Ap horizon is 10YR or 2.5Y in hue, 3 or 4 in value, and has a chroma of 2. The B2 horizon is 10YR to 5Y in hue, 4 or 5 in value, and 3 or 4 in chroma. Mottles in the lower part are 4 to 6 in value, 1 to 6 in chroma, and 10YR to 2.5Y in hue. Mottles low in chroma are at a depth of 24 inches or less. Texture ranges from fine sandy loam to silt loam. The B horizon is structureless or has weak, medium, subangular blocky structure. Reaction ranges from medium acid to slightly acid. Coarse fragments make up 5 to 20 percent of the volume of the subhorizons in some profiles. The C horizon is variable. It ranges from 10YR to 5Y in hue, 3 to 5 in value, and 1 to 4 in chroma. Mottles are grayish brown and yellowish brown. Texture ranges from silt loam to sandy loam, or lenses of stream gravel alternate with layers of sand at a depth below 40 inches. The C horizon is structureless or platy. Reaction ranges from slightly acid to neutral.

Middlebury soils are closely associated with the well-drained Tioga soils and the poorly drained and very poorly drained Papakating soils. All these soils developed in alluvial sediment on flood plains and are subject to periodic flooding. Some areas of Middlebury soils are adjacent to Chenango channery silt loam, fans. The Chenango soil contains many flat stone fragments and is well drained to somewhat excessively drained, in contrast to the relatively gravel-free, moderately well drained to somewhat poorly drained Middlebury soils.

Middlebury silt loam (Me).—This nearly level soil occupies entire alluvial flats or is in slight depressions adjacent to the well-drained Tioga soils on flood plains. Slopes are less than 3 percent. This soil is flooded periodically, mostly in spring. Individual areas are rounded or irregular, and they range from too small to delineate to 50 acres in size.

Included in mapping were spots of wet Papakating soils and small knolls of well-drained Tioga soils. Also included were areas having a considerable amount of channery or gravelly material in the surface layer and subsoil. These included areas are generally bottom lands adjacent to alluvial fans.

This soil is suitable for crops, pasture, or woodland. Flooding and slight wetness are the main limitations. This soil is well suited to crops, such as corn, oats, and hay, that are grown mainly to feed dairy cattle. (Capability unit IIw-4; woodland suitability group 2o2)

Muck

Muck (Mu) is a miscellaneous land type that consists of undifferentiated organic deposits. These deposits are in small depressions throughout the county. Included are areas of black, well-decomposed material from woody plants, rushes, and cattails and areas of brown, partly decomposed, peaty material. The organic materials range from 2 feet to about 10 feet in thickness. Where they are adjacent to mineral soils, the organic material overlies light-gray silt loam or silty clay loam.

These organic soils are undrained and permanently wet. They have a vegetative cover of poor, open forest consisting of elm, willow, and alder trees, or a thick cover of rushes, sedges, and cattails. (Capability unit VIIw-1; woodland suitability group unclassified)

Papakating Series

The Papakating series consists of deep, poorly drained to very poorly drained, silty soils. They developed in alluvial sediment on first bottoms and are subject to periodic flooding. Topography is flat to slightly depressed.

In a typical profile the surface layer is very dark gray to black silt loam about 10 inches thick. It is underlain by a subsurface layer of mottled dark-gray, medium acid silt loam that is slightly sticky and extends to a depth of about 16 inches. The subsoil is prominently mottled, dark-gray silt loam that is firm and medium acid. At a depth of about 37 inches, it merges with a substratum of firm, mottled, gray silt loam that is slightly acid in the upper part and becomes neutral at a depth of about 48 inches.

These soils have a water table at or near the surface most of the year. They are subject to frequent flooding. Rooting depth is determined by the water level and is mainly in the upper 10 to 15 inches. The total nitrogen content is high, but it is released slowly because of the saturated condition of the soil. These soils have a medium supply of available potassium and phosphorus. Unlimed, the surface layer is strongly acid to medium acid.

Typical profile of Papakating silt loam, in an idle area, one-eighth mile south of State Highway 224, one-half mile west of McDuffy Hollow Road, in the town of Van Etten:

Ap—0 to 10 inches, very dark gray (10YR 3/1) to black (10YR 2/1) silt loam; weak, medium, granular structure; friable, sticky; many fine roots; medium acid; abrupt, smooth boundary.

A2g—10 to 16 inches, dark-gray (N 4/0) silt loam; many, fine and medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/4) mottles; moderate, medium, granular structure; slightly sticky; common roots; medium acid; abrupt, smooth boundary.

B2g—16 to 37 inches, dark-gray (N 4/0) silt loam, 35 percent contains prominent, coarse mottles of yellowish brown (10YR 5/6); weak, fine, subangular blocky structure; firm; medium acid; gradual, smooth boundary.

Cg—37 to 50 inches, gray (N 6/0) silt loam; many, prominent, coarse mottles of yellowish brown (10YR 5/6); massive; firm; slightly acid, becoming neutral at a depth of 48 inches.

Thickness of the solum ranges from 24 to 38 inches. Coarse sandy or gravelly material is at a depth of more than 40 inches. Sand that is coarser than very fine is less than 15 percent of the mass; clay is 18 to 35 percent. Coarse fragments are less than 5 percent of the solum. Reaction is strongly acid to medium acid in the upper horizons, becoming less acid with depth. The Ap horizon is 10YR or 2.5Y in hue, 2 or 3 in value, and 1 and 2 in chroma. The A2g horizon has neutral gray colors that are 4 or 5 in value; mottles are 7.5YR to 10YR in hue, 4 and 5 in value, and 4 to 6 in chroma. Structure is weak or moderate; reaction is strongly acid to medium acid. The B2g horizon is neutral gray in color, or it ranges from 10YR to 5Y in hue, 4 to 6 in value, and 1 to 2 in chroma and has prominent or distinct mottles. This horizon is massive, or has weak, subangular blocky structure. Texture ranges from silt loam to light silty clay loam. Reaction ranges from medium acid to slightly acid and, in places, it becomes neutral in the lower part. The Cg horizon is similar in color to the B2g horizon. Texture is more variable and ranges from silt to silty clay at a depth below 40 inches. Lenses of sandy or gravelly material occur in places. Reaction is neutral at a depth of 40 to 48 inches.

Papakating soils are closely associated with well drained Tioga soils and moderately well drained to somewhat poorly drained Middlebury soils, both of which developed in similar recent alluvial sediment and are subject to periodic flooding. Papakating soils also occur in depressed areas surrounded by Howard or Chenango soils. Howard and Chenango soils are well drained to somewhat excessively drained and contain large amounts of coarse fragments characteristic of the glacial outwash and alluvial fan deposits.

Papakating silt loam (Pg).—This soil is in low areas on flood plains along major rivers and streams. Slopes are less than 2 percent. Individual areas are irregular or long and narrow in shape and range from 2 to more than 20 acres in size.

Included in mapping were small spots of Alluvial land and better drained Middlebury soils. About 20 percent of the areas have a black mucky surface layer in which the water table is at the surface for extended periods.

Wetness and flooding are the main limitations to farming. Undrained, this soil is better suited to pasture and forest than to crops. Where suitable outlets are available, some areas can be drained and used for row crops. (Capability unit IVw-3; woodland suitability group 4w1)

Phelps Series

The Phelps series consists of deep, moderately well drained, medium-textured soils. These soils developed in glacial outwash material derived mainly from shale, sandstone, and limestone. They are nearly level to gently sloping soils on outwash plains, terraces, deltas, and alluvial fans.

In a typical profile in a cultivated area, the plow layer is dark, grayish-brown, gravelly loam about 8 inches thick. It is underlain by a leached layer of friable, light olive-brown, very gravelly loam that has a few faint mottles and is slightly acid in reaction. The subsoil is at a depth of about 15 inches. The upper part is mottled, dark grayish-brown, very gravelly loam that is firm and sticky. At a depth of about 29 inches, it is dark grayish-brown, very gravelly sandy loam that is friable and slightly sticky. Reaction is slightly acid in the upper part and becomes neutral with depth. At a depth of about 40 inches, it merges with a calcareous substratum of loose, dark grayish-brown and very dark grayish-brown stratified sand and gravel.

Early in spring and after heavy precipitation, there is a water table at a depth of 1½ to 2 feet. It is generally a fluctuating ground water table. In some places, the water table is perched on slowly pervious silty layers in the substratum. Early in the growing season the rooting depth is mainly in the top 24 inches. A few roots extend to greater depths as the season progresses and the water table recedes. The available water capacity is low to moderate, but plants are seldom affected by lack of moisture during periods of normal rainfall. The ability to supply nitrogen, potassium, and phosphorus is medium. Unlimed, the surface layer is slightly acid to neutral.

Typical profile of Phelps gravelly loam, 0 to 4 percent slopes, in a cultivated area 200 feet east of Kahler Road, 500 feet south of junction of Kahler and Sing Sing Roads, in the town of Big Flats:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, medium and fine, granular structure; friable; many fine roots; 20 to 25 percent gravel; neutral; abrupt, smooth boundary.

A2—8 to 15 inches, light olive-brown (2.5Y 5/4) very gravelly loam; few, fine, faint, light olive-brown (2.5Y 5/6) mottles; weak, fine and medium, granular structure; friable; many fine roots; 35 to 45 percent gravel; slightly acid; clear, wavy boundary, with some A2 material interfingering around peds in upper part of the B2t horizon.

B2t—15 to 29 inches, dark grayish-brown (2.5Y 4/2) very gravelly loam; common, fine, faint mottles of dark yellowish brown (10YR 4/4); moderate, medium, granular structure; firm, sticky; few fine roots; numerous patchy brown to dark-brown (10YR 4/3) clay films in pores and on ped faces in lower part; 35 to 40 percent fine and medium gravel; slightly acid; gradual, wavy boundary.

B3—29 to 40 inches, dark grayish-brown (2.5Y 4/2) very gravelly sandy loam; weak, medium and fine, granular structure; friable, slightly sticky; few roots; 35 to 40 percent fine and medium gravel; 1 percent cobblestones more than 3 inches in diameter; splotches of dark yellowish-brown (10YR 4/4) partly weathered limestone pebbles and small streaks of dark gray (5Y 4/1) more clayey material; neutral; gradual, wavy boundary.

IIC—40 to 60 inches, dark grayish-brown (10YR 4/2) and very dark grayish-brown (10YR 3/2) stratified sand and gravel; single grain; loose; very few roots in upper part; 1 percent cobblestones more than 3 inches in diameter; few yellowish-brown (10YR 5/8) partly weathered limestone pebbles; mildly to moderately alkaline; calcareous.

Thickness of the solum ranges from 30 to 40 inches. Carbonates are at a depth of 30 to 48 inches. Coarse fragments are 15 to 24 percent of the solum. The Ap horizon is generally 10YR in hue, 3 or 4 in value, and 2 in chroma. The A2 horizon is 10YR or 2.5Y in hue and has mottles high in chroma. Texture of the B2t horizon ranges from gravelly to very gravelly silt loam to clay loam. It is 7.5YR to 2.5Y in hue, 4 or 5 in value, and 2 in chroma and has mottles of higher chroma. The C horizon is stratified layers of sand and gravel or layered sands, silt, and gravel. Colors are grayish brown to very dark grayish brown.

The high content of coarse fragments in the B2t horizon is outside the defined range for the Phelps series, as is the 11-inch-thick transitional B3 horizon that occurs in most profiles. These differences do not alter the usefulness and behavior of these soils to any great degree.

Phelps soils are commonly adjacent to the well-drained to somewhat excessively drained Howard soils, the somewhat poorly drained Homer soils, and the poorly to very poorly drained Atherton soils, all of which formed in the same gravelly glacial outwash material as Phelps soil. In a few places the moderately well drained Phelps soil is near the well-drained to somewhat excessively drained Chenango channery silt loam, fans. The coarse fragments in Phelps soil are generally rounded pebbles in contrast to the channery fragments in the Chenango soil.

Phelps gravelly loam, 0 to 4 percent slopes (PhA).—This nearly level to gently sloping soil has the profile described as typical for the series. It usually occupies slightly depressed areas on gravelly outwash terraces. Phelps soil also occupies the lower ends of alluvial fans, where it spreads out and merges with silty soils of the Williamson and Wallington series. Individual areas are usually less than 10 acres.

