

SOIL SURVEY OF

Chittenden County, Vermont



**United States Department of Agriculture
Soil Conservation Service**

In cooperation with

Vermont Agricultural Experiment Station

And

Vermont Department of Forests and Parks

Major fieldwork for this soil survey was done in the period 1940-67. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service, the Vermont Agricultural Experiment Station, and the Vermont Department of Forests and Parks. This survey is part of the technical assistance furnished to the Winooski Natural Resources 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, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

All the soils of Chittenden 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" 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 is described and the page for the woodland 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 "Descriptions of the Soils."

Foresters and others can refer to the section "Woodland," where the soils of the county are interpreted 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 "Community Development and Recreational Uses of Soils."

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 were formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Chittenden 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 information about the county given in the section "General Nature of the County."

Cover: Typical landscape of the Lyman-Marlow soil association in the Town of Hinesburg. Lincoln Hill is in the background.

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SOIL SURVEY OF CHITTENDEN COUNTY, VERMONT

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UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE VERMONT AGRICULTURAL EXPERIMENT STATION AND THE VERMONT DEPARTMENT OF FORESTS AND PARKS

CHITTENDEN COUNTY is in the northwestern part of Vermont (fig. 1). It is bounded on the west by Lake Champlain, and on the east it extends well into the Green Mountains. The county occupies 340,480 acres, or 532

square miles. Burlington, the largest city and county seat, is in the west-central part of the county and is adjacent to Lake Champlain.

Land use is about a 2 to 1 ratio of woodland to farming, but the acreage used for farming is decreasing, especially in the mountainous areas. Farming is concentrated in the Champlain Valley and the major river valleys. The farmland in the hilly and mountainous parts of the county is gradually being converted to other uses, such as recreational developments and year-round or part-time country homes, or it is reverting to woodland.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Chittenden County, where they are located, and how they can be used. The soil scientists went into the county knowing they probably 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. 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 other geographic feature near the place where a soil of that series was first observed and mapped. Hinesburg and Eldridge, for example, are the names of two soil series. All the soils in the United States having the same series

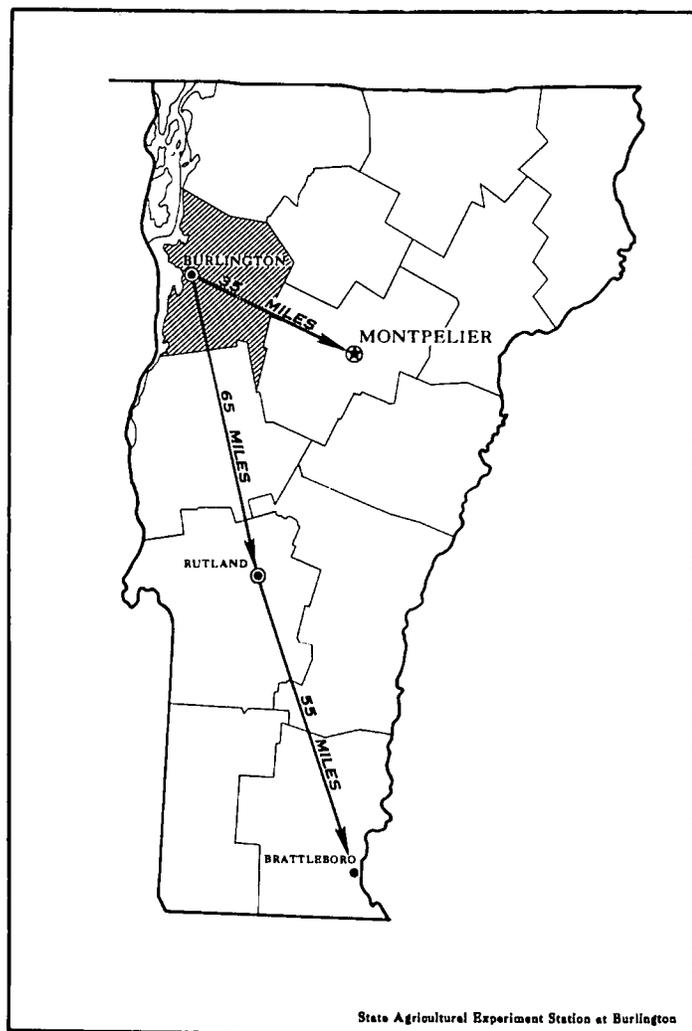


Figure 1.—Location of Chittenden County in Vermont.

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 layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Hinesburg fine sandy loam, 0 to 3 percent slopes, is one of several phases within the Hinesburg 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 publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of 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. Two such kinds of mapping units are shown on the soil map of Chittenden County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, and these names are joined by a hyphen. Farmington-Stockbridge rocky loams, 5 to 12 percent slopes, is an example of a soil complex.

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." Stockbridge and Nellis stony loams, 3 to 8 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. Rock land is a land type in Chittenden 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.

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, and 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 Chittenden 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 farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, drainage, or other characteristics that affect management.

The fifteen soil associations in Chittenden County are described in the following pages.

Soils that Formed in Water-Deposited Material in the Champlain Valley

Nine associations in the county formed in water-deposited material in the western part of the county in the Champlain Valley. This water-deposited material ranges from sand to clay in texture. These soils are dominantly gently sloping to sloping, but they range from level to steep. In these associations are the main farming areas in the county.

1. Vergennes-Covington association

Level to steep, moderately well drained and poorly drained, clayey soils; on broad lake plains

This association occurs mainly in the Champlain Valley south of the Winooski River, but one small area is adjacent to Malletts Bay. The landscape is an undulating to rolling lake plain that is dissected by creeks and other streams in places. Rocky knolls and narrow ridges are common in the association, but waterways meander throughout and are bordered by bottom lands. Flooding is a hazard on the narrow bottom lands.

This association makes up about 9 percent of the county, or about 30,650 acres. About 55 percent of this is Vergennes soils, 10 percent is Covington soils, and the remaining 35 percent is other soils. Figure 2 shows the positions of the major and minor soils in this association.

The dominant soils in this association formed mainly in clayey sediments that were deposited in an old lake

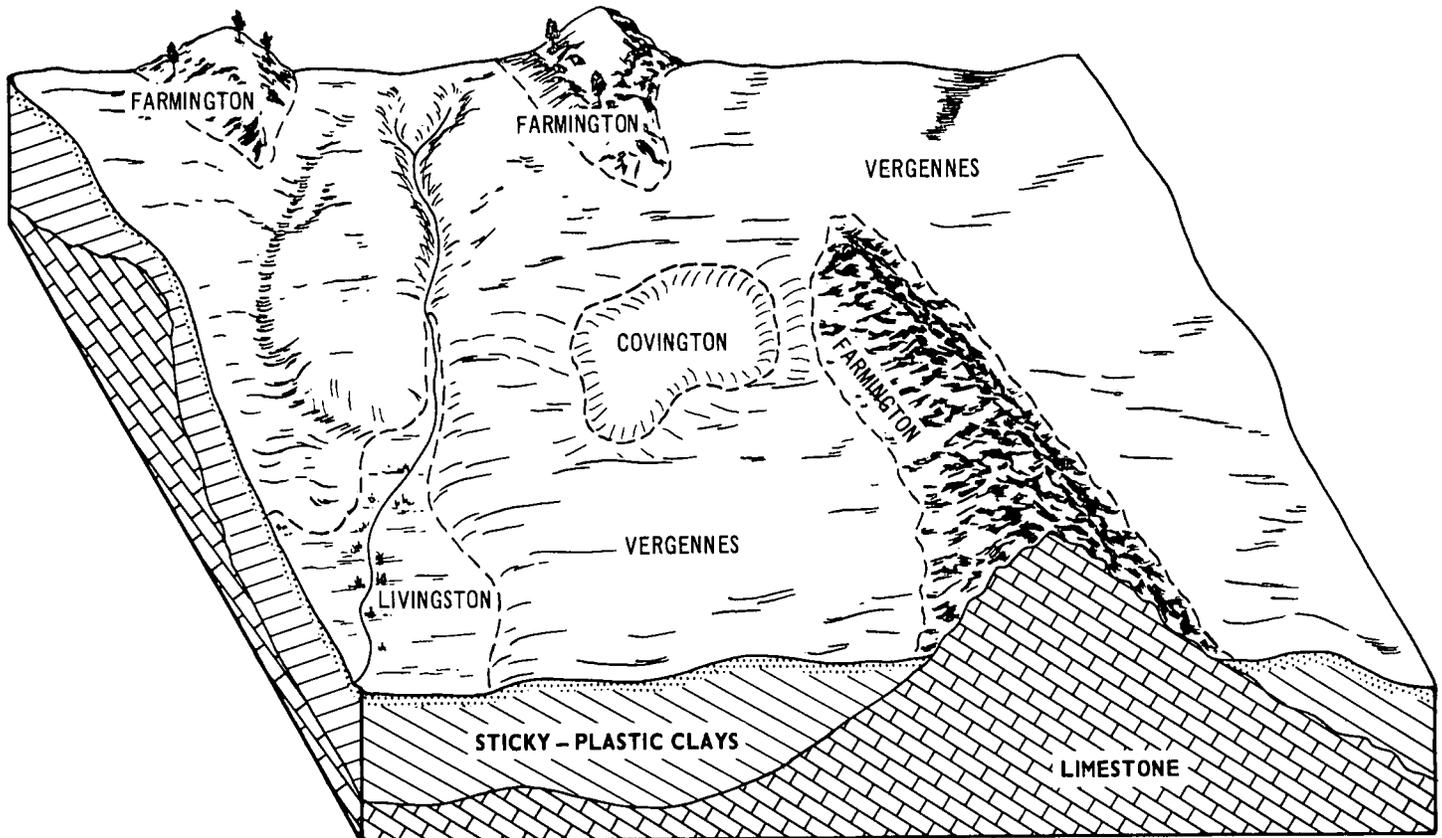


Figure 2.—Relationship of soils in association 1.

that is now extinct. Vergennes soils are moderately well drained, clayey, and mainly gently sloping or sloping, but they range from gently sloping to steep. The Covington soils also are clayey, but they are poorly drained. They typically occupy the lowest depressional areas in the association.

Minor soils in this association are the deep, well-drained, loamy Nellis and Stockbridge soils, the somewhat excessively drained, shallow Farmington soils, and the very poorly drained, clayey Livingston soils. The Farmington, Nellis, and Stockbridge soils occupy the higher knolls and narrow ridges. These soils are commonly shallow to limestone bedrock or are stony and deep. Livingston soils are more poorly drained than Covington soils but are in similar low-lying positions.

This association has the best potential for farming of any association in the county. It has been mostly cleared of trees and is farmed. Dairying is the major farm enterprise. The main crops are corn, hay, and pasture. Orchard trees are well suited to the higher and better drained sites, some of which are made up of the Nellis or Stockbridge soils. Artificial drainage is a common practice on the Covington soils. Stoniness is a hazard on the clayey soils in only a few places, but stones and bedrock outcrops are limitations to farming on the higher ridges of the Farmington, Stockbridge, and Nellis soils. Many of the higher ridges are still wooded because they are stony or rocky.

Many areas adjacent to villages or cities are no longer

farmed. These areas are building sites or are idle and awaiting development for uses other than farming. But most soils in the association have moderate or severe limitations for residential development that requires septic tank disposal systems. Use for these systems is hindered by very slow permeability or shallow depth to bedrock. Because the steep banks along Lake Champlain are severely eroded by wave action in places, buildings and roads placed adjacent to the lake are subject to damage by erosion and slumping of the soil material.

2. Covington association

Level to gently sloping, dominantly poorly drained clayey soils; in depressions of lake plains

This association lies in the lowest part of the landscape in the Champlain Valley South of the Winoosk River. The soils in this association are dominantly level but slight knolls rise in places.

This association occupies about 2 percent of the county, or about 6,810 acres. About 70 percent of this is Covington soils, and the remaining 30 percent is minor soils.

The Covington soils formed mainly in clayey sediments that were deposited in an old extinct lake. They are poorly drained, clayey, and level to gently sloping. Because of their low-lying position and very slow permeability, these soils are excessively wet and drain very slowly.

The minor soils in this association are mainly in the Livingston, Eldridge, and Vergennes series. The Livingston soils occur in positions similar to those of the Covington soils, but Livingston soils are very poorly drained. Many areas of Livingston soils remain wooded because artificial drainage is difficult. The moderately well drained Eldridge soils occupy the slightly higher positions. They typically have 16 to 40 inches of sandy deposits over the loamy material. The moderately well drained, clayey Vergennes soils also occur on the higher, better drained sites.

Most of this association has been cleared of trees and is now used for hay or pasture. Dairying is the major farm enterprise. Excess wetness is the major limitation to farming. The very slowly permeable clay restricts internal drainage and makes drainage difficult. Surface water drains slowly from the level, clayey soils. Water ponds on the surface for short periods in spring and following prolonged rains. When these soils are wet, farm machinery easily bogs down, and in some years, harvesting crops is difficult. Farmers have artificially drained some areas to overcome the limitation of excess wetness.

The soils in most of this association have severe limitations for residential and other community development. They absorb sewage effluent very slowly from private septic tanks because the seasonal water table is high and permeability is very slow.

3. Enosburg-Whately-Vergennes association

Level to steep, moderately well drained and poorly drained, sandy, loamy, and clayey soils; on old beaches of lake plains.

This association is in the Champlain Valley. The landscape is an undulating lake plain in which sandy material has been deposited by water over clayey material. The major soils in this association formed in material that was deposited when the water level of old lakes was higher than that of present Lake Champlain. This material consists of sandy deposits that are underlain with loamy material at a depth of less than 40 inches. In places the sandy material is absent and the loamy or clayey material is at the surface.

This association occupies about 2 percent of the county, or about 6,810 acres. About 35 percent of this is Enosburg soils, 25 percent is Whately soils, 10 percent is Vergennes soils, and the remaining 30 percent is minor soils.

The Enosburg soils are sandy to a depth of 16 to 40 inches and loamy below that depth. They are poorly drained and mainly nearly level and gently sloping, but they range from nearly level to moderately steep. The Whately soils are similar to the Enosburg soils but are loamy in the upper part, clayey in the lower part, and poorly drained. Whately soils occupy the lowest parts of the landscape. They are mainly south of the Winooski River. The moderately well drained, clayey Vergennes soils occupy areas where there is no sandy or loamy material and the clayey material is at or near the surface.

Minor soils in this association are the excessively drained, deep, sandy Windsor and Adams soils, the poorly drained, clayey Covington soils, the well-drained

Hinesburg soils, and the moderately well drained Eldridge soils.

Most areas of this association have been farmed, and some areas still are, mainly in cultivated crops, hay, and pasture. Areas no longer farmed are used for commercial sites, houses, or recreational facilities.

Most soils in this association have severe limitations for residential development that require private systems for sewage disposal. Absorption of effluent is restricted by the seasonal high water table and the moderately slow to very slow permeability of the clayey or loamy material. Basements tend to be wet if they are placed below the original ground level.

4. Munson-Raynham-Scantic association

Dominantly level to sloping, somewhat poorly drained and poorly drained, loamy or loamy over clayey soils; on broad lake plains

This association occurs in the Champlain Valley, along the Browns River and on the higher terraces near the village of Richmond. It is an undulating to rolling lake plain that is dissected by streams in places. Somewhat poorly drained and poorly drained soils are dominant in the association, but well-drained, steep soils also are present.

This association makes up about 5 percent of the county, or about 17,020 acres. About 35 percent of this is Munson soils, 25 percent is Raynham soils, 25 percent is Scantic soils, and the remaining 15 percent is minor soils.

The dominant soils in this association formed in loamy material that is deep and that was deposited by water or that overlies clayey material. The Munson soils consist of loamy material that is underlain with slowly to very slowly permeable clayey material at a depth of less than 40 inches. The Raynham soils are similar to the Munson soils in drainage but have deep, loamy material to a depth of 40 inches or more. Both kinds of soil are somewhat poorly drained. Munson soils range from gently sloping to moderately steep, and Raynham soils range from gently sloping to sloping.

The Scantic soils are poorly drained and consist of loamy over clayey material. These soils formed in material similar to that of the Munson soils but are more poorly drained. Scantic soils occupy the lowest parts of the landscape and receive surface water from adjoining higher lying soils.

Minor soils in this association are the well drained, gently sloping to steep Hartland soils, the moderately well drained, sandy Eldridge soils, and the well drained, sandy Hinesburg soils. These minor soils are better drained than the dominant soils and occupy the small, slightly higher knolls and narrow hills.

Most areas of this association, except the most poorly drained ones, have been cleared of trees. Farming is the main use of the soils in the association, but small areas are used for residential development. The main farm crops are hay, corn for silage, and pasture. Artificial drainage is a common practice for improving the soils for farming. Because the water table is seasonally high, excess wetness is the major limitation for farming.

Excess wetness also is the major limitation for community development. The seasonal high water table and

moderately slow to very slow permeability hinder use for private sewage disposal systems, basements, and similar community uses. The soils have a high frost-heave potential and therefore provide a poor subgrade for highways, streets, and other trafficways.

5. Hartland-Belgrade-Munson association

Nearly level to steep, well-drained to somewhat poorly drained, loamy or loamy over clayey soils; on dissected lake plains

This association is on the higher terraces near the Winooski River. It is dissected by creeks and gullies, and many steep escarpments are adjacent to the major drainways.

This association makes up about 2 percent of the county, or about 6,810 acres. About 50 percent of this is Hartland soils, 30 percent is Belgrade soils, 10 percent is Munson soils, and the remaining 10 percent is minor soils.

The dominant soils formed in deep, loamy, water-deposited material or loamy material that overlies clayey material. Hartland soils are well drained and consist of loamy material to a depth of 40 inches or more. Near creeks and other streams, Hartland soils have the steepest slopes in the association. In many places these soils are dissected by old gullies and depressions.

The Belgrade soils are moderately well drained but formed in material similar to that of the Hartland soils. Belgrade soils have a seasonal high water table.

The Munson soils consist of loamy material that is underlain with clayey material at a depth of less than 40 inches. They are somewhat poorly drained. Munson soils are excessively wet because they have a seasonally high water table and very slow or slow permeability. They are gently sloping to moderately steep.

Minor soils in this association are the moderately well drained, loamy Winooski soils, the somewhat poorly and poorly drained Limerick soils, the very poorly drained, clayey Livingston soils, and the well drained, loamy Agawam soils. The Winooski and Limerick soils occupy the narrow bottom lands and are subject to flooding. The Livingston soils occupy the wet depressions in which water ponds, and the Agawam soils lie on the steep escarpments near the Hartland soils.

The soils in this association are used mainly for farming, woodland, or residential development. The steepest areas, mainly of the Hartland soils, are in trees or are idle and in brush. The less sloping areas and areas that are not too wet are farmed. Hay, pasture, and corn grown for silage are the main crops. The steep slopes in places and excess wetness of the clayey, less sloping soils are the main limitations for farming and community development. The dominant soils have a high frost-heave potential and therefore provide poor subgrade for highways, streets, and other surfaced areas. The soil material on steep slopes is unstable when it is wet, and it is readily eroded unless protected with vegetation. The moderately slow to very slow permeability of the soils severely restricts the absorption of effluent from septic tank filter systems. In many places steep slopes hinder the layout of sewage disposal systems, streets, and other community development.

6. Limerick-Hadley-Winooski association

Level and nearly level, poorly drained to well-drained, loamy soils subject to flooding; on bottom lands

This association lies along the major streams and creeks in the county. The largest areas are adjacent to the Winooski, Lamoille, and Browns Rivers. Loamy soils subject to flooding are dominant in the association. Other areas are adjacent to creeks and brooks throughout the county, but they are too small to delineate on the general soil map.

This association occupies about 5 percent of the county, or about 17,020 acres. About 40 percent of this is Limerick soils, 25 percent is Hadley soils, 15 percent is Winooski soils, and the remaining 20 percent is minor soils.

The Limerick soils are poorly drained and loamy. They occupy the old stream channels and broad depressions. Because of their low position, the Limerick soils are flooded more frequently than are the higher soils in the association. Figure 3 shows the relationship of the soils in this association.

The Hadley soils are well drained and loamy. They occupy the higher natural levees and rises near the present stream channel. Hadley soils are subject to flooding less frequently than the other major soils because they are higher above the rivers. Some areas of the Hadley soils are above normal flood levels and are seldom flooded.

The Winooski soils are moderately well drained and loamy. They occupy intermediate positions between the Limerick and Hadley soils.

Also in this association are land types and minor soils. These are very poorly drained Muck and peat, Alluvial land, and Agawam soils.

Most areas of this association have been cleared of trees and are now farmed. The main crops are hay, pasture, and corn grown for silage. The most poorly drained areas are idle or in trees and are seldom used for farming. The major limitation for farming is the hazard of flooding during spring and other wet periods. The Limerick soils have a high water table and are excessively wet unless artificially drained. Flooding and excess wetness also severely limit the building of houses, septic tank filter systems, highways, recreational facilities, and other construction for community development.

7. Muck and Peat association

Level, very poorly drained, organic soils; in depressions and on old lakebeds

The largest areas of this association are in the Winooski River Valley near Burlington, adjacent to Shelburne Pond, and in the town of Milton. Because this association lies in the lowest positions of the landscape, the water table is high throughout most of the year.

This association makes up about 1 percent of the county, or about 3,400 acres. Almost all of the association is Muck and peat.

Muck and peat formed from the remains of plants and aquatic life that are common in areas having a high water table. Water is at or covers the surface during the wettest periods of the year. Where this association

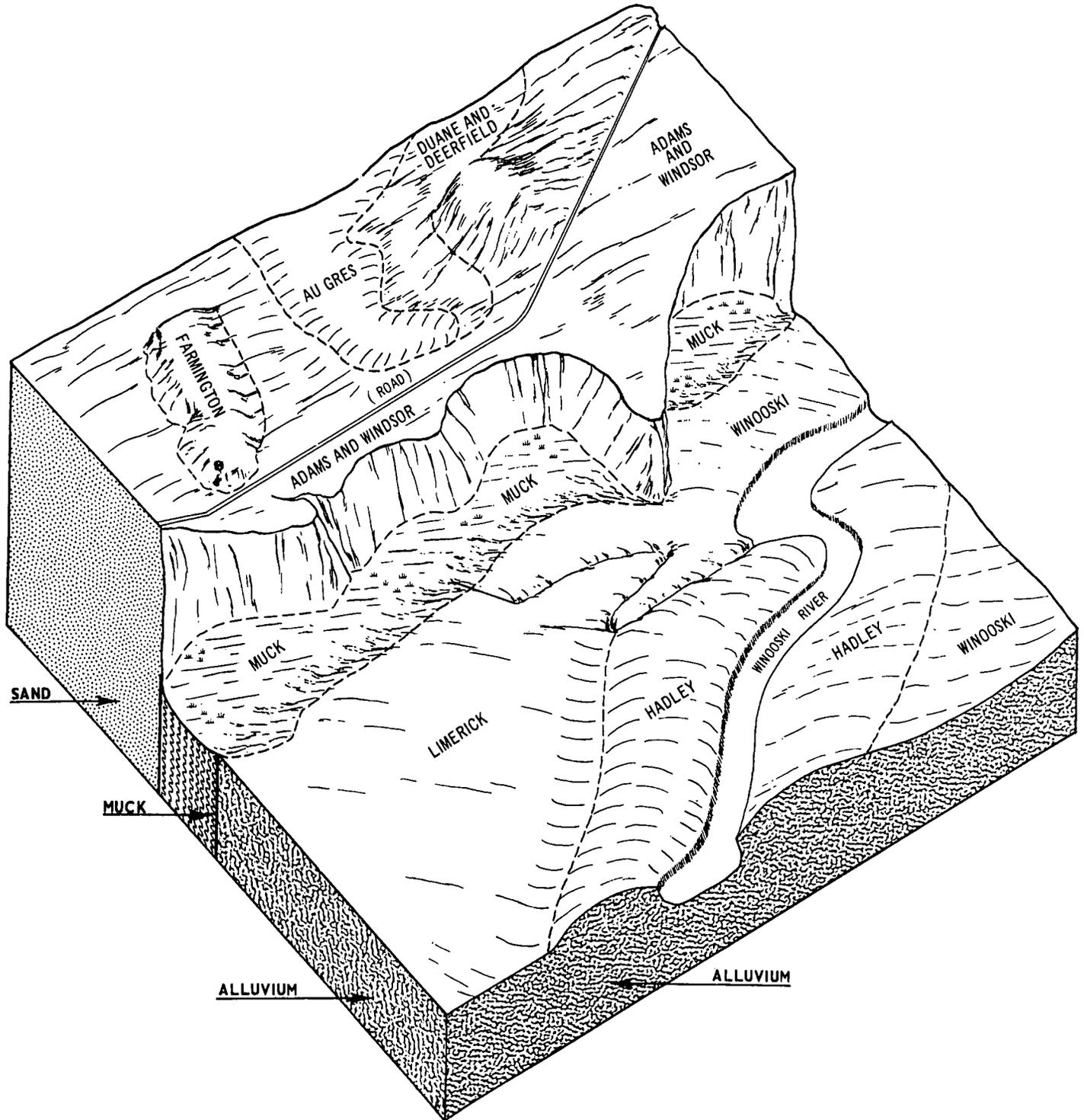


Figure 3.—Relationship of soils in associations 6 and 8.

is adjacent to creeks and other streams, it is subject to periodic flooding. Small areas of this association occur throughout the Champlain Valley and the foothills of the Green Mountains, but these areas are too small to be shown on the general soil map.

In most of this association, the soils are seldom culti-

vated. They are idle or are used to a small extent for pasture. Severe limitations for farming and community development are excess wetness, lack of adequate drainage outlets in many places, and poor potential for farming even where drained. Muck and peat has poor stability and capacity to support loads. This land type has

severe limitations for the construction of building and highways because the organic material is highly compressible and settles rapidly and unevenly under loads.

8. Adams-Windsor association

Level to steep, excessively drained, sandy soils; on deltas, old lake beaches, and terraces

This association consists of old lake beaches, deltas, and terraces that are mainly in the Champlain Valley. Smaller areas are in the foothill valleys of the Green Mountains. The landscape typically is a level or undulating plain that is dissected in places by streams or gullies. Most of the association is along or near the mouths of the Winooski and Lamoille Rivers.

This association makes up about 11 percent of the county, or about 37,460 acres. About 60 percent of this is Adams and Windsor soils, and the remaining 40 percent is minor soils.

Most of the soils in this association formed in deep sandy material that was deposited by water in an old extinct lake. In places the sandy material is underlain with loamy or clayey lacustrine deposits at a depth of less than 5 feet (see fig. 3).

The Adams and Windsor soils consist of sandy material to a depth of 40 inches or more. They are excessively drained. The Adams soils have a slightly better developed and redder subsoil than the Windsor soils and are mainly near the Green Mountains but at higher elevations than the Windsor soils. The Windsor soils generally are nearer Lake Champlain. The Adams and Windsor soils typically are level to sloping, but in places they are moderately steep or steep.

Minor soils are the somewhat excessively drained Farmington soils, the well drained Hinesburg soils, the moderately well drained Deerfield, Duane, and Eldridge soils, the somewhat poorly drained and poorly drained Au Gres soils, and the very poorly drained Scarboro soils. In the Hinesburg and Eldridge soils sandy material overlies loamy material at a depth of less than 40 inches. The Au Gres, Deerfield, and Scarboro soils are sandy in the subsoil and substratum. Duane soils have a gravelly sand subsoil and substratum. The Au Gres, Deerfield, Duane, Eldridge, and Scarboro soils are excessively wet. They occupy lower positions than Adams and Windsor soils, but are in the same kind of landscape. The Farmington soils are shallow and loamy.

In farming areas the major soils in this association are used mainly for corn grown for silage, hay, and truck crops. In and near cities and villages, these soils are used for houses, industrial and commercial developments, and recreational areas. Trees are grown in plantations in places, and native woods are still present. The dominant soils are easily tilled, but they tend to dry out quickly and are droughty during prolonged dry periods. Where large areas are exposed to the wind, soil blowing is a hazard. The Adams and Windsor soils have favorable properties for most community development uses. These soils drain readily, and depth to the seasonal high water table usually exceeds 4 feet.

Because of their seasonal high water table or normally high water table, the Deerfield soils have some limitations to use for houses, septic tank disposal systems, and other related purposes, as do the Au Gres

and Scarboro soils. Basements tend to be wet in these soils, and leach fields of private sewage systems become saturated with water. The small areas of Hinesburg and Eldridge soils have severe limitations for private sewage systems because moderately slowly permeable material is within 40 inches of the surface and because there is a perched water table that is seasonally high.

9. Colton-Stetson association

Level to steep, excessively drained and somewhat excessively drained, gravelly sandy or gravelly loamy over gravelly sandy soils; on old lake beaches and terraces

The dominant soils in this association are the coarsest textured and the most droughty soils in the county. This association is mainly along valleys in the foothills of the Green Mountains. The largest areas are near the headwaters of the Browns and La Platte Rivers and along the Huntington River. The landscape consists of old terraces and lake beaches that consist mainly of water-deposited, stratified gravelly sand and sand.

This association makes up about 2 percent of the county, or about 6,810 acres. About 55 percent of this is Colton soils, 20 percent is Stetson soils, and the remaining 25 percent is minor soils.

The Colton soils consist of gravelly sand to a depth of 40 inches or more and are excessively drained. These soils are level to moderately steep in most places, but they are steep adjacent to streams.

The Stetson soils have a loamy surface layer and upper part of the subsoil. They are somewhat excessively drained and are slightly less droughty than Colton soils.

The minor soils in this association are the moderately well drained Duane soils and the excessively drained Adams and Windsor soils. All of these soils are sandy or gravelly sandy in the subsoil and substratum. Small areas of this association are adjacent to many of the small creeks throughout the county, but the general soil map has such a small scale that these areas are not shown.

The soils in this association are used mainly for farming and forestry and partly for recreational facilities and residential development. The steepest soils are still mostly wooded, but the level to sloping soils have been or are farmed. Hay and pasture are the major crops. The soils are sandy and gravelly in most places and tend to be droughty during prolonged dry periods. Where these soils are used for roads, houses, and other community developments, the soils provide good foundations and favorable percolation for private sewage systems. This association has the best potential of any association in the county as a source of gravel for road surfacing and other construction. Many gravel pits occur in the association.

Soils that Formed in Glacial Till in the Champlain Valley

In the western part of the county in the Champlain Valley, three associations consist of soils that formed in glacial till. These soils are shallow to deep to bedrock. They are stony and extremely stony and have bedrock outcrops in places. They are sloping and steep on ridges and gently sloping to sloping on knolls. The ridges and knolls extend above the general level of the lake plain.

These three associations are discussed in the following pages.

10. Farmington-Nellis-Stockbridge association

Gently sloping to steep, somewhat excessively drained and well-drained, loamy soils that are shallow to deep to bedrock; on ridges and knolls.

In this association are the higher ridges and knolls in the Champlain Valley. The ridges are oriented in a north-south direction. Outcrops of limestone are common in this association. Two-thirds of the acreage is north of the Winooski River.

This association makes up about 5 percent of the county, or about 17,020 acres. About 80 percent of this is Farmington soils, 8 percent is Nellis soils, 6 percent is Stockbridge soils, and the remaining 6 percent is minor soils.

The Farmington soils are somewhat excessively drained and shallow. These soils formed in loamy material that is underlain with limestone or quartzite at a depth of 10 to 20 inches. They commonly are stony and rocky and are mainly sloping or moderately steep, but in some places they are steep. The Nellis and Stockbridge soils are well drained, loamy, and more than 40 inches to bedrock. These soils are mainly gently sloping and sloping but range to steep. The Nellis soils are more nearly neutral or more alkaline than the Stockbridge soils. The minor soils are the somewhat excessively drained, moderately deep Palatine soils and the moderately well drained, clayey Vergennes soils.

The major part of this association is too stony, too rocky, and too shallow to bedrock to be used intensively for farming. Most areas, therefore, remain wooded. In many areas the slope is too steep for efficient and safe operation of farm equipment. Farmed areas are used for pasture and hay. Because limestone influences these soils, they are especially suited to alfalfa.

The shallowness to bedrock and steep slopes in many places are severe limitations for building houses and installing septic tank filter systems. The downward movement of effluent is restricted unless the bedrock is fractured.

11. Palatine-Vergennes association

Gently sloping to steep, somewhat excessively drained to moderately well drained, loamy and clayey soils that are moderately deep or deep to bedrock; on ridges or knolls

Most of this association is south of the Winooski River, in the towns of Shelburne and Charlotte near Lake Champlain. The landscape, controlled partly by the underlying bedrock, is a gently undulating to rolling upland. Bedrock commonly crops out on steeper slopes and in road cuts.

This association makes up about 1 percent of the county, or about 3,400 acres. About 50 percent of this is Palatine soils, 25 percent is Vergennes soils, and the remaining 25 percent is other soils.

Palatine soils are somewhat excessively drained; in these soils bedrock is at a depth of only 20 to 40 inches. The surface layer and subsoil are loamy. Palatine soils are mainly gently sloping to sloping but range to steep. These soils occupy the highest areas in the association.

The Vergennes soils are clayey and moderately well

drained. They are dominantly gently sloping or sloping but range to steep. These soils are adjacent to the Palatine soils but in lower positions.

Minor soils are the well-drained, loamy Stockbridge and Nellis soils, the somewhat poorly drained or poorly drained Massena soils, and the poorly drained, clayey Covington soils. The Stockbridge and Nellis soils occupy similar positions to Palatine soils, but they are more than 40 inches deep to bedrock.

The soils in this association are mostly used for hay and pasture, but a few areas are planted to corn. The gently sloping, well-drained soils have good potential for farming and growing trees. Some sites that have good air drainage are suited to orchard trees. A few areas are used for residential development, but the soils in those areas have moderate or severe limitations because of moderate depth to bedrock, a seasonal high water table, or very slow permeability.

12. Stockbridge-Nellis-Palatine association

Gently sloping to steep, well-drained and somewhat excessively drained, deep or moderately deep, loamy soils; on ridges and knolls

This association is mainly in the southern part of the Champlain Valley near Lake Champlain. The landscape is an undulating or sloping upland that has low relief. The soils in this association are some of the best soils in the county for farming.

This association makes up about 2 percent of the county, or about 6,810 acres. About 35 percent of this is Stockbridge soils, 20 percent is Nellis soils, 10 percent is Palatine soils, and the remaining 35 percent is minor soils.

The Stockbridge and Nellis soils are well drained. They are more than 40 inches deep to bedrock. The Palatine soils are somewhat excessively drained. They are underlain by bedrock at a depth of 20 to 40 inches.

The minor soils in this association are in the Farmington, Vergennes, and Georgia series. The Farmington soils are shallow, loamy, and occur on the higher ridges. The Vergennes soils are moderately well drained. The Vergennes soils are clayey, and the Georgia soils are loamy.

The soils in most of this association have good potential for farming. The dominant soils drain readily and are ready for tillage earlier than the clayey Vergennes soils. In places extreme stoniness is the main limitation for cultivated crops. Most farmed areas are in hay, pasture, and corn grown for silage. Some sites have good air drainage and are suited to orchard trees. Parts of this association are used for residential and commercial developments. Except where the major soils are too steep or too shallow to bedrock, they have good potential for this development.

Soils of the Green Mountains and Associated Foothills

Three associations in the county consist of soils of the Green Mountains and associated foothills. These associations are in the eastern part of the county on the main range and the foothills of the Green Mountains. The soils on the main range are dominantly well drained, loamy,

and steep, but the soils of the foothills are well drained to poorly drained, loamy, and dominantly gently sloping to moderately steep. The soils in these associations are mostly in trees, pasture, or hay. Many areas are too steep, too stony, or too wet for farming and related uses.

13. *Lyman-Marlow association*

Sloping to steep, somewhat excessively drained or well-drained, loamy soils that are shallow or deep to bedrock; on main ranges and foothills

This association is the steepest and most mountainous one in the county. It is mostly on the main range of the Green Mountains, but a few areas are in the foothills and the Champlain Valley. Figure 4 shows the landscape position of the soils in this association. Forests cover most of the association.

This association makes up about 26 percent of the

county, or about 88,530 acres. About 50 percent of this is Lyman soils, 25 percent is Marlow soils, and the remaining 25 percent is minor soils.

The Lyman soils are somewhat excessively drained and shallow to bedrock. They are rocky or very rocky in most places and are the steepest soils in the association. The Marlow soils are well drained, loamy, and stony. They have a slowly permeable fragipan within 30 inches of the surface. These soils are moderately steep or steep but range from sloping to steep.

Also in the association are minor areas of Rock land, poorly drained Cabot soils, and moderately well drained, loamy Peru soils.