Included in mapping were small spots of better drained Howard soils on knolls and small areas of similar, but wetter, Homer soils in depressions. Also included were areas of soil at the lower ends of alluvial fans, where local channery material overlies silty sediment. Other minor inclusions were small areas where the surface layer is sandy loam or fine sandy loam and gravel is lacking.

This soil is suited to crops, pasture, or woodlands. Slight wetness can briefly delay planting but does not restrict the choice of crops to any great extent. The soil is suited to most crops if adequate amounts of lime and fertilizer are applied. (Capability unit IIw-2; woodland suitability group 2o1)

Rhinebeck Series

The Rhinebeck series consists of deep, somewhat poorly drained soils that have medium-textured surface layers and moderately fine to fine textured subsoils. These soils developed in lake-laid silts and clays that have a high content of lime. In most places, they are underlain by stratified deposits of sand and gravel at a depth of 3½ to 6 feet. They are nearly level to gently sloping.

In a typical profile in a cultivated area, the plow layer is very dark grayish-brown silt loam about 8 inches thick. It overlies a friable, light brownish-gray, silt loam leached layer 4 inches thick that contains many, prominent, strong-brown mottles and is neutral in reaction. The subsoil, at a depth below 12 inches, consists of dark grayish-brown silty clay loam and light silty clay mottled with gray and yellowish brown. It has moderate to strong blocky structure, firm consistency, and neutral reaction. The substratum is calcareous at a depth of about 31 inches. It consists of very firm, mottled dark grayish-brown silty clay loam to a depth of 48 inches and stratified sand and gravel in the lower part.

In spring and in wet periods, the water table is perched on the slowly permeable, firm, dense, fine-textured subsoil and upper part of the substratum. In undrained areas this seasonally high water table is at depths between 6 and 18 inches. Depth of rooting is influenced to a considerable extent by the water table and the periodically saturated condition of the subsoil. Most roots develop and grow in the upper 24 inches of soil. The available water supply of this zone is high. Total nitrogen content is moderate to high, but it is released slowly in spring and early in summer. The ability to supply potassium is very high, and ability to supply phosphorus is medium. Unlimed, the surface layer is slightly acid to neutral.

Typical profile of Rhinebeck silt loam, gravelly substratum, 0 to 3 percent slopes, in a cultivated area 20 feet south of Roemmelt Road, halfway between County Roads 5 and 6, in the town of Veteran:

Ap—0 to 8 inches, very dark grayish-brown (2.5Y 3/2) silt loam, light brownish gray (2.5Y 6/2) when dry; moderate, medium, granular structure; friable; many fine roots; neutral; abrupt, smooth boundary.

A2—8 to 12 inches, light brownish-gray (10YR 6/2) silt loam; many, medium, prominent mottles of strong brown (7.5YR 5/6); weak, fine, subangular blocky structure; friable; common fine roots; neutral; clear, wavy boundary.

B21t—12 to 20 inches, dark grayish-brown (2.5Y 4/2) silty clay loam; 45 percent has fine mottles of yellowish brown (10YR 5/6); moderate, coarse, prismatic structure parting to moderate to strong, medium, angular blocky; firm; few fine roots in cracks; ped faces have grayish-brown (10YR 5/2) silt coatings in the upper part and few, patchy, dark grayish-brown (10YR 4/2) clay films in lower part; neutral; clear, wavy boundary.

B22t—20 to 31 inches, dark grayish-brown (2.5YR 4/2) light silty clay; common, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, coarse prismatic structure parting to moderate to strong, coarse, angular blocky; firm; few roots in cracks of prisms; peds have patchy, dark grayish-brown (10YR 4/2) clay films on faces; mildly alkaline; clear, smooth boundary.

C1—31 to 48 inches, dark grayish-brown (10YR 4/2) silty clay loam; common, medium, faint, brown (10 YR 5/3-4/3) mottles; moderate, thick, platy structure; very firm; mildly to moderately alkaline; calcareous, with white streaks and nodules of lime in cracks and on ped faces.

IIC2—48 to 60 inches, stratified sand and gravel.

Thickness of the solum ranges from 22 to 40 inches, averaging about 30 inches. Free lime is at a depth of about 24 to 36 inches. The upper part of the solum is slightly acid to neutral, and the lower part is neutral to mildly alkaline and weakly calcareous. In some profiles there is an A & B horizon. The B2t horizon ranges from 7.5YR to 2.5Y in hue, is 4 or 5 in value, and 2 or 3 in chroma. Texture of B2t horizon ranges from silty clay loam to heavy silty clay. The C horizon is blocky clay or varved silt and clay in the upper part, resting on gravel and sand beds at a depth of 3½ to 6 feet.

Rhinebeck soils are generally adjacent to the moderately well drained to well drained Hudson soils and the poorly to very poorly drained Madalin soils that formed in similar lake-laid silts and clays. Rhinebeck soils are also near the better drained Howard and Phelps soils that formed in gravelly glacial outwash underlying the Rhinebeck soils where they are exposed on the surface.

Rhinebeck silt loam, gravelly substratum, 0 to 3 percent slopes (RhA).—This soil has the profile described as typical for the series. It occupies level or depressed areas in the lake plain where runoff is slow or accumulates. Individual areas are small, usually 5 to 15 acres in size.

Included in mapping were small spots of similar, but better drained, Hudson soils on small knolls. Also included, in depressions and along drainageways, were spots of wetter Madalin soils that formed in similar materials.

This soil can be used for crops, pasture, or woodland. Unless this soil is drained, planting is delayed in the spring, and the wetness restricts the choice of crops. Mixtures of grasses and water-tolerant legumes can be grown for hay or pasture. Small grains and corn can be grown, but the somewhat poor drainage is a limitation in wet years. Because of the heavy texture, precise management is needed to prevent puddling during tillage operations. (Capability unit IIIw-1; woodland suitability group 3w1)

Rhinebeck silt loam, gravelly substratum, 3 to 8 percent slopes (RhB).—This soil has a profile similar to the one described as typical for the series, except that the subsurface layer is thinner in places. It usually occupies foot slopes on the lake plains and receives runoff from adjacent soils. Individual areas are irregular in shape, are usually longer than they are wide, and range in size from 5 to 15 acres.

Included in mapping were narrow strips of poorly to very poorly drained Madalin soils along drainageways. These are significant because they interfere with tillage operations. Also included were a few eroded spots that have a silty clay loam surface layer and small spots of the better drained Hudson soils.

This soil can be used for crops, pasture, or woodland. Unless this soil is drained, wetness delays planting and limits the choice of crops that can be grown. There is a hazard of erosion if this soil is cultivated and not protected. Hay and pasture mixtures of water-tolerant legumes and grasses are suited to these areas. Small grains and corn can be grown, but growth is limited by excess water during wet years. It is necessary to work this soil at the proper moisture content to avoid excess puddling. (Capability unit IIIw-2; woodland suitability group 3w1)

Tioga Series

The Tioga series consists of deep, well-drained, medium-textured and moderately coarse textured soils. These soils formed in alluvial sediment deposited on flood plains of all the major streams in the county.

In a typical profile in a cultivated area, the plow layer is dark grayish-brown silt loam about 8 inches thick. It overlies a brown, friable, strongly acid, silt loam subsoil that becomes yellowish brown at a depth below 18 inches and is medium acid in reaction. The substratum is at a depth of about 36 inches. It is friable, slightly acid, dark yellowish-brown silt loam.

Tioga soils are subject to periodic flooding. Normally the water table is at a depth of 24 inches or more. These soils are moderately permeable in the top 40 inches. Permeability ranges from moderate to rapid at a depth below 40 inches. There are no restrictions to rooting. Available water capacity is high. The ability to supply nitrogen is medium to moderately high, ability to supply potassium is medium to low, and ability to supply phosphorus is medium. The upper 30 inches is strongly acid to medium acid in reaction.

Typical profile of Tioga silt loam, in a cultivated area 1½ miles south of the village of Van Etten, between Lehigh Valley Railroad and Cayuta Creek, west of State Highway 34:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, grayish-brown (10YR 5/2) when dry; moderate, medium, granular structure; friable; many fine roots; strongly acid; abrupt, smooth boundary.

B21—8 to 18 inches, brown (10YR 5/3) silt loam; weak, fine, medium and subangular blocky structure; friable; many fine roots; strongly acid; clear, smooth boundary.

B22—18 to 36 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; medium acid; gradual, smooth boundary.

C—36 to 50 inches, dark yellowish-brown (10YR 4/4) silt loam; massive; friable; few fine roots; slightly acid.

Thickness of the solum ranges from 24 to 36 inches. Gravelly layers are at a depth of more than 40 inches; coarse fragments do not occur at depths between 10 and 36 inches. There is more than 15 percent fine and medium sand and less than 18 percent clay in the upper 40 inches. Reaction ranges from strongly acid to medium acid in the upper horizons, but becomes medium acid or slightly acid within 30 inches of the surface. The Ap horizon is 10YR or 2.5Y in hue, 3 to 5 in value, and 2 or 3 in chroma. Texture ranges from fine sandy loam to silt loam. Structure is moderate to weak granular. The B2 horizon is 10YR or 2.5Y in hue, is 4 or 5 in value, and 2 to 4 in chroma. In some profiles yellowish-brown mottles are at a depth below 30 inches. Texture is loam, fine sandy loam, or silt loam. The C horizon ranges from dark yellowish brown to grayish brown. Textures are extremely variable. Coarse sandy or gravelly layers are common at a depth below 48 inches. The C horizon is structureless or has a platy structure.

Tioga soils are commonly adjacent to moderately well drained to somewhat poorly drained Middlebury soils and poorly and very poorly drained Papakating soils that formed on flood plains in similar materials. Tioga soils are also near well-drained gravelly Howard soils and similar Unadilla soils on terraces above flood level. Tioga soils are associated with Chenango soils on alluvial fans. Tioga soils lack the coarse fragments in the solum characteristic of the Chenango soils.

Tioga fine sandy loam (Tf).—This level soil has a profile that is similar to the one described as typical, except for the texture of the surface layer and greater content of sand throughout the solum. Slopes are less than 2 percent. This soil occupies first bottoms of flood plains and is subject to flooding. Flooding generally occurs in spring, but can happen whenever precipitation is unusually heavy. This soil is usually closer to the stream channels than other Tioga soils because the sandy sediment is deposited first; the silts are carried farther out on the flood plains. Individual areas are large along the larger streams and smaller along the small streams. In the latter situation, they are long narrow bodies of soil on both sides of the stream. Areas range in size from a few acres along small streams to more than 100 acres along the larger streams.

Included in mapping were small areas of Tioga silt loam and moderately well drained to somewhat poorly drained Middlebury soils too small to delineate. Rounded pebbles or channers of local material are conspicuous in small spots, particularly in the smaller valleys. Small spots of poorly or very poorly drained Papakating soils were also included. They have considerable significance in areas where they interfere with tillage.

This soil is suited to crops, pasture, or woodland. It is subject to flooding, but free water occurs in the upper layers for only short periods in spring and seldom interferes with tillage more than 2 to 3 days. This soil is easy to work and highly responsive to good management. Hay, oats, and corn are forage crops generally grown with excellent results on this soil. It is especially well suited to such specialized crops as vegetables and turf for lawns. It is easy to landscape. To utilize this soil to full capacity, lime and nutrients need to be added. (Capability unit IIw-3; woodland suitability group 2o2)

Tioga silt loam (Tg).—This soil has the profile described as typical for the series. Slopes range from 0 to 2 percent. It occupies first bottoms on flood plains of the rivers and other streams in the county. Areas range in size from 2 to more than 100 acres.

Included in mapping were small spots of Tioga fine sandy loam, moderately well drained and somewhat poorly drained Middlebury soils, and poorly drained and very poorly drained Papakating soils. Some gravelly areas are in former stream channels. Other included soils are only slightly acid in the surface layer and neutral to alkaline in the subsoil. These areas are located in the southern part of the county, in the vicinity of Wellsburg.

This soil is suited to crops, pasture, or woodland. The hazard of flooding is the major limitation. Flooding usually occurs early in spring and does not interfere to any great extent with farming. Usually 2 to 3 days after flooding, this soil is dry enough to be worked. This soil is very responsive to good management. If properly managed, it is well suited to general and specialized crops. (Capability unit IIw-3; woodland suitability group 2o2)

Tioga silt loam, high bottom (Th).—This soil has a profile similar to the one described as typical for the series. Slopes range from 0 to 3 percent. This soil occupies high bottoms made up of older alluvial deposits that are above normal flood levels. The upper horizons usually have brighter colors than in the more frequently flooded Tioga soils. Though above normal flood level of the streams, this soil floods during periods of extreme high water. Individual areas are usually more than 10 acres in size and uniform in shape.

Included in mapping were some small, low areas of moderately well drained to somewhat poorly drained Middlebury soil. Also included were small spots of Unadilla soils that are above flood level.

This soil is suited to crops, pasture, or woodland. If adequate amounts of lime and fertilizer are applied, it is well suited to the forage crops commonly grown by dairy farmers. It is especially well suited to such specialized crops as vegetables and turf for lawns. It is easy to landscape. (Capability unit I-1; woodland suitability group 2o2)

Tuller Series

The Tuller series consists of shallow, somewhat poorly drained to poorly drained, medium-textured soils. These soils developed in thin till derived mainly from the underlying sandstone, siltstone, or shale bedrock that is at a depth of less than 20 inches. They are nearly level to gently sloping and occupy flat hilltop positions and narrow treadlike areas in stairstep topography where water accumulates.

In a typical profile the surface layer is dark grayish-brown channery silt loam about 6 inches thick. It is underlain by a subsoil of mottled, grayish-brown channery silt loam that is friable to a depth of 9 inches and firm below. It rests on fine-grained sandstone bedrock at a depth of about 15 inches. Reaction of the surface layer and subsoil is strongly acid.

Seasonally, the water table in Tuller soils is perched on the underlying bedrock at a depth of 6 to 18 inches. Late in summer and fall, these soils sometimes become very dry, because there is less than 2 feet of soil material to store water. Rooting is almost entirely above the rock; a few roots are along joints in the rock, but not enough to be significant. Available moisture capacity is low to very low. After a week without precipitation, plants growing on Tuller soils show evidence of moisture stress. Total nitrogen content is medium to high, but it is released slowly in spring because of wetness. These soils are medium in available potassium and phosphorus reserves. They are very strongly acid to medium acid and, if cropped, they need liming.

Typical profile of Tuller channery silt loam, 0 to 8 percent slopes, in an idle area 50 feet west of Middle Hill Road and one-half mile west of junction with Kies Road, in the town of Van Etten:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, fine, granular structure; friable; many fine roots; 15 to 20 percent coarse fragments; strongly acid; clear, wavy boundary.

B21g—6 to 9 inches, grayish-brown (10YR 5/2) to gray (10YR 5/1) channery silt loam; many, fine, faint, brown (10YR 5/3) mottles; weak, fine, subangular blocky structure; friable; few fine roots; 15 to 20 percent coarse fragments; strongly acid; clear, wavy boundary.

B22g—9 to 15 inches, grayish-brown (10YR 5/2) channery silt loam, brown (10YR 5/3) when rubbed; common, medium distinct yellowish-brown (10YR 5/4-5/6) mottles; moderate, medium, subangular blocky structure; firm; few fine roots; 20 to 30 percent coarse fragments; strongly acid.

R—15 inches +, horizontally bedded, fine-grained sandstone bedrock.

Thickness of the solum ranges from 10 to 20 inches and corresponds to the depth to bedrock. In places bedrock is highly fractured, and where this condition exists, there is a thin 2- to 3-inch layer of mixed soil and coarse fragments on top of solid bedrock. Coarse fragments of thin, flat pieces of rock make up 10 to 35 percent of the volume of material above the rock. They range from 1 to 15 inches in length. Reaction of the solum ranges from very strongly acid to medium acid. The Ap horizon ranges from 10YR to 2.5Y in hue, is 3 or 4 in value, and is 2 or 3 in chroma. The B21g horizon is 10YR to 2.5Y in hue, 5 or 6 in value, and 1 to 3 in chroma. The B22g horizon ranges from 10YR to 5Y in hue, is 4 or 5 in value, and is 2 or 3 in chroma. Mottles in the B2 horizon are many to few and faint to distinct. Bedrock is massive; or it is thick-bedded, fine-grained sandstone; or it is highly fractured, thin-bedded sandstone, siltstone, or weak fissile shale.

The content of coarse fragments in the solum is lower than that in the defined range for the series, but this does not alter the usefulness and behavior of the soils.

Tuller soils are commonly adjacent to moderately well drained to well drained, shallow Arnot soils and moderately deep, well drained Lordstown soils that formed in similar material. Other soils that are near Tuller soils are the moderately well drained Mardin soils, the somewhat poorly drained Volusia soils, and the poorly drained Chippewa soils. Tuller soils formed in similar materials, but Mardin, Volusia, and Chippewa soils are deep and have a fragipan.

Tuller channery silt loam, 0 to 8 percent slopes (TuB).—This soil has the profile described as typical for the series. It occupies flat areas, depressions, and gentle slopes on the higher hills and ridgetops where water accumulates. Individual areas are regular in shape and from 2 to 15 acres in size.

Included in mapping were small spots of better drained Arnot soils, small areas of deeper Chippewa soils, and spots where bedrock is at a depth of less than 10 inches. Also included were spots where the surface layer is silt loam and nearly free of coarse fragments.

This soil can be used for crops, pasture, or woodland, but it is poorly suited to crops. In spring it is wet, cold, slow to dry out, and is difficult to drain because of shallowness. In summer it is very dry and has little moisture available for plants. Nutrient and lime deficiencies are limitations to farming. Much of the acreage in the county is idle or abandoned. It is better suited to forest or wildlife habitat than to farming. (Capability group IIIw-4; woodland suitability group 5w1)

Unadilla Series

The Unadilla series consists of deep, nearly level, well-drained, silty soils. These soils developed in deposits of silts and very fine sands on stream terraces.

In a typical profile in a cultivated area, the plow layer is brown to dark-brown silt loam about 8 inches thick. The subsoil is medium acid to strongly acid, light yellowish-brown and yellowish-brown silt loam that is friable to a depth of 12 inches and firm below. It extends to a depth of 31 inches, where it merges with the substratum. The upper part of the substratum is firm, yellowish-brown to dark yellowish-brown silt loam to very fine sandy loam that is strongly acid. At a depth below 42 inches, the substratum is loose, dark grayish-brown, stratified sand and gravel, becoming weakly calcareous at a depth of about 60 inches.

Roots readily penetrate this moderately permeable to moderately rapidly permeable soil to a depth of 40 inches or more. Available moisture capacity is high. The ability to supply nitrogen and phosphorus is medium; ability to supply potassium is low to medium. Unlimed, these soils are strongly acid in the surface layer.

Typical profile of Unadilla silt loam, 0 to 3 percent slopes in a cultivated area on Lowman Road, 1 mile north of its junction with State Highway 17, in the town of Chemung:

Ap—0 to 8 inches, brown to dark-brown (10YR 4/3) silt loam, pale brown (10YR 6/3) when dry; moderate, fine and very fine, granular structure; very friable; many fine roots; slightly acid; abrupt, smooth boundary.

B21—8 to 12 inches, light yellowish-brown (10YR 6/4) silt loam; weak, medium, subangular blocky structure; friable; many fine roots; medium acid; gradual, wavy boundary.

B22—12 to 18 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; firm, slightly sticky; common fine roots; strongly acid; clear, smooth boundary.

B23—18 to 31 inches, light yellowish-brown (10YR 6/4) silt loam; moderate, medium, subangular blocky structure; firm; few fine roots; strongly acid; clear, smooth boundary.

C1—31 to 42 inches, yellowish-brown (10YR 5/4) to dark yellowish-brown (10YR 4/4) light silt loam to very fine sandy loam; weak, medium and coarse, subangular blocky structure; firm; few fine roots; strongly acid; no coarse fragments.

IIC2—42 to 60 inches, dark grayish-brown (10YR 4/2) stratified sands and gravel; single grain; loose; no roots; less than 10 percent of material is smaller than cobblestone size; neutral, becoming weakly calcareous at a depth of about 60 inches.

Thickness of the solum ranges from 24 to 42 inches. Silty material over unconforming material is 40 to 60 inches thick. Reaction is strongly acid to a depth of 30 inches or more unless limed. Gravel and sand are commonly calcareous at depths between 4 and 5 feet. The Ap horizon is 10YR or 2.5Y in hue, 3 to 5 in value, and 2 or 3 in chroma. Consistence is friable or very friable. The B2 horizon ranges from 7.5YR to 2.5Y in hue and from 4 to 6 in value and is 4 or 6 in chroma. Subhorizons have a texture of very fine sandy loam or silt loam, and are up to 10 percent gravel.

Structure is moderate to weak subangular blocky, and consistence is friable to firm. The C1 horizon is silt loam or very fine sandy loam. It has weak blocky or platy structure or is massive. Consistence is firm, and reaction is strongly acid to slightly acid. The IIC2 horizon ranges from loose, dark grayish-brown sand and gravel to compact loamy glacial till.

Unadilla soils are commonly near soils of the Howard, Tioga, Williamson, and Wallington series. Unadilla soils are more acid than the Howard soils and lack the gravelly solum.

They are similar to Tioga soils on lower lying flood plains. Unadilla soils formed in similar materials to the Williamson and Wallington soils, but these latter soils are moderately well drained and somewhat poorly drained respectively and have a fragipan that is lacking in the Unadilla soils.

Unadilla silt loam, 0 to 3 percent slopes (UnA).—This level to very gently undulating soil has the profile described as typical for the series. It occupies terrace positions above flood plains. Individual areas are regular in shape and range in size from 5 to more than 20 acres.

Typical Unadilla soil has a gravel-free surface layer and subsoil. The most common inclusions in the areas shown on the map were spots that have a slight amount of gravel scattered over the surface and mixed through the soil material. Stratified gravel is normally at a depth of 40 inches or more, but spots were included having gravel at a depth of 24 to 32 inches. Small areas of similar, but moderately well drained, Williamson soil and wetter spots of Wallington soil were also included in a few places.

This soil is suitable for crops, pasture, and woodland. It is well suited to crops commonly grown on dairy farms and is especially well suited to specialized crops, like vegetables. The principal management need is maintenance of proper soil reaction and a high nutrient level. (Capability group I-1; woodland suitability group 2o1)

Valois Series

The Valois series consists of deep, well-drained, medium-textured soils that developed in gravelly glacial till derived mainly from shale and sandstone and from small amounts of limestone. Pockets of materials that are poorly sorted by water action are common in the till mass. Valois soils are gently sloping to steep and are on uniform or irregular topography on uplands. They are generally along lower valley walls adjacent to glacial outwash deposits.

In a typical profile in a cultivated area, the plow layer is brown to dark-brown gravelly loam about 7 inches thick. To a depth of about 30 inches, the subsoil is very friable, strong-brown gravelly loam that is strongly acid. The lower part of the subsoil, to a depth of 47 inches, is brown to dark-brown gravelly silt loam that is friable and strongly acid. The substratum is mainly dark grayish-brown, friable, very gravelly sandy loam. It has pockets of gravelly silt loam and gravelly clay loam.

These soils are moderately permeable. The water table is rarely within 3 feet of the surface during frost-free periods. There are few restrictions to depth of rooting, but most roots are in the top 30 inches. These soils have a moderate available water capacity in this 30 inch zone. Plants show moisture stress after about a week without rain during the growing season. The ability to supply nitrogen, potassium, and phosphorus is medium. Unlimed, the surface reaction is very strongly acid to strongly acid.

Typical profile of Valois gravelly loam, 2 to 8 percent slopes, in a cultivated area 800 feet south of Sturdivent Road, 1,000 feet east of junction of DeMunn and Sturdivent Roads, in the town of Catlin:

Ap—0 to 7 inches, brown to dark-brown (10YR 4/3) gravelly loam; weak, medium and fine, granular structure; very friable; many fine roots; 15 to 20 percent gravel; strongly acid; abrupt, smooth boundary.