Most areas of this association are too steep, too rocky, and too shallow to bedrock for farming. Trees grow in most areas, but the steep, rocky soils hinder use for forestry. The Long Trail passes through part of this associ-

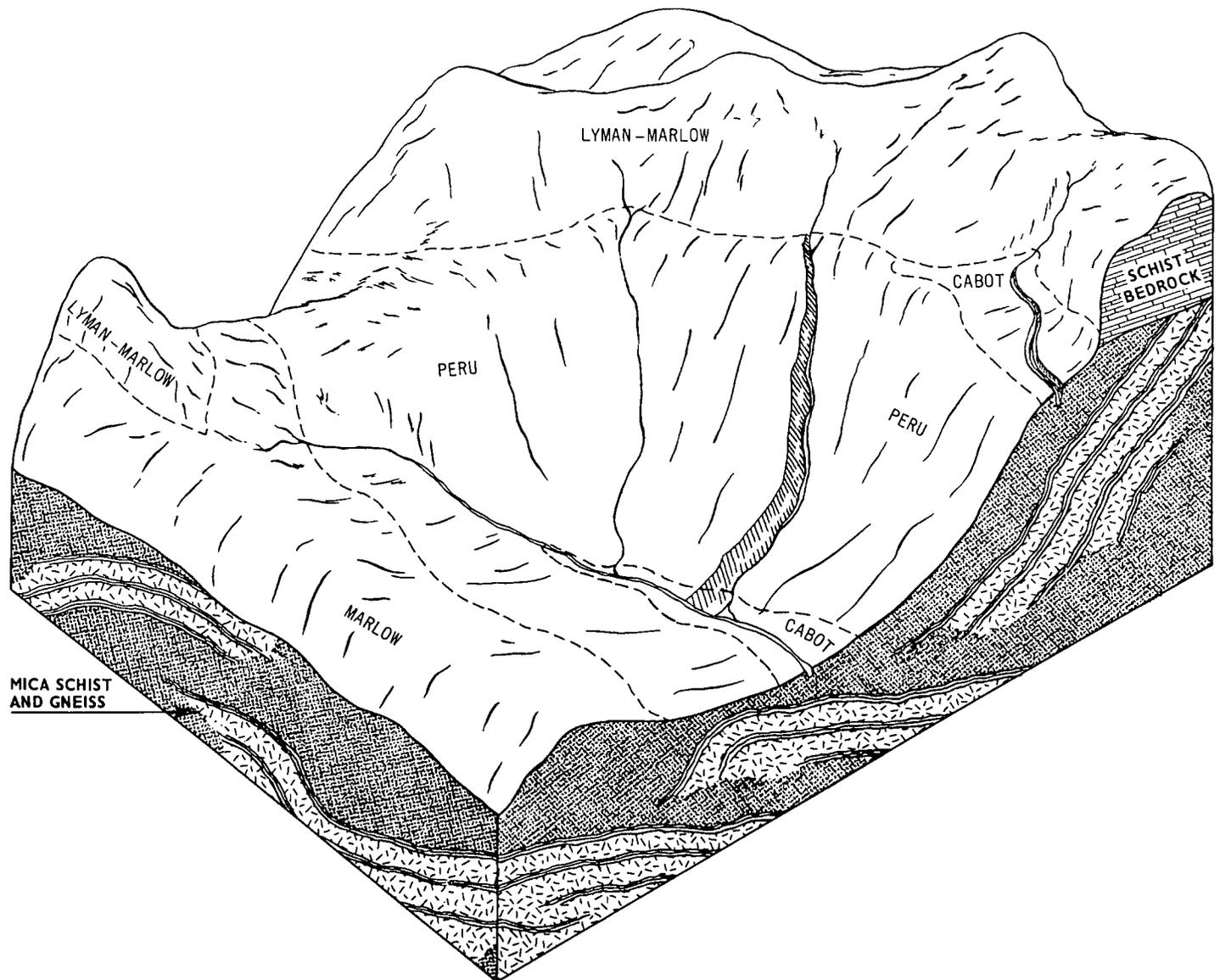


Figure 4.—Relationship of soils in associations 13 and 14.

ation, and hiking is a recreational use. This association also has potential for ski slopes.

14. Peru-Marlow association

Nearly level to steep, moderately well drained or well drained, deep, loamy soils; on main ranges and foothills

This association occupies the side slopes of the main range of the Green Mountains and the foothills. It occurs east of a line from the village of Milton to the village of Hinesburg.

This association makes up about 22 percent of the county, or about 74,910 acres. About 50 percent of this is Peru soils, 30 percent is Marlow soils, and the remaining 20 percent is other soils.

The major soils in this association are mainly deep, loamy, and moderately well drained or well drained. The Peru soils are moderately well drained and have a slowly permeable fragipan within 34 inches of the surface. They are mainly gently sloping or sloping but range from nearly level to steep. The Marlow soils are similar to the Peru soils but are well drained. Marlow soils also have a slowly permeable fragipan, which is within 30 inches of the surface and are sloping to moderately steep. Figure 4 shows the relationship of soils in this association.

The minor soils are the somewhat poorly drained and poorly drained Cabot soils and the somewhat excessively drained, shallow Lyman soils. The Cabot soils are lower and less sloping than the Lyman soils, which are shallow to bedrock and range to steep.

The presence of many stone fences indicates that much of this association was farmed at one time. Many of the less sloping and better drained areas are still farmed, but they are used mainly for pasture and hay. Other areas are idle and growing up in brush or are in trees. The major limitations for farming are the seasonal high water table in areas of Peru soils and the moderately steep slopes and shallowness to bedrock in places. Excess stoniness also is a limitation in many places that have not been farmed intensively. The slowly permeable fragipan and moderately steep slopes in many places hinder the use for private sewage disposal systems. Excess water also is a limitation where basements are excavated below ground level in areas of the Peru and Cabot soils.

15. Peru-Cabot association

Level to steep, moderately well drained to poorly drained, deep, loamy soils; on foothills

This association occupies the lowest positions on the side slopes of the foothills of the Green Mountains. It has a higher proportion of poorly drained soils than other associations in the county that consist of soils formed in glacial till.

This association makes up about 5 percent of the county, or about 17,020 acres. About 50 percent of this is Peru soils, 40 percent is Cabot soils, and the remaining 10 percent is minor soils.

This association consists dominantly of moderately well drained to poorly drained soils. The Peru soils are moderately well drained and loamy and have a slowly permeable fragipan that is less than 34 inches from the surface. Peru soils are mainly gently sloping or sloping

but range from nearly level to steep. The Cabot soils are similar to the Peru soils in texture and also have a fragipan, but Cabot soils have a higher water table than Peru soils and are less sloping. The fragipan of Cabot soils is within 24 inches of the surface. Cabot soils occupy lower positions than Peru soils and are mainly level to gently sloping but are sloping in places. Stones are commonly on the surface of Peru and Cabot soils unless they have been cleared for farming.

The well-drained, loamy Marlow soils are the minor soils in this association.

This association has been cleared of trees and stones in many areas, and these areas are now farmed. The main use is for pasture and hay. Stone fences are common in the association. Some of the former farms have been abandoned and have grown up in brush and trees. Other areas are still in woodland because they are steep or extremely stony. Excess wetness and stoniness are the major limitations for farming and for community development, such as houses, recreational facilities, and roads. During wet periods leach fields of septic tank systems are saturated and basements are wet.

Descriptions of the Soils

This section describes the soil series and mapping units of Chittenden County. The approximate acreage and proportionate extent of each mapping unit are given in table 1. Their location in the county is shown on the detailed soil map at the back of this survey.

The procedure is first to describe the soil series, and then the mapping units in the series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. The soil series contains a brief nontechnical description of a soil profile, the major layers from the surface downward. This profile is considered typical for all the soils of a series. If the profile for a given mapping unit differs from this typical profile, the differences are stated in the description of the mapping unit, unless the differences are apparent in the name of the mapping unit. Following the brief nontechnical description of the soil profile is a paragraph discussing soil properties that affect the use and management of all the mapping units of that series. The available moisture capacity was estimated for the upper 30 inches of the soil profile. Unless otherwise stated, permeability is estimated for the least permeable horizon in the soil profile. Also described for the series is a detailed technical profile representative for the series. This profile is included for soil scientists, engineers, and others who need to make thorough and precise studies of the soils.

As mentioned in the section "How This Survey Was Made", not all mapping units are members of a soil series. Rock land, for example, is a miscellaneous land type and does not belong to a soil series. It is nevertheless in alphabetic order 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.

TABLE 1.—Approximate acreage and proportionate extent of the soils

Soil	Area	Extent	Soil	Area	Extent
	<i>Acres</i>	<i>Percent</i>		<i>Acres</i>	<i>Percent</i>
Adams and Windsor loamy sands, 0 to 5 percent slopes.....	14, 840	4. 4	Groton gravelly fine sandy loam, 5 to 12 percent slopes.....	800	0. 2
Adams and Windsor loamy sands, 5 to 12 percent slopes.....	3, 240	1. 0	Groton gravelly fine sandy loam, 12 to 20 percent slopes.....	450	0. 1
Adams and Windsor loamy sands, 12 to 30 percent slopes.....	3, 270	1. 0	Groton gravelly fine sandy loam, 20 to 30 percent slopes.....	550	0. 2
Adams and Windsor loamy sands, 30 to 60 percent slopes.....	4, 000	1. 2	Groton gravelly fine sandy loam, 30 to 60 percent slopes.....	540	0. 2
Agawam fine sandy loam, 0 to 5 percent slopes.....	1, 130	0. 3	Hadley very fine sandy loam.....	1, 840	0. 5
Agawam fine sandy loam, 12 to 30 percent slopes.....	320	(¹)	Hadley very fine sandy loam, frequently flooded.....	2, 510	0. 7
Agawam fine sandy loam, 30 to 60 percent slopes.....	1, 730	0. 5	Hartland very fine sandy loam, 2 to 6 percent slopes.....	820	0. 2
Alluvial land.....	750	0. 2	Hartland very fine sandy loam, 6 to 12 percent slopes.....	490	0. 1
Au Gres fine sandy loam.....	1, 900	0. 6	Hartland very fine sandy loam, 12 to 25 percent slopes.....	750	0. 2
Beaches.....	110	(¹)	Hartland very fine sandy loam, 25 to 60 percent slopes.....	2, 670	0. 8
Belgrade and Eldridge soils, 0 to 3 percent slopes.....	1, 940	0. 6	Hinesburg fine sandy loam, 0 to 3 percent slopes.....	1, 030	0. 3
Belgrade and Eldridge soils, 3 to 8 percent slopes.....	1, 400	0. 4	Hinesburg fine sandy loam, 3 to 8 percent slopes.....	1, 060	0. 3
Belgrade and Eldridge soils, 8 to 15 percent slopes.....	210	(¹)	Hinesburg fine sandy loam, 8 to 15 percent slopes.....	380	0. 1
Belgrade and Eldridge soils, 15 to 25 percent slopes.....	120	(¹)	Hinesburg fine sandy loam, 15 to 25 percent slopes.....	240	(¹)
Blown-out land.....	650	0. 2	Hinesburg fine sandy loam, 25 to 60 percent slopes.....	510	0. 2
Borrow pits.....	650	0. 2	Limerick silt loam.....	5, 130	1. 5
Cabot stony silt loam, 0 to 3 percent slopes.....	790	0. 2	Limerick silt loam, very wet.....	2, 570	0. 8
Cabot stony silt loam, 3 to 15 percent slopes.....	3, 210	0. 9	Livingston clay.....	2, 650	0. 8
Cabot extremely stony silt loam, 0 to 3 percent slopes.....	930	0. 3	Livingston silty clay, occasionally flooded.....	460	0. 2
Cabot extremely stony silt loam, 3 to 25 percent slopes.....	11, 060	3. 3	Lyman-Marlow rocky loams, 5 to 12 percent slopes.....	960	0. 3
Colton gravelly loamy sand, 0 to 5 percent slopes.....	1, 040	0. 3	Lyman-Marlow rocky loams, 12 to 20 percent slopes.....	890	0. 3
Colton gravelly loamy sand, 5 to 12 percent slopes.....	580	0. 2	Lyman-Marlow very rocky loams, 5 to 30 percent slopes.....	39, 300	11. 6
Colton gravelly loamy sand, 12 to 20 percent slopes.....	380	0. 1	Lyman-Marlow very rocky loams, 30 to 60 percent slopes.....	40, 620	11. 9
Colton and Stetson soils, 20 to 30 percent slopes.....	1, 560	0. 5	Marlow stony loam, 5 to 12 percent slopes.....	1, 480	0. 4
Colton and Stetson soils, 30 to 60 percent slopes.....	1, 920	0. 6	Marlow stony loam, 12 to 20 percent slopes.....	990	0. 3
Covington silty clay.....	8, 850	2. 6	Marlow stony loam, 20 to 30 percent slopes.....	390	0. 1
Duane and Deerfield soils, 0 to 5 percent slopes.....	2, 330	0. 7	Marlow extremely stony loam, 5 to 20 percent slopes.....	5, 390	1. 6
Duane and Deerfield soils, 5 to 12 percent slopes.....	1, 140	0. 3	Marlow extremely stony loam, 20 to 60 percent slopes.....	6, 450	1. 9
Duane and Deerfield soils, 12 to 20 percent slopes.....	220	(¹)	Massena stony silt loam, 0 to 15 percent slopes.....	170	(¹)
Enosburg and Whately soils, 0 to 3 percent slopes.....	2, 930	0. 9	Massena extremely stony silt loam, 0 to 15 percent slopes.....	280	(¹)
Enosburg and Whately soils, 3 to 8 percent slopes.....	790	0. 2	Muck and peat.....	3, 630	1. 1
Farmington extremely rocky loam, 5 to 20 percent slopes.....	8, 540	2. 5	Munson and Belgrade silt loams, 12 to 25 percent slopes.....	3, 030	0. 9
Farmington extremely rocky loam, 20 to 60 percent slopes.....	8, 910	2. 6	Munson and Raynham silt loams, 2 to 6 percent slopes.....	6, 180	1. 8
Farmington-Stockbridge rocky loams, 5 to 12 percent slopes.....	1, 410	0. 4	Munson and Raynham silt loams, 6 to 12 percent slopes.....	3, 410	1. 0
Farmington-Stockbridge rocky loams, 12 to 20 percent slopes.....	340	0. 1	Palatine silt loam, 3 to 8 percent slopes.....	1, 650	0. 5
Farmington-Stockbridge rocky loams, 20 to 60 percent slopes.....	130	(¹)	Palatine silt loam, 8 to 15 percent slopes.....	740	0. 2
Fill land.....	1, 900	0. 6	Palatine silt loam, 15 to 25 percent slopes.....	570	0. 2
Fresh water marsh.....	580	0. 2	Palatine silt loam, 25 to 60 percent slopes.....	220	(¹)
Georgia stony loam, 3 to 8 percent slopes.....	1, 120	0. 3	Peacham stony silt loam.....	730	0. 2
Georgia stony loam, 8 to 15 percent slopes.....	420	0. 1	Peru stony loam, 0 to 5 percent slopes.....	830	0. 3
Georgia extremely stony loam, 0 to 15 percent slopes.....	800	0. 2	Peru stony loam, 5 to 12 percent slopes.....	5, 240	1. 5
Georgia extremely stony loam, 15 to 60 percent slopes.....	200	(¹)	Peru stony loam, 12 to 20 percent slopes.....	2, 570	0. 8
Groton gravelly fine sandy loam, 0 to 5 percent slopes.....	410	0. 1	Peru stony loam, 20 to 30 percent slopes.....	470	0. 1
			Peru extremely stony loam, 0 to 20 percent slopes.....	24, 090	7. 1
			Peru extremely stony loam, 20 to 60 percent slopes.....	13, 600	4. 0
			Quarries.....	60	(¹)
			Rock land.....	6, 880	2. 0
			Scantic silt loam, 0 to 2 percent slopes.....	3, 400	1. 0

See footnote at end of table.

TABLE 1.—Approximate acreage and proportionate extent of the soils—Continued

Soil	Area	Extent	Soil	Area	Extent
	<i>Acres</i>	<i>Percent</i>		<i>Acres</i>	<i>Percent</i>
Seantic silt loam, 2 to 6 percent slopes.....	2, 130	0. 6	Stockbridge and Nellis extremely stony loams, 3 to 15 percent slopes.....	1, 020	0. 3
Scarboro loam.....	840	0. 3	Stockbridge and Nellis extremely stony loams, 15 to 60 percent slopes.....	720	0. 2
Stetson gravelly fine sandy loam, 0 to 5 percent slopes.....	2, 100	0. 6	Terrace escarpments, silty and clayey.....	2, 430	0. 7
Stetson gravelly fine sandy loam, 5 to 12 per- cent slopes.....	2, 050	0. 6	Vergennes clay, 2 to 6 percent slopes.....	13, 480	4. 0
Stetson gravelly fine sandy loam, 12 to 20 per- cent slopes.....	1, 470	0. 4	Vergennes clay, 6 to 12 percent slopes.....	3, 020	0. 9
Stockbridge and Nellis stony loams, 3 to 8 percent slopes.....	2, 170	0. 6	Vergennes clay, 12 to 25 percent slopes.....	1, 420	0. 4
Stockbridge and Nellis stony loams, 8 to 15 percent slopes.....	1, 210	0. 4	Vergennes clay, 25 to 60 percent slopes.....	630	0. 2
Stockbridge and Nellis stony loams, 15 to 25 percent slopes.....	460	0. 1	Winooski very fine sandy loam.....	3, 380	1. 0
			Military test firing area.....	3, 530	1. 0
			Water.....	1, 900	0. 3
			Total.....	340, 480	100. 0

¹ Less than 0.1 percent; the total of these percentages amounts to 0.7 percent.

Not all soil boundaries on the Chittenden County soil map join with those on the map of Addison County that was surveyed and published earlier. Part of the differences results from refinement in the current system of soil classification and part from greater detail required for present needs in use and management.

The description of each mapping unit suitable for cultivation contains a discussion of some of the management needs of that unit. Additional information about managing soils for tilled crops and tame pasture is given in the section "Use and Management of the Soils." That section also has subsections providing information about use of the soils for woodland, wildlife, engineering, and for community development and recreation.

Listed at the end of each description of a mapping unit are the capability unit and the woodland suitability group in which the mapping unit has been placed. The page number showing where each of these are described can be found by referring to the "Guide to Mapping Units" at the back of the survey. Many terms in the soil descriptions and in other parts of the survey are defined in the "Soil Survey Manual" (10)¹ and in the glossary.