B21—7 to 30 inches, strong-brown (7.5YR 5/6) gravelly loam; weak, medium and fine, granular structure; very friable; common fine roots; 25 to 30 percent gravel, cobblestones, and angular rock fragments; strongly acid; clear, wavy boundary.

B22—30 to 47 inches, brown to dark-brown (10YR 4/3) gravelly silt loam; weak, medium, subangular blocky structure; friable; few fine roots; 15 to 20 percent coarse fragments mainly of gravel and angular rock fragments, but some are cobblestones; strongly acid; gradual, wavy boundary.

IIC—47 to 60 inches, dark grayish-brown (10YR 4/2) very gravelly sandy loam that has pockets of gravelly silt loam and gravelly clay loam; some faint yellowish-brown mottles in the heavier material; weak, medium, granular structure; friable; 35 to 40 percent coarse fragments; clay films and silt coatings are prominent on tops of coarse fragments; slightly acid.

Thickness of solum ranges from 42 to 60 inches. Bedrock is at a depth of 6 feet to many tens of feet. Coarse pebbles, cobblestones, and angular rock fragments make up 15 to 35 percent of the volume. The Ap horizon is 10YR or 2.5Y in hue, 3 or 4 in value, and 3 or 2 in chroma. Structure is weak to moderate granular, and consistence is friable or very friable. The B horizon is 7.5YR to 2.5Y in hue, 4 or 5 in value, and 3 to 6 in chroma. Texture is gravelly loam or silt loam, structure is weak, and consistence is friable or very friable. The IIC horizon ranges from medium acid to mildly alkaline, and in places it becomes calcareous at a depth below 60 inches.

In many places Valois soils are adjacent to Howard soils that formed in gravelly glacial outwash. Valois soils lack the well-sorted gravelly substratum of the Howard soils. Other soils near Valois soil are the moderately well drained Mardin soils, the somewhat poorly drained Volusia soils, and the well-drained Lansing soils. Like Valois soils, the Mardin and Volusia soils formed in deep glacial till, but they have a very dense, compact fragipan and substratum in contrast to the friable and more permeable substratum of the Valois soil. Valois soils are more permeable, contain less clay in the subsoil and substratum, and are generally more acid than the Lansing soils.

Valois gravelly loam, 2 to 8 percent slopes (VaB).—This gently sloping soil has the profile described as typical for the series. It occupies rounded knolls of morainic landforms at the junction of valley floors and the lower parts of upland slopes. Individual areas are irregular in shape and range in size from 4 to more than 100 acres.

Included in mapping were small areas of moderately well drained Mardin soils and similar, but less permeable, Lansing soils. Also included were small spots of similar Howard soils that formed in well-sorted glacial outwash.

This soil can be used for crops, pasture, or woodland. It is suitable and used mainly for growing corn for silage and grain and oats and hay for dairy cattle. This soil is particularly well suited to deep-rooted legumes. Good pasture and meadows of legume and grass mixtures can be grown with proper management. There is a slight hazard of erosion if this soil is cultivated and not protected. Because complex slopes are common, the use of contour measures for erosion control and moisture conservation is not practical in many places. Nutrient and lime deficiencies are other limitations to farming. (Capability unit IIe-1; woodland suitability group 3o1)

Valois gravelly loam, 8 to 15 percent slopes (VaC).—This soil occupies lower valley slopes and moraines where topography is both simple and complex. Individual areas are usually irregular in shape and range from 5 to more than 50 acres.

Included in mapping were small areas of Mardin soils having moderate drainage and a distinct fragipan, and spots of similar, but less permeable, Lansing soils. In places that substratum consists of water-worked material that is somewhat similar to the underlying Howard soils. Also included were small spots of wet Volusia and Chippewa soils. They are in depressions and along drainageways.

This soil is suitable for crops, pasture, or woodland. Most crops grown in the county are well suited, especially deep-rooted legumes. There is a moderate hazard of erosion if this soil is cultivated and not protected. Because runoff is rapid, plants show moisture stress sooner than on the less sloping Valois soil. Because many slopes are complex, contour measures to control erosion and conserve moisture are often not practical. (Capability unit IIIe-1; woodland suitability group 3o1)

Valois gravelly loam, 15 to 25 percent slopes (VaD).—This soil has a profile that is similar to the one described as typical for the series, except that the surface layer is thinner in places as a result of erosion and there are more pebbles and coarse fragments in the surface layer. This soil is moderately steep and occupies lower valley slopes and morainic areas on irregular and complex topography.

Included in mapping were spots of wetter Volusia and Chippewa soils in morainic depressions and hillside seeps. Where this soil joins the Lordstown soils, bedrock is closer to the surface than is typical for the series. In places spots of Howard soils that have a loose, gravelly substratum were included, as well as small areas of similar, but less permeable, Lansing soils.

The less sloping parts of this soil can be used for crops, but generally this soil is used to better advantage for hay, pasture, or woodland. A high percentage is forested, and much of the cleared portion is idle or abandoned. Runoff is rapid, and there is a severe hazard of erosion if this soil is cultivated and not protected. Also, this soil tends to be droughty. Because many slopes are complex, the use of contour measures to control erosion and conserve moisture is usually not feasible. It is extremely difficult and hazardous to use machinery on this soil because of slopes. (Capability unit IVe-1; woodland suitability group 3r1)

Valois gravelly loam, 25 to 40 percent slopes (VaE).—This steep soil has a profile similar to the one described as typical for the series, except that the upper layers are usually thinner and the surface layer has a higher content of gravel and coarse fragments. The soil is steep and occupies lower valley walls and complex, irregular, morainic landforms.

Included in mapping were spots of deep, moderately well drained Mardin soils, as well as moderately deep, well-drained Lordstown soils, in which the bedrock is at a depth of 20 to 40 inches.

This soil is too steep for cultivation. It can be used for native pasture, woodland, and recreational development. Much of it is forested, and the cleared acreage is idle or abandoned. This soil is droughty, and the hazard of erosion is severe. (Capability unit VIe-1; woodland suitability group 3r3)

Volusia Series

The Volusia series consists of deep, somewhat poorly drained, medium-textured soils. These soils formed in dense glacial till that is derived mainly from shale, siltstone, and sandstone. They are gently sloping to moderately steep and occupy valley sides and broad divides on ridgetops on uplands in all sections of the county.

In a typical profile in a cultivated area, the plow layer is very dark grayish-brown channery silt loam about 8 inches thick. This is underlain by a leached layer of mottled, grayish-brown, firm channery silt loam that is strongly acid in reaction. It extends to a depth of 17 inches. The subsoil is mottled, olive-brown and grayish-brown, dense, compact channery silt loam that is a strongly expressed fragipan. It is strongly acid in the upper part and becomes medium acid in reaction at a depth below 30 inches. The till substratum is at a depth of about 48 inches. It consists of very firm, dense, olive-brown very channery silt loam that is neutral in reaction.

In spring and during wet periods, the water table, at a depth of about 6 to 18 inches, is perched on the impervious fragipan layer. In exposed sections and cuts, the soil water can be seen moving laterally on top of the fragipan, while the soil material below appears to be partly dry. Rooting is confined largely to the 12 to 18 inches above the fragipan. Available water capacity is low to moderate.

Crops growing on Volusia soils show moisture stress during the growing season after about 1 week without rain. Total nitrogen content is medium to high, but nitrogen is slowly available in spring because of the cold, wet, soil condition. The supply of available potassium and phosphorus is medium. Unlimed, the surface reaction is strongly acid.

Typical profile of Volusia channery silt loam, 2 to 8 percent slopes, in an idle area at junction of Marsh and Wynkoop Creek Roads, in the town of Erin:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) channery silt loam; moderate and weak, medium, granular structure; friable; many fine roots; 15 to 20 percent coarse fragments; strongly acid; abrupt, smooth boundary.

A2—8 to 17 inches, grayish-brown (10YR 5/2) channery silt loam; many, medium to coarse, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; many fine roots; 15 to 25 percent coarse fragments; strongly acid; clear, wavy boundary.

Bx1—17 to 30 inches, olive-brown (2.5Y 4/4) channery silt loam; many, medium, faint, dark grayish-brown (10YR 4/2) mottles on broken ped faces; strong, very coarse prisms about 12 inches across separated by grayish-brown (10YR 5/2) silty material that has outer edges of yellowish brown (10YR 5/6); very firm and brittle, hard; few fine roots between prisms; 20 to 30 percent coarse fragments; strongly acid; diffuse, wavy boundary.

Bx2—30 to 48 inches, grayish-brown (2.5Y 5/2) channery silt loam; common, medium, faint, olive-brown (2.5Y 4/4) and distinct, yellowish-brown (10YR 5/6) mottles; strong, very coarse prisms 8 to 24 inches across; very firm and brittle, hard; no roots; 20 to 35 percent coarse fragments; medium acid; diffuse, wavy boundary.

C—48 to 60 inches, olive-brown (2.5Y 4/4) very channery silt loam; massive; very firm basal glacial till; 35 to 40 percent coarse fragments; neutral.

Thickness of solum ranges from 42 to 60 inches. Coarse fragments are mainly flat, angular pieces of sandstone that make up 15 to 35 percent of the volume in the solum and 30 to 60 percent in the C horizon. The Ap horizon is 10YR and 2.5Y in hue, 3 to 4 in value, and 2 in chroma. Structure is moderate to weak granular, and consistency is friable or very friable. The A2 horizon is 2.5Y or 10YR in hue, 4 to 6 in value, and 2 or 3 in chroma. Mottles range from few to many and from faint to distinct and are higher in chroma than the matrix. Texture is dominantly channery silt loam, but in places it is channery loam. Structure is weak to moderate, medium, subangular blocky. Consistence is friable to firm. The Bx horizon is 10YR to 5Y in hue, 4 or 5 in value, and 2 to 4 in chroma. Chroma higher than 2 is dominant in the matrix of the Bx1 horizon. Mottles are few to many, medium to coarse, faint to distinct, and higher in chroma than the matrix. Structure is very coarse prismatic, parting to medium or coarse blocky in places. Consistence is firm to extremely firm and brittle. Reaction is strongly acid to medium acid. The C horizon is grayish brown or olive brown; texture ranges from channery silt loam or very channery silt loam to channery loam or very channery loam. It is massive or has platy structure. Consistence is firm to very firm. Reaction is medium acid in the upper part and becomes less acid with depth. In places, calcareous material is at a depth of 60 to 70 inches.

Volusia soils are generally adjacent to moderately well drained Mardin soils and poorly drained Chippewa soils that formed in similar materials. In many places Volusia soils are closely associated with the moderately deep, well-drained Lordstown soils that lie above them and are the source of runoff water and seepage that contribute to the somewhat poor drainage of the Volusia soils.

Volusia channery silt loam, 2 to 8 percent slopes (VoB).—This gently sloping or undulating soil has the profile described as typical for the series. This soil occupies foot slopes below the steep Lordstown soils or long, uniform slopes anywhere from valley floors to hilltops and ridgetops (fig. 11). Individual areas are generally longer than they are broad and commonly include entire sides of ridges and hills. They range in size from 5 to several hundred acres.

Included in mapping were spots of similar, but wetter, Chippewa soils. They account for as much as 20 percent of the acreage of some areas. Small spots of moderately well drained Mardin soils were also included. In some small areas shale bedrock is at a depth of 3 to 4 feet, and the soil contains many shale fragments and has a finer texture than is typical. Some areas, mainly in the vicinity of Sullivanville, have a higher reaction in the fragipan than is typical for Volusia soil.

This soil can be used for crops, pasture, or woodland. Wetness and a deficiency of nutrients and lime are the main limitations to farming. There is a slight to moderate hazard of erosion if this soil is cultivated and not protected. Midsummer drought is also a hazard. (Capability unit IIIw-3; woodland suitability group 3w2)

Volusia channery silt loam, 8 to 15 percent slopes (VoC).—This soil generally occupies foot slopes below the steep Lordstown soils and adjacent to the smooth, slightly concave Mardin soils. This soil receives seepage and runoff from the surrounding soils. Individual areas are uniform and usually are longer than they are wide. They range from 5 to more than 100 acres.

Included in mapping were small and medium-sized areas of poorly drained Chippewa soils. In some areas shale bedrock is at a depth of 36 to 48 inches and the soils have a higher shale content and heavier texture than is normal for the series. Some areas, mainly in the vicinity of Sullivanville, have a fragipan reaction approaching neutral, which is higher in pH than normal for Volusia soil.

This soil can be used for crops, pasture, or woodland. The hazards of erosion, seasonal wetness, and nutrient and lime deficiencies are the main limitations to farming. Midsummer drought is also a limitation. (Capability unit IIIe-5; woodland suitability group 3w2)

Figure 11.—**Stump fence near hilltop on Volusia channery silt loam, 2 to 8 percent slopes.**

Volusia channery silt loam, 15 to 25 percent slopes (VoD).—This moderately steep soil has a profile similar to the one described as typical for the series, except that the upper horizons are generally thinner and the surface layer contains more coarse fragments. This soil is mainly on foot slopes below areas of steep Lordstown soils. Individual areas are long and relatively narrow and range from 5 to more than 50 acres in size.

Included in mapping were small areas of poorly drained Chippewa soils in seepy spots. Also included were small areas of Mardin soils on convex topography and spots of moderately deep, well-drained Lordstown soils.

This soil can be used for hay, pasture, or forest. Because of slope, it is difficult and hazardous to work with modern machinery. The hazard of erosion, nutrient deficiencies, seasonal wetness, and dryness are other limitations to farming. These soils are fairly well suited to some types of hay and pasture if they are well managed. (Capability unit IVe-3; woodland suitability group 3r2)

Wallington Series

The Wallington series consists of deep, somewhat poorly drained, silty soils. They formed in silty lake-laid deposits and old stream terraces that are commonly underlain by stratified sand and gravel at a depth below 40 to 60 inches. These soils are nearly level to gently sloping and occupy flat areas that have slow runoff or depressed areas that receive runoff.

In a typical profile the surface layer is dark grayish-brown silt loam about 9 inches thick. It overlies a leached layer of light olive-brown, highly mottled, strongly acid, friable silt loam that extends to a depth of about 13 inches. The subsoil is a fragipan of highly mottled, olive-gray silt loam that is very firm and brittle and strongly acid. It merges with the substratum at a depth of about 50 inches. The substratum consists of olive very gravelly loam that is slightly sticky when wet and strongly acid.

In spring and during periods of heavy precipitation, the water table is perched above the firm, silty fragipan that is moderately slowly permeable or slowly permeable. During frost-free periods, the water table is at a depth of 6 to 18 inches. Rooting is confined mainly to the zone above the fragipan. Available water capacity is moderate, but lack of available water is seldom a limiting factor for crops. Total nitrogen content is high, but nitrogen is released slowly in spring when the soil is cold and wet. The ability to supply potassium is low and ability to supply phosphorus is medium. Unlimed, the surface layer is very strongly acid to medium acid.

Typical profile of Wallington silt loam, gravelly substratum, 0 to 3 percent slopes, in a meadow 300 feet north of State Highway 17, on SCS plant material farm, one-half mile east of Steuben County line, in the town of Big Flats.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium to fine, granular structure; very friable; many fine roots; strongly acid; abrupt, smooth boundary.

A2—9 to 13 inches, light olive-brown (2.5Y 5/4) silt loam; common, fine, prominent, strong-brown (7.5YR 5/8) mottles and faint, grayish-brown (2.5Y 5/2) mottles; moderate, medium, platy structure; friable; common fine roots; strongly acid; clear, wavy boundary.

Bx—13 to 50 inches, olive-gray (5Y 5/2) silt loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) and strong-brown (7.5YR 5/6) mottles; moderate, thick, platy structure in 12- to 18-inch prisms; silt coatings on prisms are ¼ to ¾ inch thick, light gray to gray (5Y 6/1) at the center and strong brown (7.5YR 5/8) around the edges; very firm and brittle; few fine roots along borders of prisms; strongly acid; abrupt, wavy boundary.

IIC—50 to 65 inches, olive (5Y 5/3) very gravelly sandy loam; single grain; slightly sticky; no roots; 50 percent gravel and cobblestones; strongly acid.

Thickness of solum ranges from 40 to 55 inches. Clay content of the material between the Ap and Bx horizons is less than 18 percent; content of sand coarser than very fine sand is less than 15 percent. Coarse fragments, mainly pebbles, range from 0 to 5 percent of the volume. Reaction of the solum ranges from very strongly acid to medium acid. The Ap horizon ranges from 10YR to 5Y in hue, is 3 or 4 in value, and is 2 in chroma. Structure is granular, and consistence is friable or very friable. The A2 horizon is 4 or 5 in value, 2 to 4 in chroma, and 2.5Y to 10YR in hue. It has common to many distinct mottles. Texture is very fine sandy loam or silt loam, and structure is weak to moderate, medium, subangular blocky or platy. Reaction is medium to strongly acid. The Bx horizon is 10YR to 5Y in hue, 4 or 5 in value, and 2 to 4 in chroma. Distinct mottles higher in chroma than the matrix are common. Structure consists of very coarse prisms, parting to medium or thick plates. Consistence is firm or very firm and brittle. Reaction ranges from medium acid to strongly acid. In most areas the C horizon is gravel and sand at a depth below 40 to 60 inches, but in some areas the C horizon has layers of silt and very fine sand immediately below the fragipan.

Wallington soils are commonly associated with similar, but moderately well drained, Williamson soils and well-drained Unadilla soils that lack the fragipan. They are also near silty, moderately well drained Collamer soils. Wallington soils are more acid than Collamer soils and contain more silt and less clay. In places, Wallington soils are near the Howard, Phelps, and Homer soils, all of which formed in the gravelly glacial outwash underlying the Wallington soils.

Wallington silt loam, gravelly substratum, 0 to 3 percent slopes (WaA).—This soil has the profile described as typical for the series. It is nearly level and occurs on flat or slightly depressed areas on stream terraces and lake plains. Individual areas are irregular in shape and relatively small, seldom exceeding 10 acres.

Included in mapping were small areas of better drained Williamson soils. Some areas of a similar, somewhat poorly drained, silty soil without a fragipan were included. The latter soil is neutral to alkaline in the upper layers and weakly calcareous in the lower part of the subsoil and the substratum. Also included were areas where gravel is at a depth of 30 to 36 inches.

This soil is suited to crops, pasture, and woodland. Unless it is drained, the choice of crops is restricted and planting is delayed. With adequate drainage and additions of lime and plant nutrients, this soil is well suited to most crops commonly grown in the area. (Capability unit IIIw-1; woodland suitability group 3w2)

Wallington silt loam, gravelly substratum, 3 to 8 percent slopes (WaB).—This soil is gently sloping and occupies positions where it receives runoff from higher surrounding land. Individual areas are small and irregular and seldom exceed 10 acres.

Included in mapping were small spots of moderately well drained, silty Williamson and Collamer soils. Also included were similar silty soils that have somewhat poor drainage and lack the fragipan typical of Wallington soil.

These soils are slightly acid and neutral in the upper layers and alkaline to weakly calcareous in the lower part of the subsoil and the substratum. In a few areas gravel is at a depth of 30 to 36 inches.

This soil is suitable for crops, pasture, and woodland. Unless this soil is drained, the choice of crops is limited to some extent and planting is delayed. There is a moderate to severe hazard of erosion if this soil is cultivated and not protected. Nutrient deficiencies also need to be corrected. (Capability unit IIIw-2; woodland suitability group 3w2)

Williamson Series

The Williamson series consists of deep, moderately well drained, silty soils that have a fragipan. They developed in lake-laid silts and silty deposits on stream terraces. Most of these silty deposits are underlain by stratified sand and gravel at a depth below 40 to 60 inches. These soils are nearly level to gently sloping.

In a typical profile in a cultivated area, the plow layer is dark-brown silt loam about 10 inches thick. The upper part of the subsoil is friable, yellowish-brown silt loam that is faintly mottled in the lower 4 inches. It extends to a depth of 19 inches and is separated from the lower part of the subsoil by a 2-inch leached layer of pale-brown, firm silt loam that is faintly mottled. The lower part of the subsoil is a very firm and brittle fragipan of faintly mottled, dark yellowish-brown silt loam. It merges with the substratum at a depth of about 41 inches. The upper part of the substratum consists of firm layers of dark yellowish-brown and strong-brown silts. At a depth below 50 inches are layers of olive colored medium and coarse sands and gravel. Unlimed, the reaction of the surface layer and subsoil is strongly acid.

In spring and during wet periods, the water table is at a depth of about 1½ to 2 feet. It is perched above the slowly permeable or moderately slowly permeable, dense, silty fragipan for short periods. Later in the season and during dry periods, it falls to a depth below 36 inches. The depth of rooting is influenced to some extent by the temporary high water table and by the dense, tightly packed silt of the fragipan. In spring most roots are in the upper 12 to 18 inches of soil. As the season progresses, few roots extend to a depth below 24 inches. Available moisture capacity is moderate to high. Total nitrogen content is medium. Potassium reserve is low, and the ability to supply phosphorus is medium. Unlimed, the soil is strongly acid to medium acid.

Typical profile of Williamson silt loam, gravelly substratum, 0 to 3 percent slopes, in a cultivated area, east of Lowman, along County Road 2, 500 feet north of its junction with County Road 60, in the town of Chemung:

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam; weak, fine and very fine, granular structure; very friable; many fine roots; no coarse fragments; medium acid; abrupt, smooth boundary.

B21—10 to 15 inches, yellowish-brown (10YR 5/6) silt loam; weak, subangular blocky structure; friable; many fine roots; strongly acid; clear, wavy boundary.

B22—15 to 19 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, faint, yellowish-brown (10YR 5/6) mottles; moderate, thick, platy structure, parting to weak, fine, subangular blocky; friable; many fine roots; strongly acid; clear, wavy boundary.

A'2—19 to 21 inches, pale-brown (10YR 6/3) silt loam; many, fine, faint mottles of dark yellowish brown (10YR 3/4) and yellowish brown (10YR 5/6); moderate, medium, platy structure; firm; common fine roots; strongly acid; abrupt, wavy boundary.

B'x—21 to 41 inches, dark yellowish-brown (10YR 3/4) silt loam; many, fine, faint mottles of pale brown (10YR 6/3) and yellowish brown (10YR 5/8); moderate, very coarse, prismatic structure, parting to strong, medium, platy; very firm and brittle; few fine roots; strongly acid; gradual, wavy boundary.

C1—41 to 50 inches, dark yellowish-brown (10YR 3/4) layered silts; thin bands of strong brown (7.5YR 5/8); strong, platy structure, coinciding with bedding planes of the silts; firm; no roots; strongly acid.

IIC2—50 to 72 inches, olive (5Y 5/3) bands of medium and coarse sand and gravel; single grain; loose; no roots; medium to slightly acid.

Thickness of the solum ranges from 36 to 50 inches. Gravel and sand are at a depth of 40 to 60 inches. Clay content of the horizons below the Ap horizon and above the fragipan is less than 18 percent; sands coarser than very fine sand are less than 15 percent of the soil materials. Coarse fragments are not characteristic of the soil, but the Ap horizon is up to 5 percent gravel in some areas. The Ap horizon is 10YR in hue, 3 or 4 in value, and 2 or 3 in chroma. The B2 horizon is 10YR or 2.5Y in hue, 4 or 5 in value, and 4 to 6 in chroma. The B22 horizon generally has many, fine, faint to distinct mottles of higher chroma than the matrix but are sometimes absent. Reaction ranges from medium to strongly acid. A'2 horizon is 10YR or 2.5Y in hue, 5 or 6 in value, and 3 or 4 in chroma. It has common or many, faint or distinct mottles high in chroma. Texture is silt loam or very fine sandy loam. It is massive or has weak to moderate, platy structure. Consistence is friable or firm; reaction is medium acid or strongly acid. The B'x horizon is 10YR or 2.5Y in hue, 3 to 5 in value, and 3 or 4 in chroma. It has common to many, fine, faint mottles high in chroma. Texture is silt loam or very fine sandy loam; consistence is firm or very firm and brittle. Reaction is medium acid to strongly acid. The C horizon is variable. It generally has strata of gravel and sand at a depth of 40 to 60 inches, but some profiles have varved silt and fine sands at these depths. Reaction is strongly acid to mildly alkaline. Gravelly and sandy material becomes calcareous with depth in some profiles.