Adams Series

The Adams series consists of deep, loose, excessively drained soils that are sandy throughout. These soils are level to steep. The larger areas are in Milton, Jericho, and Essex, east of the Windsor soils, and at higher elevations. Smaller areas of Adams soils are in Underhill, Bolton, and Richmond, and in stream valleys of the Green Mountains.

These soils developed in sandy beaches, deltas, and terraces. The sand is deeper than 4 feet. In most places it is underlain by stratified sand, gravel, sandy loam, loam glacial till, clay, silt, or bedrock.

In a representative profile the surface layer in an unplowed area is black loamy sand, high in content of organic matter, and about 1 inch thick. Under this is a

layer of light brownish-gray loamy sand about 6 inches thick. In cultivated areas, these two layers are mixed with some of the subsoil to form the very dark grayish-brown loamy sand plow layer. The subsoil is very friable or loose loamy fine sand about 23 inches thick. It is dark reddish brown in the upper part, dark yellowish brown in the middle part, and yellowish brown in the lower part. The substratum is grayish-brown loamy fine sand to a depth of about 45 inches or more.

The bright colors and lack of mottles in the Adams soils indicate that they are well aerated and porous. The soils are rapidly permeable, have a moderately low available moisture capacity, and have very low natural fertility. These soils are filled to capacity with available moisture at the start of the growing season. As the growing season progresses, rain normally is not adequate to replenish the soil moisture used by plants. Crops, therefore, show signs of lack of moisture during the growing season. These soils warm faster in the spring than the more silty, more clayey, or wetter soils in the county. They are easily tilled and can be cultivated throughout a wide range of moisture content without puddling, crusting, or becoming cloddy. The Adams soils can be worked earlier in the spring and sooner after rains than most soils in the county. These soils are susceptible to soil blowing where unvegetated. Adams soils have a low shrink-swell potential.

The Adams soils are used mainly for corn, pasture, and hay in farming areas and for housing developments, industrial sites, and roads near villages and cities. They have been farmed intensively, but many areas of Adams soils are now in trees or brush.

In Chittenden County the Adams soils were not mapped separately but in undifferentiated groups with Windsor soils. The Windsor soils are described under the Windsor series.

Representative profile of an Adams loamy sand in idle land, about three-fourths of a mile south of the hamlet of West Bolton, and one-fourth of a mile north of Bolton Notch:

A1—0 to 1 inch, black (N 2/0) loamy sand; moderate, medium, granular structure; loose; many roots; very strongly acid; abrupt, wavy boundary.

¹ Italic numbers in parentheses refer to literature cited, p. 147.

- A2—1 to 7 inches, light brownish-gray (2.5Y 6/2) loamy sand; single grain; loose; many roots; very strongly acid; clear, wavy boundary.
- B21h—7 to 9 inches, dark reddish-brown (5YR 2/2) loamy fine sand; weak, medium, granular structure and single grain; very friable; many roots; very strongly acid; clear, wavy boundary.
- B22ir—9 to 15 inches, dark yellowish-brown (10YR 3/4) loamy fine sand; weak, medium, granular structure and single grain; loose; common roots; strongly acid; gradual, wavy boundary.
- B3—15 to 30 inches, yellowish-brown (10YR 5/4) loamy fine sand; single grain; loose; few roots; medium acid; gradual, wavy boundary.
- C—30 to 45 inches, grayish-brown (2.5Y 5/2) loamy fine sand; single grain; loose; few roots; medium acid.

The solum of Adams soils ranges from 16 to 30 inches in thickness. In most places it is free of coarse fragments, but the C horizon commonly is up to 15 percent coarse fragments by volume.

The A1 or Ap horizon has a hue of 10YR, a value of 2 or 3, and a chroma of 1 or 2 or neutral colors that have a value of 2 or 3. In a few places an A2 horizon occurs and is gray (10YR 5/1) or light brownish gray (2.5Y 6/2). In unlimed soils the A horizon ranges from extremely acid to strongly acid.

The upper part of the B horizon has a hue of 7.5YR or 5YR, a value of 2 to 5, and a chroma of 2 to 6. The lower part of the B horizon has a hue of 10YR or 2.5Y, a value of 3 to 5, and a chroma of 4 to 6. The B horizon is loamy fine sand, fine sand, or sand. It ranges from very strongly acid to medium acid.

The C horizon, in most places, has a hue of 2.5Y or 5Y, a value of 4 to 6, and a chroma of 2 to 4. It is loamy sand, loamy fine sand, fine sand, or sand. In some places thin strata of gravelly sand occur below a depth of 18 inches. The C horizon is strongly acid or medium acid.

Adams soils are adjacent to the moderately well drained Duane and Deerfield soils, the somewhat poorly drained or poorly drained Au Gres soils, the somewhat poorly drained Munson and Raynham soils, the excessively drained Colton soils, and the somewhat excessively drained Stetson soils. The Adams soils are somewhat similar to the Colton and Stetson soils but have a much lower content of gravel in the subsoil and substratum.

Adams and Windsor loamy sands, 0 to 5 percent slopes (AdA).—The Windsor soil is predominant in this mapping unit, but an area may consist of either the Adams soil, the Windsor soil, or of a mixture of the two. These soils occupy irregularly shaped terraces 2 to 200 acres in size. The irregular shape is due to the many gullies dissecting the sand plains. The profiles of the Adams and Windsor soils are the ones described as representative for the respective series.

Included with these soils in mapping are some areas of Adams and Windsor soils that have a thin surface layer where soil blowing has taken place. These areas are roughly circular in shape and less than 100 feet in diameter. Also included are areas of soil in which the content, by volume, of gravel, cobblestones, and stones averages more than 15 percent between depths of 10 and 40 inches. Some of the areas mapped contain areas of Deerfield soils and Colton soils. Areas that have stones and cobblestones on the surface are also included. In a few areas, the surface layer is sand or fine sand. In many areas this mapping unit is slightly acid or neutral throughout.

These soils are used for truck gardening, intertilled farm crops, hay, and pasture (fig. 5). They have few limitations for many nonfarm uses such as housing developments. A large part of this mapping unit is woodland or idle.

Surface runoff is very slow. The ground should be kept well covered by vegetation to prevent soil blowing. On these soils the hazard of water erosion is very slight, even in unvegetated areas. (Both parts, capability unit IIIs-1; both parts, woodland suitability group 4s1)

Adams and Windsor loamy sands, 5 to 12 percent slopes (AdB).—A given area of this mapping unit may consist of Adams soil, Windsor soil, or a mixture of the two. These soils occupy irregularly shaped terraces 2 to 20 acres in size. Slopes are mainly 100 and 300 feet long.

Included with these soils in mapping are areas of Duane and Deerfield soils and of Agawam soils. The Duane and Deerfield soils are in the concave areas, and the Agawam soils occupy ridges. Also included are areas that have cobblestones and stones on the soil surface and throughout the soil. In a few areas the surface layer is sand or fine sand. In many areas soils are slightly acid or neutral throughout. In some areas the content of gravel, cobblestones, and stones, by volume, averages more than 15 percent between depths of 10 and 40 inches.

These soils are used for hay and pasture and for non-farm uses. A large part of the acreage is woodland or is idle.

Surface runoff is slow. The soils should be well covered most of the time to protect them from soil blowing and water erosion. In unvegetated areas the water erosion hazard is slight. (Both parts, capability unit IVs-1; both parts, woodland suitability group 4s1)

Adams and Windsor loamy sands, 12 to 30 percent slopes (AdD).—An area of this mapping unit may consist of Adams soil, Windsor soil, or both. These soils are in areas that are 2 to 50 acres in size and occupy irregularly shaped terrace edges or valley slopes. Slopes are between 100 and 300 feet long.

Included with these soils in mapping are areas of Agawam, Colton, and Hartland soils. Generally, the Hartland soils are near the bottom of the slopes and the Agawam and Colton soils are near the top. Also included are areas where the content of gravel, cobblestones, and stones, by volume, averages more than 5 percent between depths of 10 and 40 inches. Other inclusions are areas of soils that have been severely blown by wind and gullied by water. In a few areas the surface layer is sand or fine sand. In many areas the soils are slightly acid or neutral throughout.

This mapping unit is mostly woodland or is idle. In the less sloping areas, the soils are in hay and pasture.

Surface runoff is medium. Where these soils are not vegetated, they are highly susceptible to soil blowing and water erosion. Where the soils are steepest, the use of modern farm machinery is limited. These soils have severe limitations for most nonfarm uses, especially those for which steepness is a consideration. (Adams soil, capability unit VI s-1, woodland suitability group 4s2; Windsor soil, capability unit VII s-2, woodland suitability group 5s2)

Adams and Windsor loamy sands, 30 to 60 percent slopes (AdE).—An individual area of this mapping unit may be all Adams soil, all Windsor soil, or some of both. These soils are in areas that are 5 to 200 acres in size and occupy irregularly shaped terrace edges or gully walls. Slopes are between 100 and 500 feet long. These soils have profiles similar to the profiles described

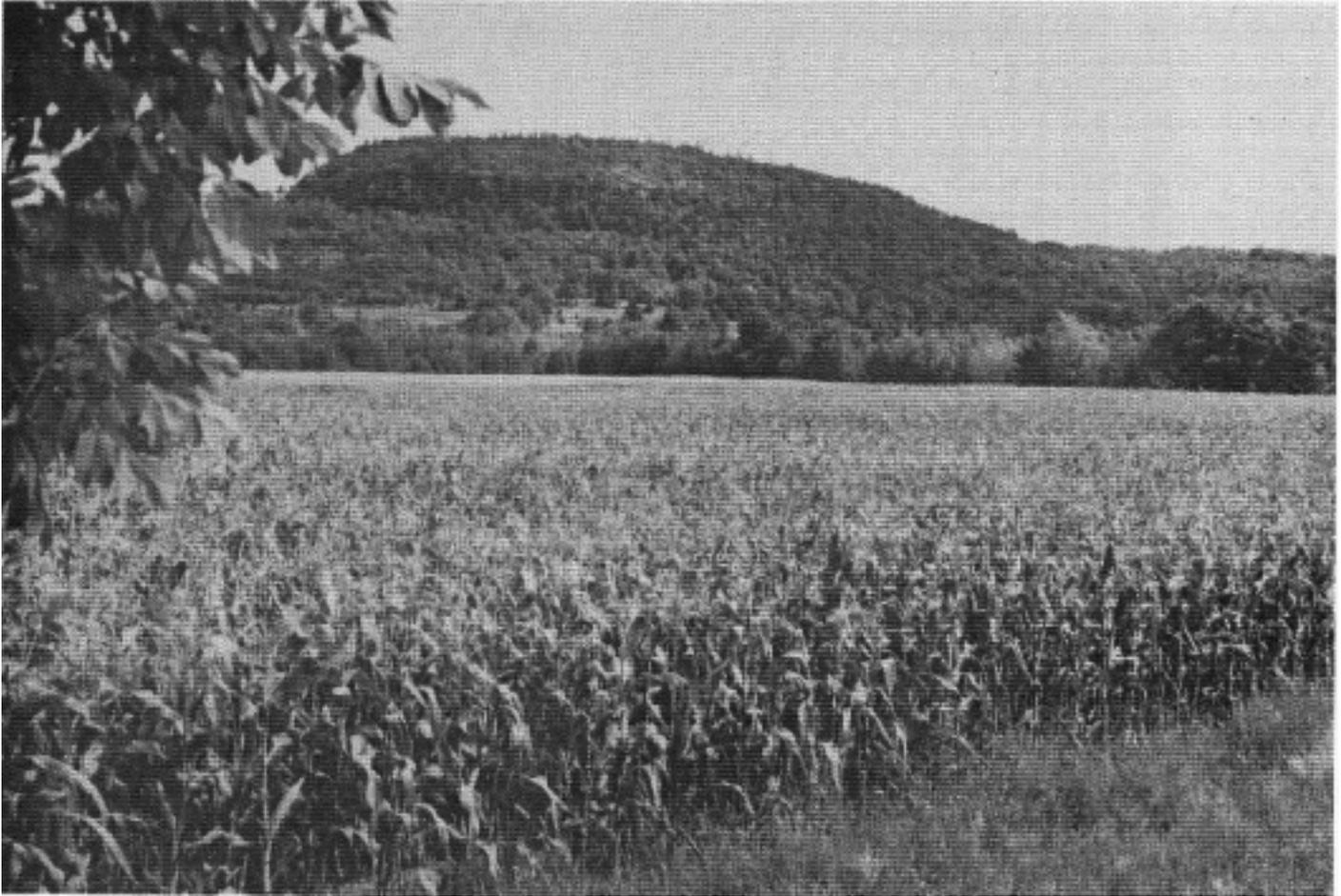


Figure 5.—Corn on Adams and Windsor soils.

as representative for the respective series, except that the total thickness of the surface layer and subsoil is slightly less.

Included with these soils in mapping are areas of the Colton and Agawam soils. The Colton and Agawam soils normally are near the top of the slopes. In some included areas, the content of gravel, cobblestones, and stones, by volume, averages more than 15 percent between depths of 10 and 40 inches. In a few included areas the surface layer is sand or fine sand. In many areas this mapping unit is slightly acid or neutral throughout.

Woodland is the most extensive use for these soils. A few areas are idle.

Surface runoff is rapid. In areas not vegetated, these soils are very susceptible to soil blowing and the water erosion hazard is very severe. The use of logging equipment or farm machinery is difficult and hazardous. These soils have severe limitations for most nonfarm uses, especially those where steepness is a consideration. (Both soils, capability unit VIIIs-2; Adams soil, woodland suitability group 4s3; Windsor soil, woodland suitability group 5s3)

Agawam Series

In the Agawam series are deep, friable, well-drained soils that consist of fine sandy loam over sandy material. These soils are nearly level to steep. The Agawam soils occur mainly along the Winooski and Lamoille Rivers just above the flood plain. The larger areas of these soils lie near the mouths of the streams. A few small areas are in the foothills of the Green Mountains. These soils formed in water- or wind-laid sand that was derived from quartz, schist, and phyllite.

In a representative profile the surface layer in a plowed area is very dark grayish-brown fine sandy loam about 9 inches thick. The upper part of the subsoil is dark yellowish-brown, friable fine sandy loam about 2 inches thick. The lower part of the subsoil is olive-brown, friable fine sandy loam about 7 inches thick. The substratum is olive-brown loamy sand to a depth of about 32 inches and is gravelly loamy fine sand to a depth of 40 inches or more.

The bright color and lack of mottles in the subsoil indicate that these soils are well aerated. They have moderately rapid permeability in the moderately coarse textured upper part of the soil profile and rapid per-

meability in the coarse-textured lower part. Their available moisture capacity is medium. Water is available for plants only in layers above the sand and gravel. Natural fertility is low, but the soils are easily tilled and can be cultivated throughout a wide range of moisture content without crusting or puddling.

These soils warm faster in the spring than the more silty, more clayey, or wetter soils in the county. Although these soils are saturated during rainy periods in spring, the water disappears quickly after rains stop. They are filled to capacity with available moisture at the start of the growing season. As the growing season progresses, rain normally is not adequate to replenish the soil moisture used by plants. The crops therefore show signs of lack of moisture during extended dry periods. Since these soils dry out quickly, they are ready for planting earlier than many other soils in the county. Shrink-swell potential is low.

The Agawam soils are used mainly for corn, pasture, and hay on farms and for housing developments, industrial sites, and roads near villages and cities.

Representative profile of an Agawam fine sandy loam in a field in the town of Huntington, 1½ miles south of Huntington Center:

- Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; moderate, very fine, granular structure; friable; many roots; 5 percent gravel; medium acid; abrupt, smooth boundary.
- B21ir—9 to 11 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, fine, granular structure; friable; many roots; 5 percent gravel; medium acid; clear, smooth boundary.
- B22—11 to 18 inches, olive-brown (2.5Y 4/4) fine sandy loam; weak, fine and medium, granular structure; friable; common roots; 5 percent gravel; medium acid; abrupt, wavy boundary.
- IIC1—18 to 32 inches, olive-brown (2.5Y 4/4) loamy sand; single grain; loose; common roots; 10 percent gravel; medium acid; abrupt, wavy boundary.
- IIC2—32 to 40 inches, olive-brown (2.5Y 4/4) gravelly loamy fine sand; weak, thin, platy structure; very friable; 25 percent gravel; slightly acid.

The solum of Agawam soils is 15 to 35 inches thick. In most places it coincides with depth to sandy material. The A1 and the Ap horizons have a hue of 2.5Y and 10YR, a value of 2 to 4, and a chroma of 1 to 4. In a few places where there is an A1 horizon, there is an A2 horizon that is about 1 to 2 inches thick and is dark grayish brown 10YR 4/2. In farmed areas the A horizons range from strongly acid to neutral.

The upper part of the B horizon is dark yellowish brown (10YR 4/4), dark brown (7.5YR 4/4), or yellowish brown (10YR 5/6). The B horizon is fine sandy loam or very fine sandy loam. The lower part of the B horizon has a hue of 10YR or 2.5Y, a value of 4 or 5, and a chroma of 4. The B horizon dominantly is fine sandy loam but, in places, is sandy loam, loamy fine sand, or loamy sand. The B horizon is medium acid in the upper part and medium acid or slightly acid in the lower part.

The C horizon has a hue of 10YR or 2.5Y, a value of 3 to 6, and a chroma of 2 to 4. The C horizon commonly is loamy sand or gravelly loamy fine sand but ranges from fine sandy loam to gravelly sand. The C horizon is medium acid to neutral.

Since the Agawam soils in this county typically have sandy material near the soil surface, they are more droughty than typical of the Agawam series.

The Agawam soils occur near Hartland, Adams, Windsor, Duane, Deerfield, and Au Gres soils. They have coarser sand throughout the soil profile than the Hartland soils. Agawam soils have finer texture in the upper part of the soil profile than the Adams and Windsor soils. The Agawam soils are

better drained and are finer textured in the upper part of the soil profile than the Duane, Deerfield, and Au Gres soils.

Agawam fine sandy loam, 0 to 5 percent slopes (AgA).—This soil occupies irregularly shaped terraces above the flood plain of the streams. Areas are 2 to 80 acres in size. Slopes range from 100 to 400 feet in length. The profile of this soil is the one described as representative for the Agawam series.

Included with this soil in mapping are areas of Agawam fine sandy loam that have slopes of 5 to 12 percent. Also included are areas of Adams, Windsor, Hartland, and Deerfield soils, and of a moderately well drained, moderately coarse textured soil. The Adams, Windsor, and Hartland soils occupy the more nearly level areas or the slight rises. The slight rises normally have slopes of more than 5 percent and normally occur in the larger mapped areas. The rises are oriented in the same direction as the stream channel. The Deerfield soil and the moderately well drained, moderately coarse textured soil occupy depressions that are somewhat circular or long and narrow. The long, narrow depressions normally are in the larger mapped areas of this soil. They are oriented in the same direction as the stream channel. Also included are areas of soils on glacial till that have cobbles and stones on the surface. In a few included areas, the surface layer is sandy loam or very fine sandy loam. Other inclusions are of soils that have neutral reaction in some part of, or throughout, the soil.

This soil is used for hay, pasture, and corn silage. It also is used for many nonfarm purposes.

Surface runoff is slow, but this soil is susceptible to soil blowing in areas not vegetated. The hazard of water erosion is slight in cultivated areas or where the soil is not vegetated. (Capability unit IIS-2; woodland suitability group 4o1)

Agawam fine sandy loam, 12 to 30 percent slopes (AgD).—This soil occupies irregularly shaped terrace edges that are 2 to 50 acres in size. Slopes range from 50 to 400 feet in length. The profile of this soil is similar to that described as representative for the series, but its surface layer is thinner in areas that have been cultivated.

Included with this soil in mapping are areas of Adams, Hartland, and Windsor soils. Gullies that cannot be crossed with farm machinery occur within some mapped areas of this soil. A few mapped areas have cobbles and stones on the soil surface. These areas occur near soils derived from glacial till. In a few areas the surface layer is sandy loam or very fine sandy loam. Also included are soils that have neutral reaction in some part of, or throughout, the soil.

This soil is used mainly for trees, hay, and pasture. Where it is less sloping, it is used for cultivated crops. A few areas are idle.

Where this soil is not vegetated, it is susceptible to soil blowing. Surface runoff is medium. The hazard of water erosion is severe if cultivated crops are grown and the soil is not vegetated. This soil has limitations for most nonfarm uses, especially those uses where steepness is a consideration. (Capability unit IIVe-2; woodland suitability group 4r1)

Agawam fine sandy loam, 30 to 60 percent slopes (AgE).—This soil occupies irregularly shaped terrace edges or the steep sides of gullies. Most of the gullies are in the

town of Essex. The mapped areas range from 2 to 150 acres in size. The slopes range from 50 to 500 feet in length. Surface runoff is rapid. The profile of this soil differs from the soil profile described as representative for the series in having a slightly thinner surface layer and subsoil.

Included with this soil in mapping are small areas of Adams and Windsor soils at the tops of gullies or terrace edges and of Munson, Raynham, or Scantic soils at the bottoms of the gullies. In a few mapped areas cobblestones and stones are on the soil surface. These areas occur near soils formed in glacial till. In a few included areas, the surface layer is a sandy loam or very fine sandy loam. Also included in mapping are soils that have neutral reaction in some part of, or throughout, the soil.

Woodland is the main use of this soil. A few areas are idle or are in unimproved pasture.

Where not vegetated, this soil is susceptible to soil blowing and is subject to a very severe hazard of water erosion. The steep slopes make the use of modern farm machinery hazardous. This soil has severe limitations for most nonfarm uses, especially those for which steepness is a consideration. (Capability unit VIIe-2; woodland suitability group 4r2)

Alluvial Land

Alluvial land (An) consists of recent stream deposits of sandy, gravelly, or cobbly and stony materials. Large stones and boulders are in these deposits near the swiftest streams in the mountains and hills of the county. A few low-lying islands in the rivers are mostly cobbly and sandy or gravelly.

Most of this mapping unit is flooded at least once or twice a year. Some areas have been gouged or cut by the stream current, ice, and debris. The low-lying islands in the rivers have sparse vegetation and are under water for several days or weeks in spring. Alders, willows, aspen, and American elm grow on islands that are higher and are above the normal flow of the rivers.

Most of this mapping unit is idle, wooded, or used for unimproved pasture. Streambanks on either side or both sides of some of the smaller streams are in pasture. (Capability unit and woodland suitability group not assigned)

Au Gres Series

The Au Gres series consists of deep, loose, level to gently sloping, somewhat poorly drained and poorly drained soils that are sandy throughout their profile. These soils occupy concave positions on the terraces and in the gently sloping to sloping valleys. They formed in water-deposited sand and gravel that are high in quartz and schist content. The larger areas of the Au Gres soils are in the sand plains in Burlington, South Burlington, Colchester, Essex, and Milton. Smaller areas are in stream valleys. These soils developed in sand that is deeper than 4 feet. In most places this sand is underlain by stratified sand and gravel, fine sandy loam or loam glacial till, clay, silt, or bedrock.

A representative profile in a cultivated area has a very dark grayish-brown surface layer of fine sandy loam

about 8 inches thick. It is underlain by a subsurface layer of dark-gray loamy sand mottled with dark reddish brown and yellowish red. This layer is about 4 inches thick. The subsoil, about 11 inches thick, is dark reddish-brown, weakly cemented coarse sand in the upper part and olive-brown, loose sand in the lower part. The substratum is olive sand to a depth of more than 40 inches.

Au Gres soils are used mainly for trees, pasture, and hay. Some areas have been drained and are used for corn and crops. Other areas formerly farmed are now idle.

Au Gres soils are porous to air and water above the fluctuating water table. They are rapidly permeable. These soils are saturated with water from late in fall to late in spring, but water disappears during summer. They have a moderately low available moisture capacity and low natural fertility. The shrink-swell potential is low.

Representative profile of Au Gres fine sandy loam in a hayfield in the town of Essex, 100 yards southwest of a brick and tile store, between the River Road and the Central Vermont Railway:

- Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles; platy clods separating to weak, fine, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.
- A2—8 to 12 inches, dark-gray (10YR 4/1) loamy sand; many, fine and medium, prominent, yellowish-red (5YR 5/8) and dark reddish-brown (2.5YR 3/4) mottles; subangular blocky structure separating to very weak, fine, granular; very friable; many roots; 10 percent gravel; slightly acid; abrupt, broken boundary.
- B21ir—12 to 17 inches, dark reddish-brown (2.5YR 3/4) coarse sand, weakly cemented in chunks 1 to 3 inches long and ½ to 1 inch thick; friable; common roots; 10 percent gravel; medium acid; abrupt, smooth boundary.
- B22—17 to 23 inches, olive-brown (2.5Y 4/4) sand; many, medium, distinct, dark yellowish-brown (10YR 3/4) mottles; single grain; loose; few roots; 5 percent gravel; medium acid; abrupt, smooth boundary.
- C—23 to 40 inches +, olive (5Y 4/3) sand; many, coarse, prominent, dark reddish-brown (5YR 3/2 and 5YR 3/3) mottles; single grain; less than 5 percent gravel; loose; medium acid.

The solum of Au Gres soils ranges from 20 to 30 inches in thickness. Depth to mottling ranges from 0 to 9 inches. The content of coarse fragments, consisting of pebbles and cobbles, is less than 15 percent.

The A1 and Ap horizons are black (5YR 2/1) or very dark grayish brown (10YR 3/2). The A2 horizon is dark gray (10YR 4/1) or gray (5Y 5/1) and is distinctly or prominently mottled. It is loamy fine sand or loamy sand. Reaction ranges from strongly acid to slightly acid.

The B21ir horizon has a hue of 2.5YR, 5YR, 7.5YR, or 10YR, a value of 2 to 4, and a chroma of 3 to 6. The B22 horizon is 2.5Y or 5Y in hue, 4 to 6 in value, and 2 to 4 in chroma. The B horizon is loamy fine sand, fine sand, sand, and loamy coarse sand. Reaction ranges from medium acid to neutral.

The C horizon is 10YR, 2.5Y, or 5Y in hue, 3 or 4 in value, and 2 to 4 in chroma. It ranges from loamy fine sand to coarse sand and gravelly sand. Reaction ranges from medium acid to neutral.

Au Gres soils are adjacent to the Adams, Windsor, Colton, Deerfield, Duane, and Scarboro soils. Au Gres soils are wetter than the Colton and Duane soils and have less gravel and cobblestones in the substratum. They are mottled in the surface and subsurface layers or throughout the subsoil, whereas the Deerfield soils are mottled in the lower part of the subsoil and Adams and Windsor are not mottled above the substratum.

Au Gres fine sandy loam (Au).—This soil has slopes of 0 to 5 percent. It occupies irregularly shaped areas

2 to 50 acres in size. Slopes range from 50 feet in length or less in natural drainage channels to 400 feet in length in concave areas.

Included with this soil in mapping are small areas of Deerfield, Duane, Scarboro, Whately, and Enosburg soils. The Deerfield and Duane soils are on slight rises, and the Scarboro soils are in depressions. In a few included areas, soils are 5 percent to more than 35 percent pebbles and cobblestones at a depth of 10 to 40 inches. Also included are soils that have thin layers of finer textured material in the subsoil and substratum and soils that have a calcareous substratum. In a few areas the surface layer is loam, sandy loam, fine sand, sand, loamy fine sand, or loamy sand.

This soil is used mainly for hay, pasture, and trees. A small acreage is idle or is used for corn grown for silage.

Surface runoff is slow. Unless a drainage system is installed, the water fluctuates from near the soil surface during the wetter part of the year to a depth below 3 feet during the drier part. Because this soil has a seasonal high water table, especially late in fall and in spring, it is so wet that growth of plants and operation of farm machinery are hindered. Overdrainage of this soil results in droughtiness. The soil is susceptible to soil blowing where not vegetated. The hazard of water erosion is slight on the steeper slopes where cultivated crops are grown and where a plant cover is lacking. This soil has severe limitations for many nonfarm uses, especially those for which wetness is a consideration. (Capability unit IVw-5; woodland suitability group 4w1)

Beaches

Beaches (Be) include the sandy and gravelly beaches of Lake Champlain in the towns of Charlotte, Colchester, and Milton and the city of Burlington. In back of these beaches are the sand dunes beach area of Colchester, northwest and southeast of Barney Point. In this area camps have been built on the dune sand above normal water level. Beaches occupy a very small acreage in the county. Most of the beaches are covered by the waters of Lake Champlain early in spring. Contents of sand and gravel are variable. The thickness of the sand over clay or other materials ranges from 6 inches to more than 4 feet. Most of the beaches have a slope of more than 3 percent. (Capability unit VIIIs-2; woodland suitability group not assigned)

Belgrade Series

The Belgrade series consists of deep, nearly level to moderately steep, moderately well drained soils that are loamy throughout their profile. These soils are mostly in the central part of the county near the Winooski and Browns Rivers. They developed in silt loam or very fine sandy loam glaciolacustrine material that is deeper than 4 feet. In a few places beneath this medium-textured material, the texture is sandy below a depth of 4 feet.

A representative profile of a Belgrade soil has a dark-brown very fine sandy loam surface layer about 7 inches thick. The subsoil is 5 inches of strong-brown very fine sandy loam over 11 inches of yellowish-brown very fine sandy loam. The underlying material is light

brownish-gray very fine sandy loam in the upper part and is mottled with dark reddish brown and yellowish red. A layer of grayish-brown silt loam about 4 inches thick occurs at a depth of about 31 inches. It is underlain by a thick layer of pale-brown very fine sandy loam. Many prominent yellowish-red mottles are throughout the soil mass.

Belgrade soils have a moderately high available moisture capacity and high natural fertility. They are moderately slowly permeable. These soils are slow to warm in the spring. A seasonal high water table keeps the soils wet from late in fall to early in spring. These soils puddle if worked when wet and crust when they dry. Farm machinery is easily bogged down in these soils when they are wet. Belgrade soils have a low shrink-swell potential.

The Belgrade soils are mainly used for hay, pasture, and corn grown for silage. A few areas are idle.

In Chittenden County, the Belgrade soils were not mapped separately. They were mapped with Eldridge soils and with Munson soils in undifferentiated units. The Eldridge soils are described under the Eldridge series. The undifferentiated unit of Munson and Belgrade soils is described under the Munson series.

A representative profile of a Belgrade very fine sandy loam in an idle field in the town of Shelburne, one-half mile east of Shelburne Museum:

- Ap—0 to 7 inches, dark-brown (7.5YR 3/2) very fine sandy loam; weak, very fine, granular structure; very friable; many roots; slightly acid; abrupt, smooth boundary.
- B21ir—7 to 12 inches, strong-brown (7.5YR 5/6) very fine sandy loam; massive; very friable; common roots; neutral; abrupt, smooth boundary.
- B22ir—12 to 23 inches, yellowish-brown (10YR 5/4) very fine sandy loam; massive; very friable; few roots; neutral; abrupt, smooth boundary.
- C1—23 to 31 inches, light brownish-gray (10YR 6/2) very fine sandy loam; many, coarse, prominent, dark reddish-brown (5YR 3/4), yellowish-red (5YR 4/8), and dark yellowish-brown (10YR 4/4) mottles; massive, but separates to weak, moderate, angular blocky structure; friable; few roots; neutral; abrupt, smooth boundary.
- C2—31 to 35 inches, grayish-brown (10YR 5/2) silt loam; many, medium and coarse, prominent, yellowish-red (5YR 4/6 and 5/8) and dark yellowish-brown (10YR 4/4) mottles; weak, thick, platy structure; friable; few roots; slightly acid; abrupt, smooth boundary.
- C3—35 to 60 inches, pale-brown (10YR 6/3) very fine sandy loam; many, medium and coarse, prominent, dark reddish-brown (5YR 3/4) and yellowish-red (5YR 4/8 and 5/8) mottles; massive; very friable; neutral.

The solum ranges from 20 to 30 inches in thickness. Depth to mottles ranges from 12 to 23 inches.

The A horizon has a hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. It is silt loam or very fine sandy loam. The reaction of the A horizon ranges from strongly acid to slightly acid.

The upper part of the B horizon has a hue of 7.5YR or 10YR, value of 4 or 5, and chromas of 4 to 6. The lower part of the B horizon has a hue of 10YR or 2.5Y, values of 4 to 6, and chromas of 2 to 4. If mottles occur in the lower part of the B horizon, they are distinct to prominent. The B horizon ranges from very fine sandy loam to silt loam. The reaction of the B horizon ranges from medium acid to neutral.

The C horizons have a hue of 10YR or 2.5Y in most places. Values range from 4 to 6, and chromas from 2 to 4. The mottles in the C horizons are distinct or prominent. The C horizons are very fine sandy loam or silt loam. Reaction ranges from medium acid to neutral.

Belgrade soils in this county are less acid than the defined

range for the series, but this difference does not alter their usefulness and behavior.

In most places Belgrade soils are near the somewhat poorly drained Munson and Raynham soils and the well-drained Hinesburg and Hartland soils. In places the Belgrade soils have less clay in the substratum than Munson soils. The upper part of the subsoil of the Belgrade soils is redder than that of the Raynham soils. The Belgrade soils are more silty in the upper part of the soil profile than the Hinesburg soils. Mottles occur in the lower part of the subsoil of the Belgrade soils but are lacking in the Hartland soils.

Belgrade and Eldridge soils, 0 to 3 percent slopes (BIA).—This is an undifferentiated group of Belgrade and Eldridge soils. Any given area may consist of Belgrade soils, Eldridge soils, or soils of both series. These soils occupy irregularly shaped areas 2 to 80 acres in size. Generally, 10 to 15 acres is the most common size. The profiles of these soils are the ones described as representative for their respective series.

Included with these soils in mapping are small areas of wetter soils in slight depressions. In a few places where the soils of this unit occur near the Groton and Stetson soils, gravel occurs at a depth of 4 feet or more. Also included are areas of soils that have thin layers of material in the subsoil and substratum that is coarser textured than that in corresponding layers in the Belgrade and Eldridge soils. In unvegetated areas that have been exposed to the wind, the surface layer of the Eldridge soils has been thinned by soil blowing. In a few areas mapped at lower elevations, the material underlying the sandy material is clay instead of very fine sandy loam and silt loam. The surface layer in a few areas is silt loam in the Belgrade soils and fine sandy loam or fine sand in the Eldridge soils.

This mapping unit is used mainly for hay and corn silage. A few areas are in pasture or woodlots or are idle.

Surface runoff is slow. Because this mapping unit contains more inclusions of wetter soils than undifferentiated groups of steeper Belgrade and Eldridge soils, tillage is delayed longer in spring and following heavy rains. The wetter soils in drainageways and depressions dry more slowly, and if they are tilled when wet, their finer textured surface layer is puddled and compacted. If the soils of this mapping unit have not been artificially drained, the water table is near the soil surface during the wetter part of the year and falls to a depth below 3 feet during the drier part. Because these soils have a high water table late in fall and early in spring, they are so wet that the growth of plants and operation of farm machinery are hindered. The hazard of water erosion is very slight, even in unvegetated areas where cultivated crops are grown. The Eldridge soils are subject to soil blowing when they are unvegetated or when the intertilled crop is too small to protect the soil. If Eldridge soils are overdrained, they are droughty. The Belgrade and Eldridge soils have limitations for many nonfarm uses, especially those that are affected by wetness and permeability. (Belgrade soils, capability unit IIw-3, woodland suitability group 3o1; Eldridge soils, capability unit IIw-4, woodland suitability group 4o4)

Belgrade and Eldridge soils, 3 to 8 percent slopes (BIB).—These soils occupy irregularly shaped areas that range from 2 to 35 acres in size but most commonly are 5 to 10 acres. An individual area may be all Belgrade soils, all Eldridge soils, or some of both.

Included with these soils in mapping are wetter soils in the slight depressions. Gravel is at a depth of 4 feet or more in a few places where the soils of this unit occur near the Groton and Stetson soils. Also included in mapping are soils that have thin layers of material in the subsoil and substratum that is coarser textured than that in corresponding layers described as representative. Other included areas consist of eroded Eldridge soils that have a thinner surface layer. At lower elevations in the county, a few mapped areas have clay instead of very fine sandy loam and silt loam under the sandy material. The Belgrade soils have a thinner combined surface layer and subsoil in areas that have been eroded. In a few places the surface layer is silt loam in the Belgrade soils and fine sandy loam or fine sand in the Eldridge soils.

These soils are used mainly for hay and corn silage. A few areas are in pasture or woodlots, or they are idle.