Williamson soils are commonly adjacent to somewhat poorly drained Wallington soils and well-drained Unadilla soils that formed in similar silty material. The Williamson soils have a fragipan but lack the grayer colors and more distinct mottles of Wallington soils. Williamson soils have a mottled subsoil and a fragipan that are lacking in Unadilla soils. In places Williamson soils are near similar, moderately well drained, silty Collamer soils, but they contain more clay in the subsoil and lack the fragipan of the Williamson soils. Williamson soils are also near the Howard, Phelps, and Homer soils that formed in the gravelly glacial outwash underlying the Williamson soils.

Williamson silt loam, gravelly substratum, 0 to 3 percent slopes (WlA).—This soil has the profile described as typical for the series. It is nearly level and occupies areas on the lake plain in the valleys where local ponding occurred at the end of the glacial period. Individual areas are small and irregular and usually less than 10 acres in size.

Included in mapping were small spots of better drained Unadilla soil on knolls and similar but somewhat poorly drained Wallington soil in depressions. The layered sand and gravel substratum does not always occur and, in places, is at a depth of only 36 inches. Also included were small spots of similar Collamer soils that contain more clay than this Williamson soil and lack the fragipan.

This soil can be used for crops, pasture, or woodland. A slight wetness can delay planting, but this soil is fairly well suited to most crops grown in the county. In addition to the slight seasonal wetness, nutrient deficiencies are also limitations to farming. (Capability unit IIw-2; woodland suitability group 3o1)

Williamson silt loam, gravelly substratum, 3 to 8 percent slopes (WlB).—This soil has a profile similar to the one described as typical for the series, except that the upper part of the subsoil is thinner in places. This soil occupies slightly rounded areas on the lake plain where runoff is accumulated. Individual areas are irregular in shape and are seldom more than 5 to 10 acres in size.

Included in mapping were spots of somewhat poorly drained Wallington soil in depressions and areas of silty soils that lack the fragipan. Also included are a few areas where gravel is at a depth of less than 36 inches.

This soil is suited to crops, pasture, or woodland, but is used mainly for crops to feed dairy cattle. There is a severe hazard of erosion if this soil is cultivated and not protected. Wetness can be a moderate limitation in spring, but surface drainage is usually adequate on these gently sloping soils. Nutrient deficiencies are also limiting. With good management, this soil is suited to most crops grown in the county. (Capability unit IIe-3; woodland suitability group 3o1)

Formation, Morphology, and Classification of the Soils

This section discusses the major factors that have affected the formation and morphology of the soils of Chemung County and classifies the soils in higher categories.

Formation of Soils

Soils are formed through the interaction of five major factors. They are climate, plant and animal life, parent material, topography, and time. The relative influence of each factor usually varies from place to place. Local variations in soils are due to differences in kind of parent material, topography, and drainage. In places one factor may dominate in the formation of a soil and determine most of its properties.

Climate

Chemung County has a humid continental climate that is marked by extreme seasonal temperature changes. It has an annual precipitation of about 34 inches and a mean annual air temperature of 48°F. The rainfall is uniform during the growing season of May through September, averaging about 17 inches. There is sufficient moisture to promote leaching of the soil and the downward movement of carbonates. The cool temperature and prolonged wetness of many areas have caused the accumulation of organic matter in the surface layer of the soils. More detailed information on climate is given in the section "General Nature of the County."

Plant and animal life

All living organisms are important to soil formation. These include vegetation, animals, bacteria, and fungi. Vegetation is generally responsible for the amount of organic matter and nutrients in the soil and the color of the surface layer. Animals, such as earthworms and burrowing animals, help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients for plant food. In Chemung County, the native forests, consisting of oak and northern hardwoods, have greatly influenced soil formation. Rooting depths are shallow in many of the soils and have caused a succession of tree-throws that have kept much of the soil material churned up in the upper 18 inches.

Parent material

Parent material is the unconsolidated earthy material from which soils are formed. It determines the mineralogical and chemical composition of the soil and, to a large extent, the rate that soil-forming processes take place. The compaction and the permeability of materials affect water movement. Rapidly permeable materials, such as glacial outwash, that do not have high water tables do not retain water long enough for major weathering processes to greatly modify the soil materials.

In Chemung County, soils have formed from glacial till, glacial outwash, lacustrine material, recent stream alluvium, and organic materials. Most of the soil materials were left after the glaciers melted 10,000 to 15,000 years ago. Alluvial and organic materials are of recent origin and are still being deposited. Soils formed from glacial till are the most extensive and have a wide range of characteristics. Firm fragipan horizons and substrata are commonly present in the deeper soils. Mardin, Volusia, and Chippewa soils formed in deep glacial till. Soils formed from glacial outwash deposits are generally loam in texture and underlain by stratified sand and gravel. An example of a soil formed in this material is Howard soil. The surface layer of soils formed in lacustrine material ranges from silt loam to silty clay loam. Examples of soils formed in fine-textured lacustrine material are those of the Hudson, Rhinebeck, and Madalin series. Soils on stream bottoms are formed from water-laid material called recent alluvium. They are medium-textured and moderately coarse textured and have little soil development. Examples are Tioga and Middlebury soils. Soils that formed from organic materials are called Muck.

Topography

The shape of the land surface, commonly called the lay of the land; the slope; and the position in relation to the water table have great influence on the formation of soils in the county. Soils formed on sloping areas, where runoff is moderate to rapid, generally are well-drained, have a bright-colored, unmottled subsoil, and are leached to a greater depth than wetter soils in the same general area. In more gently sloping areas where runoff is slower, the soils generally exhibit some evidence of wetness, such as mottling in the subsoil, for short periods of time. In level areas or slight depressions where the water table is at or near the surface for long periods, the soils show evidence of wetness to a marked degree. They have a dark-colored, thick, organic surface layer and a strongly mottled or grayish subsoil. Some soils are wet because of a high ground water table or because they have a position on the landscape where water accumulates and is perched on impervious layers in the soil. Permeability of the soil material, as well as the length, steepness, and configuration of the slopes, influences the kind of soil that is formed from place to place. Local differences in soils are largely the result of differences in parent material and topography.

Time

The formation of soils requires time for changes to take place in the parent material, and this is usually a long time when measured in years. The soils of Chemung County have developed in the period since glaciation. Evidence of this relatively limited time can be seen in the soils.

Soils that formed on low bottoms, subject to varying amounts of flooding, may receive new sediment with each flooding. These soils have a weak structure and weak color differences between horizons. An example is the Tioga soil. Soils that have well-developed horizons, such as the Howard soils, have been developing for longer periods than the Tioga soils.

Morphology of Soils

This subsection contains two parts: a brief explaination of the horizon nomenclature and a description of the processes involved in horizon development.

Major soil horizons

The soil-forming factors cause different layers, or soil horizons, to form in a soil profile. These layers extend from the surface of the soil downward to materials that are little altered by the soil-forming processes.

Most soils contain three major horizons, namely the A, B, and C horizons. These major horizons can be further subdivided by the use of numbers and letters to indicate changes within one horizon. An example is the B2t horizon, which represents a layer within the B horizon that has translocated clay illuviated from the A horizon.

The A horizon is the surface layer. The A1 horizon is the layer with the largest accumulation of organic matter. It is also the layer of maximum leaching or eluviation of clay and iron, and when considerable leaching has taken place, an A2 horizon is formed. The A2 horizon of some soils in Chemung County has a brownish color resulting from oxidation of iron.

The B horizon is below the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the A horizon. In some soils the B horizon is formed by alteration in place rather than from illuviation. The alteration is mainly due to oxidation and reduction of iron. The B horizon is generally firmer than the A horizon, has blocky or prismatic structure, and is generally lighter colored than the A1 horizon but darker than the C horizon. Most young soils have not developed B horizons.

The C horizon is below the A or B horizon. It consists of material that is little altered by the soil-forming processes but may be modified by weathering.

Processes of soil horizon differentiation

There are several processes involved in the formation of soil horizons. In Chemung County these include (1) the accumulation of organic matter, (2) the leaching of soluble salts, (3) the formation and translocation of clay minerals, and (4) the reduction and transfer of iron. These processes take place continually and generally at the same time throughout the profile. The changes in soil materials usually take thousands of years.

The accumulation of organic matter takes place as the plant residue decomposes. This process darkens the surface layer and helps to form the A1 horizon. It takes a long time to replace this organic matter, once it has been lost. The surface layer of soils of Chemung County contains about 3.5 percent organic matter.

In order for soils to have distinct horizons, some of the lime and other soluble salts must be leached before there is a translocation of clay minerals. Many factors affect this leaching, such as the kinds of salts originally present, the depth of percolation, and the texture of the soil profile.

An important process of soil-horizon formation is the translocation of silicate clay minerals. The amount of clay minerals in a soil profile is inherent in the parent material, but clay amounts vary from one soil horizon to another. Clay minerals are generally eluviated from the A horizon and illuviated in the B horizon as clay films on ped faces and in pores and root channels. In some soils the A2 horizon has been formed by considerable eluviation of clay minerals to the B horizon. The A2 horizon is light-colored and has a platy structure in places. Howard soils are an example of clay mineral translocation.

The reduction and transfer of iron occurs mainly in the wetter, more poorly drained soils. This process is called gleying. In the moderately well drained to somewhat poorly drained soils, yellowish-brown and reddish-brown mottles indicate the segregation of iron. In the poorly drained to very poorly drained soils, such as the Chippewa and Madalin soils, the grayish subsoil and underlying material indicate reduction and transfer of iron.

Classification of Soils

Soils are classified so that we can easily remember their significant characteristics, assemble knowledge about them, see their relationships to one another and to the whole environment, and develop principles that help us understand their behavior and response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Table 9 classifies the soils of Chemung County according to the current system. The current system of soil classification defines soils in terms of observable or measurable properties (*12*). The system currently used and described in this section was adopted for general use by the National Cooperative Soil Survey in 1965 and supplemented in March 1966 and September 1968. This system is under constant study; therefore, readers interested in the development of the system should research the latest revisions. The properties chosen are primarily those that permit the grouping of soils that are similar in genesis. This classification may change as more precise information becomes available. Some of the soils of Chemung County are not in a series that is recognized in the classification system, but recognition of a separate series would not serve a useful purpose. Such soils are named for series they strongly resemble because they differ from those series in ways too small to be of consequence in interpreting their usefulness or behavior. Soil scientists designate such soils as taxadjuncts to the series for which they are named. In this survey soils named in the Atherton, Collamer, Homer, Phelps, and Tuller series are taxadjuncts to those series.

The current system of classification has six categories. Beginning with the most inclusive, the categories are: order, suborder, great group, subgroup, family, and series. Following are brief descriptions of each of the six categories in the system.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad, climatic groupings of soils. The exceptions to this are the Entisols, the Histosols, and, to some extent, the Inceptisols, which occur in many different climates. Table 9 shows the three soil orders in Chemung County, Entisols, Inceptisols and Alfisols. Entisols are recent soils in which there has been little, if any, horizon development. Inceptisols most often are found on young, but not recent, land surfaces. Alfisols are soils that have a clay-enriched B horizon that is relatively high in base saturation.

SUBORDER.—Each order is subdivided into suborders, primarily on the basis of soil characteristics that indicate genetic similarity. The suborders narrow the broad climatic range of the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from climate or vegetation.

GREAT GROUP.—Each suborder is divided into great groups on the basis of uniformity in the kind and sequence of major soil horizons and other features. The horizons considered in making separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with the growth of roots or movement of water. The main features considered are the degree of development of horizons, soil temperature, and the major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium).

SUBGROUP.—Great groups are subdivided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of the group and also have one or more properties of another group, suborder, or order. Subgroups may also be used in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILIES.—Families are established within a subgroup primarily on the basis of properties important to plant growth or behavior of soils when used for engineering.