Surface runoff is medium. Since this mapping unit has fewer inclusions of wetter soils than units of more nearly level Belgrade and Eldridge soils, tillage is not delayed so long in spring and following heavy rains. Where the soils of this unit have not been artificially drained, the water table is near the soil surface during the wetter part of the year and falls to a depth below 3 feet during the drier part. Because these soils have a high water table late in fall and early in spring, they are so wet that the growth of plants and operation of farm machinery are hindered. The hazard of water erosion is slight, even in unvegetated areas where cultivated crops are grown. Soil blowing is a hazard on the Eldridge soils where the soil is not protected by a plant cover or where an intertilled crop is too small to protect the soil. Where overdrained, the Eldridge soils are droughty. The Belgrade and Eldridge soils have limitations for many nonfarm uses, especially those that are affected by wetness and slope. (Belgrade soils, capability unit IIw-3, woodland suitability group 3o1; Eldridge soils, capability unit IIw-4, woodland suitability group 4o4)

Belgrade and Eldridge soils, 8 to 15 percent slopes (BIC).—These soils have concave slopes and occupy long, narrow areas 2 to 5 acres in size. Some areas of the mapping unit are only Belgrade soils, others are only Eldridge soils, and still others are both.

Included with these soils in mapping are wetter soils in drainageways or around springs. Also included are small areas of soils that have slopes of less than 8 percent or of more than 15 percent. In a few places mapped near the Groton and Stetson soils, gravel occurs at depths of 4 feet or more. Also included are soils that have thin layers of material in the subsoil and substratum that is coarser textured than that in corresponding layers of the representative profile. The combined surface layer and subsoil are thinner in eroded included areas. At lower elevations in the county, a few areas of included soils have clay instead of the very fine sandy loam or silt loam under the sandy material. In a few areas the surface layer is a silt loam in the Belgrade soils and fine sandy loam or fine sand in the Eldridge soils.

These soils are used mainly for hay. In the less sloping areas, corn is grown for silage. A few areas are in pasture or woodlots, or they are idle.

Surface runoff is medium. The water table rises to near the surface during the wetter part of the year, but it falls to a depth below 3 feet during the drier part. Because these soils have a high water table late in fall and early in spring, they are so wet that the growth of plants and operation of farm machinery are hindered. The hazard of water erosion is moderate where these soils are being prepared for seeding to small grain or legume and grass or where cultivated crops are grown. Unvegetated areas of the Eldridge soils are susceptible to soil blowing. Overdrained areas of the Eldridge soils are droughty. The Belgrade and Eldridge soils have limitations for many non-farm uses, especially those that are affected by wetness and slope. (Belgrade soils, capability unit IIIe-4, woodland suitability group 3r2; Eldridge soils, capability unit IIIe-7, woodland suitability group 4o4)

Belgrade and Eldridge soils, 15 to 25 percent slopes (BD).—These soils occupy irregularly shaped areas or walls of gullies that are 2 to 10 acres in size. The irregularly shaped areas generally are long and narrow. Any given area may be all Belgrade soils, all Eldridge soils, or some of both.

Included with these soils in mapping are small areas of wetter soils that occur in drainageways or around springs. Also included are areas of soils that have slopes of less than 15 percent or of more than 25 percent. The included soils that have steeper slopes are better drained than the Belgrade and Eldridge soils. These soils are underlain with gravel at a depth of 4 feet or more in a few places where they occur near the Groton or Stetson soils. Also included are soils that have thin layers in the subsoil and substratum that have coarser textured material than that in corresponding layers of the representative profiles. Some areas of eroded soils that have a thinner combined surface layer and subsoil are included. At lower elevations in the county, a few areas of eroded soils that have clay instead of the very fine sandy loam or silt loam under the sandy materials are included. In a few areas the surface layer of the Belgrade soils is silt loam and that of the Eldridge soils is fine sandy loam or fine sand.

The soils of this unit are used mainly for pasture or woodland. A few areas are used for hay crops, or they are idle.

Surface runoff is rapid. The water table of these soils is temporarily high during the wetter part of the year. Because these soils are moderately steep, water ordinarily does not stand on the surface. The hazard of water erosion is severe when these soils are being prepared for seeding to small grains, legumes, or grasses. Overdrained areas of the Eldridge soils are droughty. The Eldridge soils are susceptible to soil blowing where not protected by a plant cover. The Belgrade and Eldridge soils have severe limitations for many nonfarm uses, especially those that are affected by wetness and slope. (Belgrade soils, capability unit IVe-1, woodland suitability group 3r5; Eldridge soils, capability unit IVe-6, woodland suitability group 4r5)

Blown-Out Land

Blown-out land (Bo) consists of 1- to 15-acre tracts of sandy soils that have been blown around by the wind.

These soils are mainly in the sand plains of Richmond, Essex, Colchester, and Milton. A few small areas are in most of the stream valleys of the county. The land type has no vegetation in many places. In some areas the plants are buried by dunes, and in other areas scattered plants are emerging. Broken, irregular slopes are common, but the dunes generally have smooth surfaces. Most Blown-out land was farmed but not protected from the wind. When the soil started blowing enough to inconvenience the farmer, he stopped using the land.

Blown-out areas may have many pebbles on the surface, but the dunes have fine sand. Pebbles are polished by the wind-sand action and are slippery to the touch. A developed soil profile is lacking in the active dunes or the blown-out areas. In some places a profile of an Adams, Windsor, or Agawam soil lies directly below a shifting dune.

Pine trees have been planted on some of this land and, after a slow start, are doing fairly well. Gray birch, sweet fern, and moss cover some of the old inactive blown-out areas. In a few areas Blown-out land is becoming stabilized by native grass. (Capability unit VIIIe-2; woodland suitability group not assigned)

Borrow Pits

Borrow pits (Br) consist of areas from which sand and glacial till are removed for construction material or to create areas of Fill land. The sand and glacial till are commonly used to build up the surface of the earth or to fill in depressions. Borrow pits range from less than 2 acres to 15 acres in size. They are near highways, airports, or built-up areas.

After sand or glacial till is no longer taken, plants growing in the area may revegetate naturally in Borrow pits. Sandy Borrow pits are revegetated slowly. Borrow pits can be planted to trees or other plants. The plants selected for sandy Borrow pits should be those that grow in droughty and infertile soil material that has poor tilth. The plants selected for Borrow pits in glacial till should be those that grow in acid or limy soil material that has poor tilth. Some of the borrow pit areas have had the original surface soil replaced or new topsoil spread over the surface and are now farmed. These areas may be shown on the soil map as Fill land rather than Borrow pits. (Capability unit and woodland suitability group not assigned)

Cabot Series

The Cabot series consists of deep, somewhat poorly drained and poorly drained soils that have a fragipan and are loamy throughout their profile. The fragipan begins 1 to 2 feet below the soil surface. Water moves slowly through this layer but flows readily downhill on top of it. These soils formed in glacial till that was derived from schist and limestone. They are level to moderately steep.

The Cabot soils are in the Green Mountains, the foothills of these mountains, and the western hills of Chittenden County. In the Green Mountains and their foothills, these soils are near the Peru, Marlow, and Lyman soils. In the western hills, they are near the

Peru, Marlow, and Lyman soils or the Munson, Raynham, Scantic, and Winooski soils.

Cabot soils are loamy to a depth of more than 40 inches. The surface and subsurface layers and the subsoil are easy to dig, and their material crumbles readily in the hand. The fragipan is very difficult to dig when it is dry.

A representative profile of a wooded Cabot soil has a very dark grayish-brown silt loam surface layer about 4 inches thick. The soil surface is extremely stony. The subsurface layer is grayish-brown silt loam about 3 inches thick. It has dark reddish-brown mottles. The subsoil is olive-gray silt loam about 5 inches thick. It has dark yellowish-brown mottles, is very firm in place, but is friable when removed. The substratum is olive-gray gravelly sandy loam that begins at a depth of about 12 inches. It has dark yellowish-brown mottles and is extremely firm in place.

The Cabot soils have high natural fertility. They have a medium available moisture capacity. Permeability is moderate above the fragipan but slow throughout it. Because the fragipan restricts the depth of plant roots, plants cannot use the available moisture in the fragipan. The gray colors and mottles in the subsoil are the result of intense wetness for long periods. A normally high water table keeps these soils wet from late in fall to late in spring. Because of their position, these soils receive runoff from soils above them, in addition to that received in precipitation. Water passes through the soil until it reaches the fragipan. Because its movement through this layer is impeded, the water accumulates on the surface and flows downslope. These soils are slow to warm up in the spring. Crop growth is slow unless artificial drainage is provided. The normally high water table and the fragipan restrict the depth of plant roots and artificial drainage is needed in most places for best growth of crops. The shrink-swell potential is low.

Cabot soils are used mainly for trees or are idle. A few areas are used for hay, pasture, and cultivated crops.

Representative profile of a Cabot extremely stony silt loam in a mixed forest of white pine, hemlock, white and gray birch, and sugar maple in the town of Richmond, about 0.7 mile north of Jonesville and 160 feet east of West Bolton Road:

- A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and very fine, granular structure; friable; common tree roots; 10 percent coarse fragments; slightly acid; abrupt, wavy boundary.
- A2g—4 to 7 inches, grayish-brown (2.5Y 5/2) silt loam; common, fine, prominent, dark reddish-brown (5YR 3/4) mottles; weak, fine, subangular blocky structure; friable; common tree roots; 10 percent coarse fragments; medium acid; abrupt, wavy boundary.
- B2g—7 to 12 inches, olive-gray (5Y 5/2) silt loam; common, fine, distinct, dark yellowish-brown (10YR 3/4 and 10YR 4/4) mottles; massive; very firm in place, friable when removed; few tree roots; 10 percent coarse fragments; slightly acid; abrupt, smooth boundary.
- Cx—12 to 48 inches +, olive-gray (5Y 5/2) gravelly sandy loam; common, fine, distinct mottles of dark yellowish brown (10YR 4/4); massive; extremely firm in place; 20 percent coarse fragments; neutral.

The depth to the fragipan ranges from about 12 to 24 inches. Depth to mottling ranges from about 4 to 12 inches. Content of coarse fragments ranges from less than 10 to 30 percent in the A and B horizons and from less than 10 to 35 percent in the C horizon. The coarse fragments consist mainly of pebbles, channery fragments, cobblestones, and stones of micaceous schist, quartzite, and phyllite.

The A1 horizon is 10YR to 5Y in hue, 2 or 3 in value, and 1 or 2 in chroma. The A1 and A2g horizons range from medium acid to neutral.

Matrix colors of the B horizons are 10YR to 5Y in hue, 3 to 5 in value, 1 or 2 in chroma. Mottles in the B2g horizon range from faint to prominent. This horizon is silt loam, loam, gravelly loam, or gravelly fine or very fine sandy loam. It is slightly acid to neutral.

The matrix colors of the Cx horizons have a hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 to 4. Mottles, if present, are faint to prominent. The Cx horizon is sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam, or is gravelly phases of these textures. Consistence ranges from firm to extremely firm. The Cx horizon is slightly acid or neutral.

The Cabot soils are near the Marlow, Lyman, Peru, Munson, Raynham, Scantic, and Winooski soils. Cabot soils have grayer colors in the subsoil than the Marlow and Lyman soils. Depth to bedrock is more than 40 inches in the Cabot soils, but it is only 10 to 20 inches in the Lyman soils. Cabot soils have duller colors in the subsoil than the Peru soils. Cobblestones and pebbles are throughout the Cabot soils but are lacking in the Munson, Raynham, Scantic, and Winooski soils. The Cabot soils differ from the Massena soils by having a fragipan and by having duller colors in all horizons between the surface layer and a depth of 30 inches.

Cabot stony silt loam, 0 to 3 percent slopes (CcA).—

This soil occupies slight depressions in the upland divides or concave valley slopes. Areas are 2 to 40 acres in size. Slopes range from 50 to 400 feet in length. Most of the cobblestones and stones have been removed from the soil surface and piled along the edges of fields to form stone fences or walls. Where this soil borders mapped areas of extremely stony soils, the boundary between the two is a straight stone fence or wall. This soil is mainly near the bottom of valley slopes and close to farm buildings or old farmsteads.

The profile of this soil is similar to the one described as representative for the series, but in many places the plow layer is 5 to 10 inches thick. The plow layer is a mixture of the surface and subsurface layers and part of the subsoil.

Included with this soil in mapping are areas of Peacham, Scantic, and Peru soils. Peacham and Scantic soils are in the depressions. Peru soils are on the higher mounds or the lower, elongated rises. Also included are small areas of soils that have a fragipan at a depth of less than 12 inches or more than 24 inches. Other inclusions are soils that have bedrock at a depth of less than 40 inches. In a few areas the surface layer is a loam or fine sandy loam.

This soil is used for hay and pasture in the undrained areas. Drained areas that have a high level of management are used for cultivated crops and hay and pasture. A few areas are idle or wooded.

Surface runoff is very slow. Because this soil normally has a high water table, especially late in fall and late in spring, it is so wet that crop growth and operation of farm machinery are hindered. Since this soil has more inclusions of wetter soils than steeper Cabot soils, tillage and harvesting are delayed longer. Although pebbles and cobblestones are on the soil surface, they do not prohibit

the use of farm machinery. The hazard of water erosion is very slight, even where this soil is being prepared for seeding or where cultivated crops are grown. Limitations for most nonfarm uses, especially those for which wetness is a consideration, are severe. (Capability unit IIIw-4; woodland suitability group 4w2)

Cabot stony silt loam, 3 to 15 percent slopes (CaC).—This soil occupies irregularly shaped depressions or concave valley slopes. An intermittent stream flows through many of the long, narrow areas. The mapped areas are 2 to 100 acres in size. Slopes range from 50 to 400 feet in length. The cobblestones and stones that have been removed from the soil surface have been piled along the edge of fields to form stone fences or walls. Where this soil borders mapped areas of extremely stony soils, the boundary between the two is a straight stone fence or wall. Most areas of this soil are near farmsteads or former farmsteads in the hill areas of the county or in valleys in the Green Mountains.

The profile of this soil is similar to that described as representative for the series, but in most places it has a plow layer 5 to 10 inches thick. This plow layer is a mixture of the surface and subsurface layers and the upper part of the subsoil.

Included with this soil in mapping are areas of Peacham, Peru, and Marlow soils. The less sloping areas have a higher proportion of Peacham soils than the steeper areas. Inclusions of Peru and Marlow soils are of higher proportion in the steeper areas than in the less sloping areas. A few included areas have slopes of more than 15 percent. Also included in mapping are soils that have a fragipan at a depth of less than 12 inches or of more than 24 inches. Other inclusions are of soils that have bedrock at a depth less than 40 inches. In a few areas the surface layer is loam or fine sandy loam.

This soil is used for hay and pasture in undrained areas. Cultivated crops and hay and pasture plants are grown in drained areas where the level of management is high. A few areas are idle or wooded.

Surface runoff is slow to medium. Because the water table is high, especially late in fall to late in spring, this soil is so wet that growth of plants and operation of farm machinery are hindered. Since this soil has fewer inclusions of wetter soils than less sloping Cabot soils, tillage and harvesting of crops are not delayed so long. The fragipan is slowly permeable, and absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off the soil surface. The water erosion hazard is slight to moderate where this soil is being prepared for seeding or where cultivated crops are grown. Although pebbles, cobblestones, and a few stones are on the soil surface, they do not prohibit the operation of farm machinery. This soil has severe limitations for many nonfarm uses, especially those for which steepness and wetness are considerations. (Capability unit IIIe-6; woodland suitability group 4w2)

Cabot extremely stony silt loam, 0 to 3 percent slopes (CbA).—This soil occupies irregularly shaped depressions in the upland divides or concave valley slopes. Areas are 2 to 200 acres in size, and slopes are 50 to 400 feet in

length. Where this soil borders mapped areas of stone-cleared soils, the boundary separating the two soils is a straight stone fence or wall. The small hummocks made by cattle trampling the soft ground between stones reduces surface runoff (fig. 6).

Included with this soil in mapping are areas of the Peacham and Peru soils. Peacham soils are in depressions or natural drainageways or near springs. The less sloping areas mapped as this Cabot soil have a higher proportion of Peacham soils included than the steeper areas. The Peru soils are on the higher mounds or lower elongated rises. A few areas of this Cabot soil contain inclusions of soils that have no stones on the soil surface. Also included are small areas of soils that have a fragipan beginning at a depth of less than 12 inches or of more than 24 inches. Also included are soils that have bedrock at a depth of less than 40 inches. In a few areas the surface layer is loam or fine sandy loam.

This soil is used mainly for unimproved pasture and as woodland. A few areas are idle. Numerous small ponds have been constructed in this soil because it has a slowly permeable substratum.

Because this soil normally has a high water table, especially late in fall to late in spring, it is so wet that growth of plants is hindered. Since the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water.

Surface runoff of water is very slow. This soil is too stony to be used for cultivated crops. Loose stones prohibit the use of ordinary tillage machinery and mechanical equipment for harvesting hay. This soil has severe limitations for many nonfarm uses, especially those for which wetness and stoniness are considerations. (Capability unit VIIs-2; woodland suitability group 4x1)

Cabot extremely stony silt loam, 3 to 25 percent slopes (CbD).—This soil occupies irregularly shaped depressions in the upland divides or in concave valley slopes. Areas are 2 to 200 acres in size. Slopes are 50 to 600 feet long. Where this soil borders areas of stone-cleared soils, the boundary separating the two is a straight stone fence or wall. Surface runoff is reduced by small hummocks caused by cattle trampling the soft ground between stones and mounds that are the result of tree windthrow. The profile of this soil is the one described as representative for the Cabot series.

Included with this soil in mapping are small areas of the Peacham and Peru soils. Peacham soils are in depressions or natural draws or near springs. Peru soils are on the higher mounds or the lower elongated rises. The more sloping areas mapped as this Cabot soil have a lower proportion of Peacham soils and a higher proportion of Peru soils included than the areas that have more nearly level slopes. A few areas of this soil contain inclusions of soils that are less stony or more stony and inclusions that are less sloping or more sloping. Also included in mapping are small areas of soils that have a fragipan beginning at a depth less than 12 inches or of more than 24 inches. Also included are soils that have bedrock beginning at a depth of less than 40 inches. In a few areas the surface layer is loam or fine sandy loam.