TABLE 9.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order
Arnot	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Atherton [1]	Fine-loamy, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols.
Chenango	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Chippewa	Fine-loamy, mixed, mesic	Typic Fragiaquepts	Inceptisols.
Collamer [2]	Fine-silty, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Homer [3]	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Aeric Ochraqualfs	Alfisols.
Howard	Loamy-skeletal, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Hudson	Fine, illitic, mesic	Glossoboric Hapludalfs	Alfisols.
Lansing	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Lordstown	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Madalin	Fine, illitic, mesic	Mollic Ochraqualfs	Alfisols.
Mardin	Fine-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Middlebury	Coarse-loamy, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Papakating	Fine-silty, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Phelps [4]	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Glossaquic Hapludalfs	Alfisols.
Rhinebeck	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Tioga	Coarse-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Tuller [5]	Loamy-skeletal, mixed, acid, mesic	Lithic Haplaquepts	Inceptisols.
Unadilla	Coarse-silty, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Valois	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Volusia	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Wallington	Coarse-silty, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Williamson	Coarse-silty, mixed, mesic	Typic Fragiochrepts	Inceptisols.

[1] The Atherton soils in Chemung County are taxadjuncts. They differ from the defined range for the series in lacking a subhorizon that has a chroma of more than 2 within 30 inches of the surface.

[2] The Collamer soils in Chemung County are taxadjuncts. They differ from the defined range for the series in having faint mottles that are low in chroma within the upper 10 inches of the argillic horizon. This mottling indicates slight wetness.

[3] The Homer soils in Chemung County are taxadjuncts. They differ from the defined range for the series in having a transitional horizon (B3) more than 5 inches thick over stratified sand and gravel.

[4] The Phelps soils in Chemung County are taxadjuncts. They differ from the defined range for the series in having a high content of coarse fragments in the upper part of the B horizon.

[5] The Tuller soils in Chemung County are taxadjuncts. They differ from the defined range for the series in having too low a content of coarse fragments to be classified as skeletal.

Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizon, and consistence. A family name consists of a series of adjectives preceding the subgroup name. An example is the fine-loamy, mixed, mesic family of Typic Fragiaquepts. Fine-loamy in this instance is the average texture of the textural control section; mixed indicates a heterogeneous minerology of the silt and sand fractions; and mesic indicates an annual soil temperature between 47° and 59° F.

General Nature of the County

This section tells a little about the history of the county, the population, industries and transportation, and farming. It also has sections on water supply, physiography and drainage, geology, and climate.

History and Development

The earliest farming of the area that is now Chemung County was carried on by Indians of the Iroquois Confederation and had reached a comparatively high stage of development at the time of General Sullivan's invasion of the area in 1779. In those early days the principal crops were fruit, corn, beans, pumpkin, and squash.

The first settlement was built in 1786 along Wyncoop Creek; settlement was rapid once initiated and was at first limited to the Chemung River Valley and the major tributaries. By 1803 as much as 50,000 bushels of wheat a year were transported to eastern markets by way of canals and the Susquehanna River. Population by 1900 was 54,063; by 1930, it was 74,680; and in 1966, it was 103,768. Elmira, the largest and only city, had a population of 46,517 in 1960. Other important population centers are Elmira Heights, Elmira S.E., Horseheads, and Van Etten. Elmira is the county seat and the site of the first women's college in the United States.

Recreational facilities of the area are being improved. Many isolated areas on uplands that were once farmed are used for summer recreation. That part of the county that is wooded is also valuable for recreation. Wherever a source of water is available, ponds constructed in the deep soils on uplands are generally successful.

The major industries of the county are the manufacture of fire fighting equipment, automobile and machine parts, electronic equipment, and steel and the processing of food.

Transportation facilities are good.

The main line of the Erie-Lackawanna Railroad passes through the middle of the county, and the Lehigh Valley Railroad passes through the Cayuta Valley. Branch lines of the Penn-Central railroad also serve the county. Chemung County is well provided with highways and roads. State Highway No. 17, a divided limited-access highway, connects the county with regions to the east and west. Good transportation and the large acreage of land available for development are responsible in part for the rapid development of the area.

Farming

According to the U. S. Bureau of the Census in 1964, 40 percent of the land area of Chemung County was in farms. This was broken down into 34,112 acres of harvested crops, 13,524 acres of pasture, 9,191 acres of cropland used for pasture, and 29,813 acres of forest. Dairying was the main farm enterprise. Poultry production was of considerable importance in the town of Van Etten (fig. 12).

The number of farms abandoned has steadily increased over the years. The number of farms decreased from 1,280 in 1950 to 602 in 1964; however, the size of the individual farm increased from 122 to 174 acres. Of the 602 farms reported in the county in 1964, 339 were operated on a commercial basis and 197 were operated on a part-time basis. Dairying remained fairly constant.

The dominant crops are hay, corn, and oats. In 1964, 22,144 acres was used for hay, 10,015 acres for alfalfa and alfalfa-grass mixture, and 10,164 acres for clover and timothy. Total acreage in corn was 4,508, of which 3,462 acres was used for silage. Oats were grown on 5,106 acres and wheat on 622 acres. About 18,328 acres, which is almost 20 percent of the land in farms, was idle. All of the farms in operation are serviced by electricity, telephones, and improved roads.

Water Supply

Chemung County is well supplied with water. The Chemung River, which has an average annual flow of 2,489 cubic feet per second, crosses the middle of the county. The extensive area of unconsolidated deposits of gravel and sand throughout Chemung Valley and the valley between Horseheads and Big Flats is an important source of water from wells. Many of the wells in this aquifer of sand and gravel yield less than 50 gallons per minute (*14*), but some provide as much as 1,000 gallons per minute and have a drawdown of less than 10 feet.

***Figure 12.*—Large poultry house east of Van Etten on Howard soils.**

Wells in glacial till on uplands supply local farm needs. They are large in diameter and provide a large area for infiltration and a large volume for storage. Wells providing a few hundred gallons per day are more common than those providing 5 gallons per minute.

Silt and clay areas in Catharine Creek Valley supply only a limited amount of water, even if wells are large in diameter. Wells are generally inadequate, except for limited domestic or farm use. Silts and clay act as confining beds, retarding movement of water from underlying bedrock or from the more permeable unconsolidated sand and gravel deposits.

About 60 percent of the wells in the county obtain water from bedrock where it is held in joints along bedding planes. Wells in bedrock supply an average of 8 gallons per minute. The range is from 1 to more than 100 gallons per minute. The average depth of wells in bedrock is about 100 feet.

Physiography and Drainage

Chemung County is in the southwestern plateau section of New York located in the northern, glaciated part of the Allegheny Plateau physiographic province (*6*). It is a mature, eroded plateau, dissected by erosion to a depth of 600 to 900 feet. The extreme elevation is 1,900 feet above sea level, and the lowest point is 775 feet where the Chemung River leaves the county.

The area is characterized by flat-topped hills and ridges that have long slopes. They are rounded and less sloping in the upper part and smooth and more sloping at lower elevations. The larger valleys are broad and flat. The even elevation of the hilltops and the almost level to gently sloping relief reflect the nearly horizontal character of the underlying shale and sandstone bedrock. Severe dissection gives the uplands a strongly rolling relief. The rounded shoulders of the hills and ridges and the steep lower slopes indicate that the present deep valleys probably resulted in part from erosion by ice lobes that moved down the broad, shallow valleys during Pleistocene time. Depth of dissection is greatest along the Chemung River, where the difference in elevation between the valley floor and adjacent hilltops is 600 to 800 feet. The tributary valleys are shallower because glaciation and erosion were greatest in the broad central valley. The variation in elevation in these minor valleys is 200 to 500 feet. Slopes of the valley walls, although smooth for the most part, are steep. Areas of maximum elevation are less than 1 mile from the valleys. Elevations of the valley floors range from 900 feet at Big Flats to 775 feet at Chemung. The hills and ridgetops range from 1,500 to 1,800 feet above sea level.

Most of the county is drained by the Chemung River. It is a part of the Susquehanna River system and flows into this river south of Waverly. A small section in the north-central part of the county drains into the Lake Ontario system through Catharine Creek. The principal rivers and other streams and areas they drain are the Chemung River, 318 square miles; Seely Creek, 104 square miles; Newtown Creek, 80 square miles; Cayuta Creek, 53 square miles; and Catharine Creek, 36 square miles. Preglacial drainage was probably the reverse of what it is today. The most striking change was the diversion of the Chemung River at Big Flats to its present channel through the narrow gorge to Elmira; the preglacial course followed the broad valley to Horseheads, then south to the channel it now occupies below Elmira.

Glacial Geology

During Pleistocene time, a continental ice sheet several thousand feet thick covered the region of which Chemung County is now a part. This ice sheet at its maximum growth covered the highest hills of the county. It was probably preceded by the movement of tongues of ice down the major valleys, and as these lobes of ice moved, they deepened and broadened the valleys. Eventually, the ice sheet associated with these tongues completely covered the uplands as well as the valleys, but because the ice in the valleys was thicker and faster moving, it caused a greater erosion of bedrock here than on uplands.

The growth and advance of the ice sheet ceased when melting in summer exceeded growth in winter. The recession was most rapid on uplands because here the ice was thinner. The valleys were probably choked with lobes and blocks of stagnant ice. As the ice melted, the rock material it had picked up during its advance was transported by melt waters into the adjoining valleys. There it was deposited by streams flowing in channels in the ice or along the margin of the ice blocks that choked the valleys. The melt waters flowing from the ice front were heavily laden with rock debris from the ice. As the volume of water became less, the ability of the streams to transport material was diminished, resulting in the deposit of sand and gravel in the channels. These deposits are known under the general term "outwash." Extensive areas of soils formed in such material are found throughout the large and small valleys in the county. The important Howard soils are formed in outwash.

Prior to the last advance of ice over the area, an extensive lake caused by ice damming the northward-draining rivers occupied the Chemung Valley to an altitude of approximately 1,100 feet. Very fine sand, silt, and clay were deposited in the still waters of the lake. As the ice advanced, streams of melt water cut channels in this material; but as the icefront continued to advance, these channels filled with sand and gravel. The overriding ice deposited an unsorted mixture of clay, silt, sand, gravel, and boulders, termed "glacial till," in an almost continuous layer over the entire area. During recession of the ice from the area, outwash sand and gravel were deposited by melt water on the basal till.

As the ice front receded northward from the area, extensive Glacial Lake Newberry was formed along the front. At one stage the entire discharge of this lake, which included the Seneca and Cayuga Lake basins, was southward through the valley at Horseheads. Valley trains of glacial outwash materials were deposited far to the south through the Chemung Valley. As lower outlets were uncovered to the north, flow to the south of Horseheads ceased. These lake waters extended from the divide at Horseheads north to Schuyler County. The extensive areas of silt and clay in which the Hudson and Rhinebeck soils formed were deposited in these waters.

The uplands of the county are covered by a continuous mantle of glacial till. It ranges in thickness from practically nothing on some of the shallow hilltops to very great on some of the lower slopes. On the uplands glaciation was less active; that is, the ice mantle was thinner, and its movement was slower than in the valleys. Since the character of the till is largely determined by the underlying bedrock, that deposited on the hills and slopes of Chemung County was derived principally from shale, siltstone, and fine-grained sandstone. It has a silty texture and contains many fragments of local rock.

In the valleys and on the adjacent lower slopes where glaciation was more active, the till contains more erratic material, particularly limestone that was brought in from the north. Limestone in the form of gravel and sand is very evident in the lower part of the subsoil and substratum of the Howard soils. This limey material is the cause of the nonacid reaction of most of the soils in the valleys between Horseheads and Big Flats and Horseheads and Elmira.

Bedrock Geology

Bedrock that is exposed in outcrops or that underlies the mantle of glacial drift in Chemung County is of the Upper Devonian period (*8*). Over the entire county it consists of shale, siltstone, and fine-grained sansdtone. It is divided into two groups, the older of which is the Portage Formation, and the younger, the Chemung Formation.

Rocks of the Portage Formation crop out in a few places within the county. Among these are the sections along Catharine Creek north of Horseheads to the county line, a narrow area on the lower slope east of Elmira, and in the vicinity of Van Etten. The Enfield Member is the only one represented in this county. It consists of beds of gray, flaggy shale alternating with beds of thin, hard, fine-grained sandstone.

The Chemung Formation includes all the bedrock in the county above the Portage Formation. Here it is represented by two members, Cayuta Shale at the bottom and Wellsburg Sandstone at the top. Cayuta Shale consists of about 600 feet of alternating layers of soft gray shale and siltstone and thin-bedded, fine-grained, gray sandstone. Wellsburg Sandstone is named for the village of Wellsburg, south of Elmira, where good outcrops occur. It consists of 400 to 800 feet of interbedded shale, siltstone, and fine-grained flaggy sandstone.

These formations, essentially similar, are the bedrock that make up most of the glacial till mantle on uplands of the county. This mantle is characterized throughout the county by its silty texture and high content of channery and flaggy stone fragments. There are enough of these rock fragments in the soil to warrant the descriptive term "channery" that is appended to most names of soil series.

Climate [10]

Chemung County has a humid-continental climate. Air masses and weather systems affecting the region come primarily from the land mass of the North American continent. Cold, dry weather prevails when atmospheric flow comes from the northwesterly quadrant. Flow from the south or southwest generally produces warm, occasionally humid weather. Air masses of maritime origin play a secondary role in the climate. Periodically, when flow off the North Atlantic Ocean reaches Chemung County, cloudy, damp, and moderately cold weather results.

Table 10 gives temperature and precipitation data for Chemung County. The summers are pleasantly warm; the winters are quite long and cold. Much cloudiness is characteristic of the winter season. Periods of stormy, unsettled weather occur with some frequency. Precipitation is at a minimum in winter months, increases moderately in spring, and reaches the maximum amount late in summer.

The normal movement of atmospheric pressure systems toward the northeastern United States brings a variety of weather to Chemung County. Temperature, humidity, wind, and other atmospheric conditions usually undergo noticeable change within a few days. The weather in one week often differs from the average conditions experienced in the preceeding week or that following. There are also times when a weather pattern persists for many days without any important alteration. The climate is conducive to appreciable variation of seasonal weather from year to year.

Topography plays an important role in the county's climate, because the predominantly hilly terrain is interspersed with numerous stream and river valleys. Changes in elevation, aspect of slope, or terrain features may result in important variations of temperature and other climatic conditions within relatively short distances.

The Great Lakes are too far distant from Chemung County to have a continuing direct effect on the climate. Airflow across the lakes in winter, however, sometime extends cloudiness into the region. This has the effect of moderating otherwise cold nighttime temperatures.

In warmer months, temperatures of 90° F. or higher occur on an average of 12 to 16 days in the lower valleys and on as few as 2 to 5 days in the uplands. Below zero temperatures are recorded on 5 to 10 days in most winters. The coldest temperature of the winter can be expected to range between —1° and —15° in the Chemung River Valley.

Table 11 gives the probability of the last freezing temperature in spring and the first in fall. The freeze-free growing season has an average length of 150 days in the main river valley as well as at higher elevations that have good air drainage. Because of local terrain features, some areas on uplands have a significantly shorter period between freezing temperatures.

Annual precipitation increases from 33 to 34 inches in the Chemung River Valley to almost 36 inches in northeastern sections of the county. The amount and distribution of precipitation during the growing season is generally adequate for crops otherwise adaptable to the region. Drought is not a serious hazard to farming, but should not be disregarded in long-range planning.

Seasonal snowfall in the main river valley is among the lightest in upstate New York. At higher elevations, however, the average snowfall is 75 inches or more. Snow generally covers the ground from about mid-December to early March.

[10] By A. Boyd Pack, State climatologist, U. S. Environmental Science Services, National Weather Service, Ithaca, New York.

TABLE 10.—*Temperature and precipitation*

[Data recorded at Elmira]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	7 years in 10 will have— Maximum equal to or higher than—	7 years in 10 will have— Minimum equal to or lower than—	Average total	3 years in 10 will have— More than—	3 years in 10 will have— Less than—	Snow: Average monthly total	Snow: 7 years in 10 will have more than—
	°F.	°F.	°F.	°F.	In.	In.	In.	In.	In.
January	35	19	51	1	1.8	2.4	1.4	9	4
February	36	18	52	2	2.0	2.5	1.4	10	6
March	44	25	64	10	2.8	3.2	2.2	9	6
April	57	36	79	25	3.1	3.5	2.3	2	(1)
May	70	46	86	33	3.8	4.6	2.6	0	(2)
June	80	55	92	43	3.4	4.0	2.9	0	-----------
July	84	59	94	47	3.5	3.7	3.0	0	-----------
August	82	57	92	45	3.8	4.5	2.9	0	-----------
September	74	50	89	36	2.7	3.5	2.1	0	-----------
October	63	40	79	27	2.8	3.3	1.7	(1)	(2)
November	49	32	69	20	2.5	2.8	2.1	3	1
December	37	22	52	6	2.1	2.9	1.3	8	4
Year	60	39	95	−4	34.3	37.1	31.1	41	37

[1] Trace.
[2] 1 year in 10 will have more than a trace.

TABLE 11.—*Probability of last freezing temperature in spring and first in fall*

[Data recorded at Elmira]

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	April 4	April 10	April 26	May 8	May 28
2 years in 10 later than	March 30	April 5	April 19	May 3	May 22
5 years in 10 later than	March 17	March 26	April 8	April 23	May 10
Fall:					
1 year in 10 earlier than	November 15	October 25	October 14	September 28	September 17
2 years in 10 earlier than	November 20	November 2	October 20	October 4	September 23
5 years in 10 earlier than	November 30	November 18	November 2	October 18	October 4

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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; but that 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. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Aquifer. A porous soil or geological formation that yields ground water to wells and springs.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer 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.

Clean tillage. Cultivation to prevent the growth of all vegetation except the particular crop desired.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eluviation. The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that received material are illuvial.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and relatively low in clay, but is rich in silt or sand or both. It has a high bulk density in comparison with the horizon or horizons above it. The layer is seemingly cemented. When dry, it is hard or very hard. When moist, it is firm or very firm. When dry or moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Glacial drift (geology). Rock and soil material transported by glacial ice and then deposited; also includes the assorted materials deposited by streams flowing from glaciers.

Graded stripcropping. Growing of crops in strips that are graded toward a protected waterway.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine materials, glacial. Deposits that range from the clays to sand. They were derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are these: terminal, lateral, medial, ground. In Chemung County, loose till deposits laid down during the back-wasting or down-wasting stages of glaciation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Munsell color notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Outwash materials, glacial. Stratified sands and gravels produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Commonly the deposits occupy valley positions known as valley trains or outwash terraces, eskers, kame terraces, kames, and outwash fans or deltas.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. 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.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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 characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Till, glacial. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and rock fragments transported and deposited by glacial ice. This is in contrast to glacio-lacustrine and glacial outwash deposits laid down by melt waters.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geology). Land consisting of material unworked by water in recent geological time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Varves. Distinctly marked annual deposits of sediment, regardless of their origin.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the series to which the mapping unit belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Estimated yields, table 1, page 18.
Use of soils as woodland, table 2, page 20.
Rating for wildlife habitat elements and classes of wildlife, table 3, page 24.
Engineering uses of soils, tables 4, 5, and 6, pages 28 through 51.
Town and country planning, table 7, page 58.
Acreage and extent, table 8, page 68.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group
			Symbol	Page	Symbol
Ab	Alluvial land	66	Vw-1	16	---
ArB	Arnot channery silt loam, 2 to 8 percent slopes	67	IIIe-4	13	4d1
At	Atherton mucky silt loam	69	IVw-2	16	4w1
CeB	Chenango channery silt loam, fans, 0 to 8 percent slopes	69	IIs-1	12	3o1
ChA	Chippewa silt loam, 0 to 3 percent slopes	71	IVw-1	15	5w1
ChB	Chippewa silt loam, 3 to 8 percent slopes	71	IVw-1	15	5w1
ChC	Chippewa silt loam, 8 to 15 percent slopes	71	IVw-1	15	5w1
CoA	Collamer silt loam, 0 to 3 percent slopes	72	IIw-2	11	2o1
CoB	Collamer silt loam, 3 to 8 percent slopes	72	IIe-3	11	2o1
Hm	Homer silt loam	73	IIIw-1	14	3w1
HoA	Howard gravelly silt loam, 0 to 3 percent slopes	74	IIs-1	12	2o1
HoB	Howard gravelly silt loam, 3 to 8 percent slopes	74	IIs-1	12	2o1
HoC	Howard gravelly silt loam, 8 to 15 percent slopes	74	IIIe-1	12	2o1
HoD	Howard gravelly silt loam, 15 to 25 percent slopes	74	IVe-1	15	2r4
HoE	Howard gravelly silt loam, 25 to 45 percent slopes	74	VIe-1	16	2r4
HsB	Hudson silt loam, gravelly substratum, 2 to 8 percent slopes	75	IIe-3	11	2o1
HtC3	Hudson silty clay loam, gravelly substratum, 8 to 20 percent slopes, eroded	75	IVe-4	15	2r1
HtE3	Hudson silty clay loam, gravelly substratum, 20 to 40 percent slopes, eroded	75	VIe-1	16	2r3
LbB	Lansing gravelly silt loam, 2 to 8 percent slopes	76	IIe-1	11	2o1
LbC	Lansing gravelly silt loam, 8 to 15 percent slopes	76	IIIe-1	12	2o1
LbD	Lansing gravelly silt loam, 15 to 25 percent slopes	77	IVe-1	15	2r2
LnB	Lordstown channery silt loam, 2 to 8 percent slopes	77	IIe-2	11	3o1
LnC	Lordstown channery silt loam, 8 to 15 percent slopes	78	IIIe-2	13	3o1
LnD	Lordstown channery silt loam, 15 to 25 percent slopes	78	IVe-2	15	3r1
LoE	Lordstown and Arnot very rocky soils, 25 to 35 percent slopes	78	VIIs-1	16	3x1
LoF	Lordstown and Arnot very rocky soils, 35 to 70 percent slopes	78	VIIs-1	16	4x1
Ma	Madalin silt loam, gravelly substratum	79	IVw-2	16	5w1
Mc	Made land	79	------	--	---
MdB	Mardin channery silt loam, 2 to 8 percent slopes	80	IIw-1	11	3o1
MdC	Mardin channery silt loam, 8 to 15 percent slopes	80	IIIe-3	13	3o1
MdD	Mardin channery silt loam, 15 to 25 percent slopes	80	IVe-2	15	3r1
Me	Middlebury silt loam	81	IIw-4	12	2o2
Mu	Muck	81	VIIw-1	16	---
Pg	Papakating silt loam	82	IVw-3	16	4w1
PhA	Phelps gravelly loam, 0 to 4 percent slopes	83	IIw-2	11	2o1
RhA	Rhinebeck silt loam, gravelly substratum, 0 to 3 percent slopes	84	IIIw-1	14	3w1
RhB	Rhinebeck silt loam, gravelly substratum, 3 to 8 percent slopes	84	IIIw-2	14	3w1
Tf	Tioga fine sandy loam	85	IIw-3	12	2o2
Tg	Tioga silt loam	85	IIw-3	12	2o2
Th	Tioga silt loam, high bottom	85	I-1	10	2o2
TuB	Tuller channery silt loam, 0 to 8 percent slopes	86	IIIw-4	14	5w1
UnA	Unadilla silt loam, 0 to 3 percent slopes	86	I-1	10	2o1
VaB	Valois gravelly loam, 2 to 8 percent slopes	87	IIe-1	11	3o1
VaC	Valois gravelly loam, 8 to 15 percent slopes	87	IIIe-1	12	3o1
VaD	Valois gravelly loam, 15 to 25 percent slopes	88	IVe-1	15	3r1
VaE	Valois gravelly loam, 25 to 40 percent slopes	88	VIe-1	16	3r3
VoB	Volusia channery silt loam, 2 to 8 percent slopes	89	IIIw-3	14	3w2
VoC	Volusia channery silt loam, 8 to 15 percent slopes	89	IIIe-5	13	3w2
VoD	Volusia channery silt loam, 15 to 25 percent slopes	90	IVe-3	15	3r2
WaA	Wallington silt loam, gravelly substratum, 0 to 3 percent slopes	90	IIIw-1	14	3w2
WaB	Wallington silt loam, gravelly substratum, 3 to 8 percent slopes	90	IIIw-2	14	3w2
WlA	Williamson silt loam, gravelly substratum, 0 to 3 percent slopes	91	IIw-2	11	3o1
WlB	Williamson silt loam, gravelly substratum, 3 to 8 percent slopes	92	IIe-3	11	3o1

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