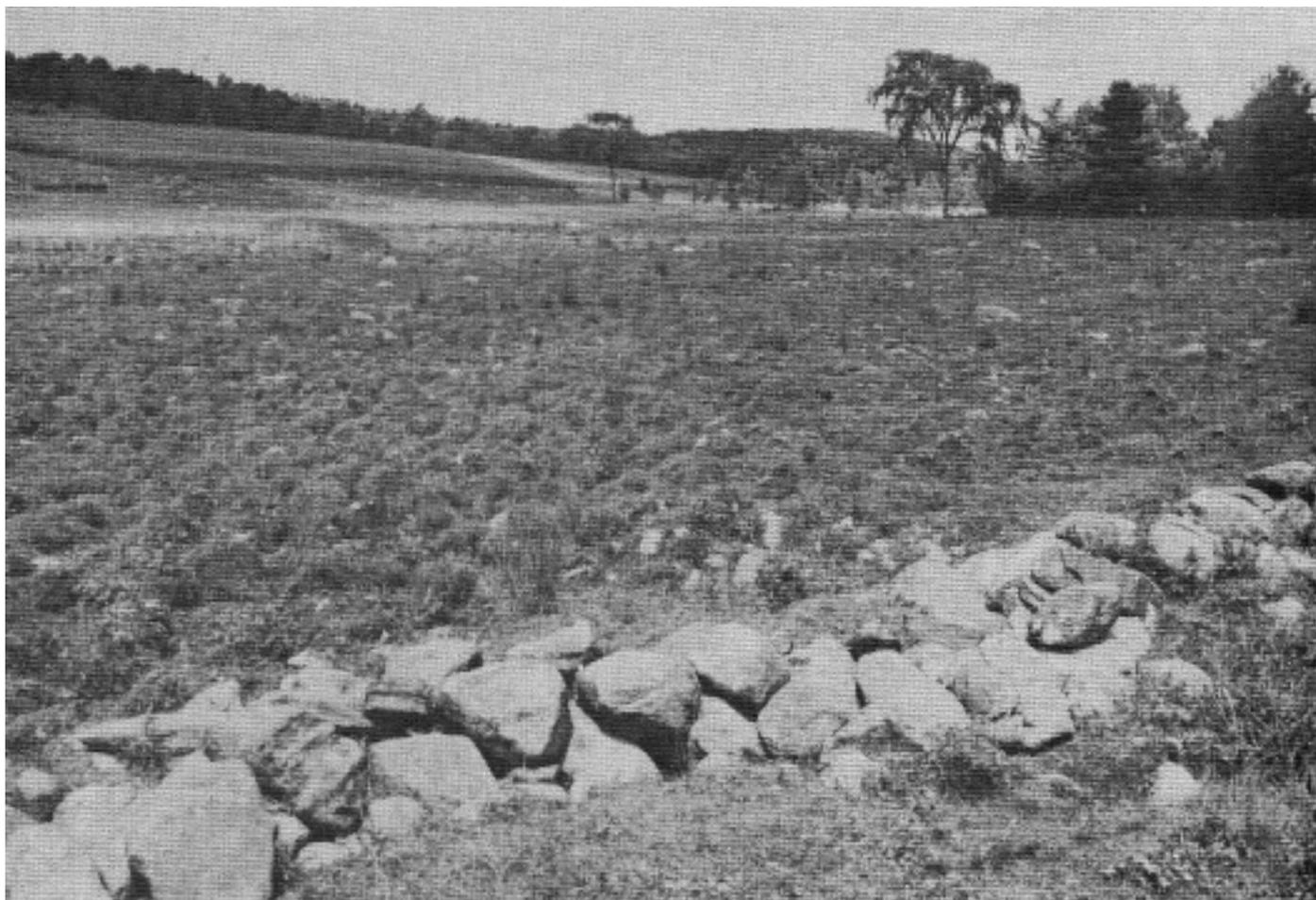


Figure 6.—An area of Cabot extremely stony silt loam, 0 to 3 percent slopes.

This soil is used mainly as woodland and for pasture. A few areas are idle.

Because this soil normally has a high water table, especially late in fall to late in spring, it is so wet that growth of plants is hindered. Since the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water.

Surface runoff of water is slow to medium. This soil is too stony to be used for cultivated crops. Loose stones prohibit the use of ordinary tillage machinery and mechanical equipment for harvesting hay. This soil has severe limitations for most nonfarm uses, especially those for which wetness, stoniness, and steepness of slope are considerations. (Capability unit VIIIs-2; woodland suitability group 4x1)

Colton Series

Soils of the Colton series are deep, very friable or loose, excessively drained, and nearly level to steep. They are gravelly throughout the profile. These soils formed in material weathered from water-deposited sand, gravel, and cobbles in layers that are more than 40 inches

thick. The deposits of sand and gravel have a high content of quartz, schist, and phyllite. In most places these soils are underlain by stratified sand, pebbles, and cobbles, but in a few areas they are underlain by bedrock, glacial till, or silt.

The Colton soils are mainly in the valleys of hills in the western part of the county and along the western edge of the Green Mountains. A few areas of these soils are on high terraces near the mouth of the Winooski and Lamoille Rivers.

A representative profile of an unplowed Colton soil, below a surface mat of twigs and leaves, has a dark-brown gravelly loamy sand surface layer 4 inches thick. The subsoil is brown in the upper part and dark yellowish brown in the lower part. It is very friable gravelly loamy sand and about 23 inches thick. The substratum is loose, olive-brown gravelly coarse sand to a depth of more than 40 inches.

The bright colors and lack of mottles in the Colton soils indicate that they are well aerated and porous. The Colton soils are very rapidly permeable. They have a low available moisture capacity and very low natural fertility. These soils are filled to capacity with available moisture at the start of the growing season. As the growing season progresses, rain normally is not adequate to

replenish the soil moisture used by plants. Crops, therefore, show signs of lack of moisture during the growing season.

These soils warm faster in the spring than the more silty, more clayey, or wetter soils in the county. They are easily tilled and can be cultivated throughout a wide range of moisture content without puddling or crusting or becoming cloddy. The Colton soils can be worked earlier in the spring and sooner after rains than most soils in the county. They are susceptible to soil blowing where not vegetated. Shrink-swell potential is low.

Colton soils are used mainly for cultivated crops, hay, pasture, and trees. These soils also are used for residential and commercial developments and as sources of sand and gravel for roads and other construction.

In Chittenden County, Colton soils that have slopes of 20 percent or more were not mapped separately. They were mapped with Stetson soils in undifferentiated groups. The Stetson soils are described under the Stetson series.

Representative profile of a Colton gravelly loamy sand in the edge of a gravel pit about 1000 feet west of West Milton on north side of West Milton Road:

- O1—2½ to 2 inches, a thin layer of undecomposed leaves and twigs.
- O2—2 inches to 0, black (5YR 2/1), partly decomposed leaves and twigs; strong, fine, granular structure; very friable; many roots; strongly acid; abrupt, smooth boundary.
- A1—0 to 4 inches, dark-brown (10YR 4/3) gravelly loamy sand; weak, fine, granular structure; very friable; many roots; 40 percent gravel; strongly acid; abrupt, wavy boundary.
- B21ir—4 to 9 inches, brown (7.5YR 4/4) gravelly loamy sand; weak, fine, subangular blocky structure; very friable; many roots; 40 percent gravel; medium acid; clear, wavy boundary.
- B22ir—9 to 27 inches, dark yellowish-brown (10YR 4/4) gravelly loamy sand; weak, medium, subangular blocky structure; very friable; common roots; 40 percent gravel; medium acid; abrupt, wavy boundary.
- IIC—27 to 40 inches +, olive-brown (2.5Y 4/4) gravelly coarse sand; single grain; loose; few roots in upper part, none below; 35 percent gravel; slightly acid.

The solum ranges from 18 to 30 inches in thickness. A few profiles have stones and cobblestones in all horizons. Generally, the stones and cobblestones are more plentiful in the C horizon and lower part of the B horizon.

In the A1 and Ap horizons, colors have a hue of 10YR, value of 2 to 4, and chroma of 2 or 3. The A2 horizon, where present, has a hue of 10YR, value of 5 or 6, and chroma of 1 or 2. The A horizon ranges from strongly acid to extremely acid in areas never farmed. In farmed areas the A horizon ranges from very strongly acid to neutral.

The B21ir horizon has a hue of 5YR or 7.5YR, a value of 4 or 5, and a chroma of 4 to 8. Where a Bh horizon is present, it is black (5YR 2/1) or dark brown (7.5YR 3/2). The B22ir horizon has a hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The B horizon ranges from very strongly acid to medium acid.

The C horizon is 2.5Y or 10YR in hue, 4 or 5 in value, and 4 to 6 in chroma. It is very gravelly fine sand, very gravelly sand, gravelly coarse sand, or very gravelly coarse sand. The C horizon ranges from strongly acid to slightly acid.

The Colton soils in this county are less acid than defined for the series, but this difference does not alter their usefulness or behavior.

Colton soils formed in materials somewhat similar to those of the Stetson, Adams, Windsor, and Groton soils. Colton soils have more sand and less silt in the upper part of the soil profile than Stetson soils. The stones, cobblestones, and

pebbles in Colton soils are lacking in the Adams and Windsor soils. Colton soils are not calcareous within 40 inches of the soil surface as are the Groton soils.

Colton gravelly loamy sand, 0 to 5 percent slopes (CoA).—This soil occupies irregularly shaped areas on terraces. These areas are 2 to 20 acres in size. Slopes are 50 to 300 feet long.

The profile of this soil is the one described as representative for the Colton series. In farmed areas this soil has a very dark grayish-brown plow layer 5 to 12 inches thick.

Included with this soil in mapping are Duane soils in depressions and the Adams, Agawam, Windsor, and Stetson soils in level areas or on low ridges. Also included are steep soils on short slopes of terrace breaks. Other included soils are less brown in the subsoil than this soil. In a few areas the surface layer is loamy sand, sand, sandy loam, gravelly sand, or gravelly sandy loam.

This soil is used mainly for cultivated crops, hay, and pasture. Pine plantations, cemeteries, and housing developments occupy small areas, and gravel pits are numerous.

Surface runoff generally is slow, and the hazard of water erosion is slight except on terrace breaks. Gullies form where the terrace edges are cultivated. Trees and pasture plants that resist drought are better suited to this soil than row crops. Drought-resistant forage plants are better suited than other kinds of plants. Soil blowing is a hazard if this soil is not vegetated. This soil has few limitations for many nonfarm uses. (Capability unit IIIs-1; woodland suitability group 4s1)

Colton gravelly loamy sand, 5 to 12 percent slopes (CoB).—This soil occupies sloping terraces, rolling hills, or knolls. It occurs in irregularly shaped areas 2 to 20 acres in size. Slopes are between 50 and 300 feet in length.

The profile of this soil is similar to that described as representative for the series, but in many places it has a plow layer about 5 to 10 inches thick. The plow layer normally is a very dark grayish brown. This layer is a mixture of the surface and subsurface layers, the upper part of the subsoil, and additions of manure and crop residues.

Included with this soil in mapping are small areas of the Stetson, Agawam, Adams and Windsor, and Duane soils. Duane soils are in depressions, and other soils are in convex areas. Also included are small areas of soils that are less brown in the subsoil than is typical for this soil. In a few areas the surface layer is loamy sand, sand, sandy loam, gravelly sand, or gravelly sandy loam.

Cultivated crops, hay, and pasture are the principal uses of this soil. A small acreage where this soil is less sloping is used for cemeteries or buildings. A few areas are woodland, are idle, or have been planted to trees. Gravel pits are numerous.

Surface runoff is medium, and the erosion hazard is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Trees and pasture plants that resist drought are better suited to this soil than row crops. Drought-resistant forage plants are better suited than other kinds of plants. Soil blowing is

a hazard in unvegetated areas. This soil has limitations for many nonfarm uses, especially those for which steepness is a consideration. (Capability unit IVs-1; woodland suitability group 4s1)

Colton gravelly loamy sand, 12 to 20 percent slopes (CoC).—This soil occupies irregularly shaped areas 2 to 30 acres in size. Slopes are between 50 and 300 feet long. This soil is on hillsides, ridges, terraces, or terrace edges. The larger areas are in Jericho and Bolton; smaller areas are in most of the stream valleys of the county outside of the Champlain Valley.

The profile of the soil is similar to that described as representative for the series, except that the upper part of the subsoil is less brown.

Included with this soil in mapping are areas of the Duane soils that are mainly small wet spots near drainageways or springs. Also included are small areas of Agawam, Stetson, and Adams and Windsor soils. In a few areas the surface layer is loamy sand, sand, sandy loam, gravelly sand, or gravelly sandy loam.

Hay and pasture are the main uses for this soil. Many acres are woodland or are idle. A few of the less sloping areas are used for cemeteries or buildings. Gravel pits are numerous.

Surface runoff is medium, but the erosion hazard is severe where this soil is being prepared for seeding or where cultivated crops are grown. Trees and pasture plants that resist drought are better suited to this soil than row crops. Drought-resistant forage plants are better suited than other kinds of plants. Soil blowing is a hazard where this soil is unvegetated. This soil has severe limitations for many nonfarm uses, especially those uses for which steepness is a consideration. (Capability unit VI s-1; woodland suitability group 4s2)

Colton and Stetson soils, 20 to 30 percent slopes (CsD).—This is an undifferentiated group of Colton and Stetson soils. Any given area may consist of Colton soils, Stetson soils, or both. These soils occupy irregularly shaped areas 2 to 10 acres in size. Slopes are mainly 50 to 300 feet long. These soils are on knolls, hills, or terrace edges.

Included with these soils in mapping are areas of wetter soils that are mainly small wet spots near springs. Also included are areas of Agawam, Adams, Marlow, and Windsor soils. The Agawam, Adams, and Windsor soils are mainly terrace edges. The Marlow soils are in small areas where the glacial till and glacial outwash adjoin. In some of the areas, water erosion has cut deep gullies or stripped away the original surface layer. Other inclusions are of soils that have a less brown subsoil than is typical. Stony or very stony areas occur where the glacial till and the glacial outwash adjoin. In a few areas, the Colton soils have a loamy sand, sandy loam, sand, gravelly sandy loam, or gravelly sand surface layer. Also in a few areas, the Stetson soils have a sandy loam, loam, gravelly sandy loam, or gravelly loam surface layer.

Most areas of the soils in this mapping unit are used for woodland and pasture. Gravel pits are common.

Surface runoff is rapid, and the erosion hazard is severe in areas not vegetated. The steep slopes limit the use of modern farm machinery. Droughtiness is a limitation to farm use. These soils have severe limitations for

most nonfarm uses, especially those for which steepness is a consideration. (Colton soils in capability unit VII s-2 and woodland suitability group 4s2; Stetson soils capability unit VI e-1 and woodland suitability group 4r1)

Colton and Stetson soils, 30 to 60 percent slopes (CsE).—Any given area of this mapping unit consists of Colton soils, Stetson soils, or some of both. These soils occupy irregularly shaped areas 2 to 50 acres in size. They occur on terrace edges, knolls, or hills. Slopes are mainly 50 to 300 feet long.

Included with these soils in mapping are small areas of Adams, Windsor, and Marlow soils. The Adams and Windsor soils are mainly on terrace edges, and the Marlow soils are on valley slopes and hills. In some areas water erosion has cut deep gullies or stripped away the surface layer. Also in some areas, soils are included that have a subsoil less brown than is typical. In some areas included soils are stony or very stony where the glacial till and glacial outwash adjoin. In a few areas the surface layer in the Colton soils is loamy sand, sand, gravelly sand, or gravelly sandy loam. In a few areas of Stetson soils, the surface layer is sandy loam, loam, gravelly sandy loam, or gravelly loam.

These soils are used mainly for trees. A few areas are idle or in unimproved pasture. Gravel pits are common.

Surface runoff of water is rapid, and these soils tend to be droughty. Steep slopes make the use of modern farm machinery hazardous. The erosion hazard is very severe in unvegetated areas. These soils have severe limitations for nonfarm uses, especially those uses for which steepness is a consideration. (Colton soils capability unit VII s-2, woodland suitability group 4s3; Stetson soils capability unit VII e-2, woodland suitability group 4r2)

Covington Series

The Covington series consists of deep, poorly drained soils that are clayey throughout their profile. These soils are level or gently sloping. They formed in water-laid deposits of clay that is high in lime content. In Chittenden County the Covington soils occur throughout the Champlain Valley. The largest areas are in the town of Charlotte. Most areas have been cultivated.

A representative profile of a cultivated Covington soil has a very dark brown silty clay plow layer about 8 inches thick. The surface layer is hard and cloddy when dry and sticky when wet. The subsoil is very dark grayish-brown or gray clay that is mottled with yellowish brown. It is about 20 inches thick. This layer is very sticky and plastic when wet and hard when dry. It breaks into large chunks where dug. Under the subsoil is dark grayish-brown clay that is mottled with strong brown and is high in lime content. This layer is very sticky and plastic when wet and very hard when dry.

Covington soils have a moderately high available moisture capacity. Their natural fertility is very high. A normally high water table keeps these soils wet from early in fall to late in spring. The mottles indicate that these soils have a fluctuating water table. The water table is less than 12 inches below the soil surface during the wettest part of the year and is below 24 inches during the driest part. The very slowly permeable clay restricts

internal drainage, and surface water drains slowly from the more nearly level areas. In these areas, water ponds on the surface for short periods during the wetter part of the year and following heavy rains. Crops in the ponded areas are subject to drowning. The normally high water table restricts rooting depth. Farm machinery is easily bogged down in these soils when they are wet. Unless the water table is lowered, weed control is difficult and spraying and harvesting are hampered. The soils puddle and are compacted if worked when wet, and crust and clod when they dry. The dry clods are very hard and difficult to crush.

These soils are slow to warm in spring. The surface layer dries out almost every growing season, but the subsoil usually remains moist during the growing season. In addition to the water received in precipitation, these soils receive runoff from adjacent soils at higher elevations. Because of the high clay content, these soils swell when they are wetted and crack when they dry. Their shrink-swell potential is moderate or high.

The Covington soils are used mainly for hay and pasture. Corn is grown for silage in a few areas. Some areas are woodland or are idle. Birdsfoot trefoil is well adapted to these soils.

Representative profile of Covington silty clay in a cultivated field in town of Charlotte, three-fourths mile south of Charlotte boundary and 300 feet east of Lake Champlain:

- Ap—0 to 8 inches, very dark brown (10YR 2/2) silty clay; moderate and strong, fine and medium, granular structure; hard when dry, plastic and sticky when wet; many roots; neutral; abrupt, smooth boundary.
- B21tg—8 to 11 inches thick, very dark grayish-brown (10YR 3/2) clay, pale brown (10YR 6/3) when dry; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, granular structure; hard when dry, plastic and sticky when wet; common roots; clay films; neutral; abrupt, smooth boundary.
- B22tg—11 to 28 inches, gray (10YR 5/1) clay; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate and strong, medium and thick, platy structure; hard when dry, plastic and sticky when wet; few roots in upper part; clay films; moderately alkaline; abrupt, smooth boundary.
- Cg—28 to 78 inches, dark grayish-brown (10YR 4/2) clay that has horizontal silt flows of light gray (10YR 7/1); many, medium, prominent, strong-brown (7.5YR 5/6) mottles; moderate to strong; very thick, platy structure; very hard when dry, very plastic and very sticky when wet; no roots; moderately alkaline; violently effervescent if cold dilute hydrochloric acid is added.

The depth to calcareous soil material is 20 to 50 inches. The solum ranges from 20 to 30 inches in thickness.

The A horizon has a hue of 10YR, a value of 2 or 3, chroma of 1 or 2. Reaction ranges from medium acid to neutral.

The matrix of the B horizons has hues of 10YR to 5Y, values of 3 to 5, and a chroma of 1 or 2. Reaction ranges from medium acid to moderately alkaline.

The matrix of the C horizon is similar to that of the B horizons. Reaction ranges from neutral to moderately alkaline.

The Covington soils are near the Livingston and Vergennes soils. The Covington soils are better drained than the Livingston soils and have a lighter colored surface layer that contains less organic matter. They have a darker colored surface layer and are wetter than the Vergennes soils. The Covington soils are similar to the Scantic soils but have a darker surface layer and more clay throughout the profile.

Covington silty clay (Cv).—This soil has slopes of 0 to 2 percent. It occupies irregularly shaped areas that are 2 to 200 acres in size. It is adjacent to a steeper, moderately well drained Vergennes soil in many places.

Included with this Covington soil in mapping are small areas of Livingston soils that are mainly in the depressions and natural drainageways. Also included are areas that have slopes of more than 6 percent. Cobblestones and stones are on the surface of a few mapped areas near soils formed on glacial till. In a few included areas the surface layer is less than 6 inches thick and is thinner and lighter colored than the surface layer described as typical for the series. Also included are areas that have a silty clay loam, clay loam, or clay surface layer. A few included areas have thin layers of silt and silt loam in the lower part of the profile.

This soil is used mainly for hay and pasture. Corn is grown for silage in a few areas, and some areas are woodland or are idle. Birdsfoot trefoil is well adapted to this soil.

Surface runoff is very slow or slow. The hazard of water erosion is very slight in the more nearly level areas and slight in the steeper areas when this soil is being prepared for seeding or when cultivated crops are grown. Because the more nearly level areas have more inclusions of wetter soils than the steeper areas of this soil, tillage is delayed longer in the spring and following rains that are heavier than normal. The soils in drainageways and depressions dry more slowly, and their surface layer becomes cloddy if they are tilled when wet. Land grading is necessary for best use of this soil. This soil has severe limitations for many nonfarm uses, especially those that are affected by wetness. (Capability unit IVw-3; woodland suitability group 5w1)

Deerfield Series

The Deerfield series consists of deep, friable to loose, moderately well drained soils that are nearly level to steep. These soils formed on sandy deltas, beaches, and stream terraces. The sand is high in content of quartz and schist. The Deerfield soils are mainly on the large sand plains near the Winooski and Lamoille Rivers. In some small areas these soils are in smaller stream valleys and near the shore of Lake Champlain. They developed predominantly in sands and loamy sands more than 4 feet thick. The sands and loamy sands in most places are stratified below the subsoil. In a few places gravel, clay, glacial till, silt, or bedrock may occur below a depth of 4 feet.

In a representative profile the surface layer in a cultivated area is very dark grayish-brown fine sandy loam about 6 inches thick. The subsoil is dark yellowish-brown to light olive-brown loamy sand and sand about 24 inches thick. The lower part of the subsoil has distinct, yellowish-brown mottles. The substratum is light olive-brown, loose sand and fine sand that are mottled with dark red in the upper part.

The Deerfield soils are porous, and air and water move through them readily. They have a seasonal high water table. The available moisture capacity is moderately low, and natural fertility is very low. Permeability is rapid. These soils have only a few mottles in the

upper part, but mottles increase in number and intensity with depth. This pattern of mottling indicates that the upper part of these soils is not frequently wet, but the lower part is saturated for significant periods. Late in fall to early in spring, water stands less than 2 feet below the soil surface. It recedes to a depth of 2 feet or more during the drier periods of the year. Because of the moderately low available moisture capacity, lack of moisture slows the growth of plants during midsummer. During dry summers, drought seriously affects crop growth.

Because of their position, these soils receive water from other adjacent soils at higher elevations in addition to that received in precipitation. Many areas of these soils are farmed, but in spring farming operations are delayed because of wetness. Artificial drainage is needed for good crop growth. These soils warm slowly in the spring. They are easily tilled and can be cultivated throughout a wide range of moisture content without clodding or crusting. Shrink-swell potential is low.

Deerfield soils are used mainly for corn, hay, pasture, and trees. In a few areas near Burlington and Malletts Bay, truck crops are grown.

The Deerfield soils were not mapped separately in Chittenden County, but were mapped with Duane soils in undifferentiated groups. The Duane soils are described under the Duane series. An individual area of any group may consist only of Deerfield soils, only of Duane soils, or some of both. The undifferentiated groups containing Deerfield soils are described under the Duane series.

Representative profile of a Deerfield fine sandy loam in a hayfield, at the edge of cellar hole, one-half mile southeast of the crossroads in Essex Center:

- Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, fine, granular structure; friable; many grass roots; less than 5 percent gravel; strongly acid; abrupt, smooth boundary.
- B21r—6 to 10 inches, dark yellowish-brown (10YR 4/4) loamy sand; single grain; loose; few grass roots; less than 5 percent gravel; medium acid; abrupt, smooth boundary.
- B22r—10 to 22 inches, light olive-brown (2.5Y 5/4) loamy sand; massive; friable; few grass roots; less than 5 percent gravel; medium acid; abrupt, smooth boundary.
- IIB23—22 to 30 inches, light olive-brown (2.5Y 5/4) sand; many, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; few grass roots; 5 percent gravel; medium acid; clear, smooth boundary.
- IIC1—30 to 39 inches, light olive-brown (2.5Y 5/4) sand; common, fine, prominent, dark red (2.5YR 3/6) mottles; single grain; loose; few grass roots; less than 5 percent gravel; slightly acid; abrupt, smooth boundary.
- IIC2—39 to 43 inches +, light olive-brown (2.5Y 5/4) fine sand; weak, thick, platy structure; friable; less than 5 percent gravel; medium acid.

The solum ranges from about 15 to 30 inches in thickness. Mottling occurs at a depth of 12 to 24 inches. Above a 30-inch depth, coarse fragments make up less than 5 percent, by volume, but in some places below this depth, the volume of coarse fragments is as much as 35 percent.

The Ap horizon has a hue of 10YR or 2.5Y, value of 3, and chroma of 2 or 3. The B horizons have a hue of 7.5YR, 10YR, and 2.5Y, value of 3 to 5, and chroma of 3 or 4. Mottles are distinct or prominent. The B horizons are loamy sand, loamy fine sand, fine sand, and sand.

The C horizons have a hue of 2.5Y and 5Y, value of 4 or 5,

and chroma of 2 to 4. These horizons are loamy fine sand, loamy sand, sand, or fine sand. Their texture below a depth of 30 inches is gravelly sand or gravelly coarse sand in some places. In most places C horizons are less than 35 percent gravel.

The Deerfield soils have level or gently sloping, concave slopes where they are adjacent to the Windsor, Adams, Agawam, Colton, Groton, Stetson, or Au Gres soils. They are gently sloping to moderately steep where they are lower than and adjacent to the Lyman-Marlow, Farmington-Stockbridge, Marlow, Stockbridge and Nellis, or the Cabot soils.

Deerfield soils in this county are slightly less acid than defined for the series, but this difference does not alter their usefulness or behavior.

Deerfield soils have less gravel from 10 to 40 inches below the soil surface than the Colton, Duane, Groton, and Stetson soils. They are sandier in the lower part of the subsoil than Agawam soils and are wetter than Adams and Windsor soils. The Deerfield soils are better drained than Au Gres soils and are sandier than the Farmington, Lyman, Marlow, Nellis, Stockbridge, or Cabot soils.

Duane Series

Soils of the Duane series are deep, very friable or loose, rapidly permeable, moderately well drained, and sandy throughout their profile. These soils formed in water-deposited sand high in content of quartz, schist, and phyllite. They are nearly level to moderately steep. The Duane soils are located mainly in the hilly parts of the county between the Champlain Valley and the Green Mountains. A few small areas of Duane soils are in valleys of the Green Mountains.

These soils developed in stratified sandy and gravelly materials that are thicker than 40 inches. In a few places cobblestones and stones occur. Duane soils are easy to dig where they are free of cobblestones and stones.

The surface layer of a representative profile in an unplowed pasture is black fine sandy loam about 4 inches thick. The upper 3 inches of the subsoil is very friable, brown gravelly fine sandy loam. It overlies about 4 inches of dark yellowish-brown gravelly loamy fine sand. The lower part of the subsoil is olive-brown gravelly loamy sand, about 4 inches thick, that is mottled with brown. The substratum is olive very gravelly sand to a depth of more than 48 inches, and it is mottled with brown.

The Duane soils are porous, and air and water move freely in them above the seasonal high water table. They have a low available moisture capacity and very low natural fertility. Permeability is rapid. These soils have only a few mottles in the upper part, but mottles increase in number and intensity with depth. This pattern of mottling indicates that the upper part is not frequently wet but that the lower part is saturated for significant periods. Late in fall to early in spring, the water table is less than 2 feet below the soil surface. It recedes to a depth of 2 feet or more during dry periods. Because of the low available moisture capacity, lack of moisture slows the growth of plants during midsummer. During dry summers this lack of moisture seriously affects crop growth. Because of their position, these soils receive water from higher adjacent soils in addition to that received in precipitation. Many areas are farmed, but in spring farming operations are delayed because of wetness. Artificial drainage is needed for good crop

growth. These soils are slow to warm in the spring. They are easily tilled and can be cultivated throughout a wide range of moisture content without clodding or crusting. Shrink-swell potential is low.

Duane soils are used mainly for hay, pasture, or trees. Some abandoned fields are covered by gray birch, brush, or white pine. In some places these soils are drained and used for building sites. The soils are a good source of gravel, but at times a high water table interferes with its removal.

In Chittenden County the Duane soils were not mapped separately but were mapped with the Deerfield soils in undifferentiated groups. A representative profile of the Deerfield soils is described under the Deerfield series.

Representative profile of a Duane fine sandy loam in a pasture in the town of Richmond, about 1.5 miles north-northwest of Jonesville, Vermont:

- A1—0 to 4 inches, black (10YR 2/1) fine sandy loam; weak, very fine, granular structure; very friable; many roots; very strongly acid; abrupt, smooth boundary.
- B21ir—4 to 7 inches, brown (7.5YR 4/4) gravelly fine sandy loam; weak, very fine, granular structure; very friable; many roots; 15 percent coarse fragments; strongly acid; abrupt, wavy boundary.
- B22ir—7 to 11 inches, dark yellowish-brown (10YR 4/4) gravelly loamy fine sand; weak, very fine, granular structure; very friable; common roots; 15 percent coarse fragments; strongly acid; abrupt, wavy boundary.
- IIB23—11 to 15 inches, olive-brown (2.5Y 4/4) gravelly loamy sand; many, fine, distinct, brown (7.5YR 4/4) mottles; weak, very fine, granular structure; very friable; common roots; 30 percent coarse fragments; medium acid; abrupt, smooth boundary.
- IIIC—15 to 48 inches, olive (5Y 4/4) very gravelly sand; many, fine, distinct, brown (7.5YR 4/4) mottles; single grain; loose; roots common in upper part but decrease with depth to none in the lower part; 50 percent coarse fragments; medium acid in upper part and slightly acid in lower part.

The solum ranges from about 15 to 30 inches in thickness. Mottling occurs at a depth of 12 to 20 inches. Between depths of 10 to 40 inches, the gravel content averages more than 35 percent, by volume, but in the upper horizons, there is 0 to 35 percent gravel. Cobblestones and stones may be present in all soil horizons.

The A1 horizon and the Ap horizon, where present, have a hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 1 to 3. An A2 horizon, where present, is gray (10YR 5/1). The A horizons are strongly acid to extremely acid where these soils have not been limed.

The B horizons are 7.5YR to 2.5Y in hue, 3 to 5 in value, and 2 to 4 in chroma. In some places the lower B horizons have manganese patches and few to many, distinct or prominent mottles. Above a depth of 10 inches, the B horizon is similar to the A horizon in texture. Below this depth the texture is loamy fine sand, loamy sand, fine sand, or sand, or gravelly or very gravelly phases of these textures. The B horizon ranges from strongly acid to slightly acid.

These soils are less acid and thinner in the solum than the defined range for the series, but these differences do not alter their usefulness and behavior.

The C horizons are 2.5Y or 5Y in hue, 4 to 6 in value, and 1 to 4 in chroma. These horizons have faint to prominent mottles. They are sand, fine sand, coarse sand, very coarse sand, or gravelly or very gravelly sand, fine sand, or coarse sand. The C horizons range from medium acid to slightly acid.

Where they are adjacent to the Adams, Agawam, Colton, Groton, Stetson, Windsor or Au Gres soils, Duane soils have level, gently sloping or concave slopes. They are gently sloping to moderately steep where they are lower and adjacent

to the Lyman-Marlow, Farmington-Stockbridge, Marlow, Stockbridge and Nellis, or Cabot soils. Duane soils have more gravel at a depth of 10 to 40 inches than have the Adams, Windsor, and Au Gres soils and are sandier in the lower part of the subsoil than are the Agawam soils. The lower part of the profile of Duane soils is more acid than that of Groton soils. Duane soils are wetter than the Adams, Agawam, Colton, Groton, Stetson, and Windsor soils and are better drained than the Au Gres soils. The Duane soils have more sand in their profile than the Farmington, Lyman, Marlow, Nellis, Stockbridge, or Cabot soils. Duane soils have more than 35 percent coarse fragments, by volume, at a depth of 10 to 40 inches below the soil surface and the Deerfield soils have less than 35 percent.

Duane and Deerfield soils, 0 to 5 percent slopes (DcA).—This is an undifferentiated group of Duane and Deerfield soils. Any given area may consist of Duane soils, Deerfield soils, or soils of both series. These soils occupy irregularly shaped depressions and are in areas 2 to 30 acres in size. Slopes are between 50 and 300 feet long. The Duane soils make up more of the mapping unit at higher altitudes, and Deerfield soils are more extensive at lower altitudes.

A profile of the Deerfield soils is the one described as representative for the Deerfield series. The Duane soils have a profile similar to that described as representative of the Duane series.

Included with these soils in mapping are small areas of the Au Gres soils in low spots and drains. Also included are soils that have thin layers of finer textured material in the subsoil and substratum and soils that are calcareous in the substratum. Some areas contain inclusions of soils that are less than 35 percent gravel at a depth of 10 to 40 inches, and their subsoil has the same color as that of the Duane soils. Other inclusions are soils that have more than 35 percent gravel at a depth of 10 to 40 inches, but the color of their subsoil is the same as that of the Deerfield soils. In a few areas the surface layer is a loamy sand, loamy fine sand, sand, fine sand, gravelly loamy sand, gravelly loamy fine sand, and gravelly sand.

These soils are used mainly for hay, pasture, and intertilled crops. Some areas are woodland or are idle.

Overdrainage of these soils results in droughtiness. Surface runoff is slow, and the hazard of erosion by water is slight. Soil blowing is a hazard where these soils are not vegetated. These soils have limitations for many nonfarm uses, especially those uses for which wetness and the texture of the surface layer are considerations. (Duane soils, capability unit IIw-4, woodland suitability group 4o3; Deerfield soils, capability unit IIIw-3, woodland suitability group 4o3)

Duane and Deerfield soils, 5 to 12 percent slopes (DdB).—An individual area of this mapping unit may be all Duane soils, all Deerfield soils, or some of both. These soils occupy irregularly shaped depressions in concave valley slopes of the sand plains. The areas are 2 to 20 acres in size, and slopes are between 50 and 300 feet in length.

The profile of the Duane soils is the one described as representative for the Duane series. The Deerfield soils have a profile similar to that described as representative for the Deerfield series.

Included with these soils in mapping are small areas of Agawam, Adams and Windsor, Colton, Stetson, or

Au Gres soils. Some areas have inclusions of soils that have thin layers of finer textured material in the subsoil and substratum and of soils that are calcareous in the substratum. Also included are soils that are less than 35 percent gravel at a depth of 10 to 40 inches and have colors in the subsoil the same as those of the Duane soils. In some included areas are soils that are more than 35 percent gravel at a depth of 10 to 40 inches, but they have the same colors in the subsoil as the Deerfield soils. In a few areas the surface layer is loamy sand, loamy fine sand, sand, fine sand, gravelly loamy sand, gravelly loamy fine sand, gravelly sand, or gravelly fine sand.

These soils are used mainly for hay, pasture, intertilled crops, and trees. Some areas are idle.

Overdrainage of these soils results in droughtiness. The erosion hazard is moderate. Soil blowing is a concern where these soils are not vegetated. These soils have limitations for many nonfarm uses, especially those uses for which wetness and surface texture are considerations. (Both soils, capability unit IIIe-7; both soils, woodland suitability group 4o3)

Duane and Deerfield soils, 12 to 20 percent slopes (DdC).—An individual area may be all Duane soils, all Deerfield soils, or some of both. These soils occupy irregularly shaped depressions in terraces and valley slopes. These areas are 2 to 10 acres in size, and slopes range from 50 to 200 feet in length.

Included with these soils in mapping are areas of the Adams, Windsor, Stetson, Au Gres, or Colton soils. Au Gres soils are mainly in small wet areas of natural drainageways or near springs. Some areas contain inclusions of soils that have slopes of more than 20 percent. Also included are soils that have thin layers of finer textured material in the subsoil and substratum and soils that are calcareous in the substratum. In some areas mapped, included soils are more than 35 percent gravel at a depth of 10 to 40 inches, and these soils have the same colors in the subsoil as the Deerfield soils. Other included soils have less than 35 percent gravel at a depth of 10 to 40 inches, but the color of the subsoil of these soils is the same as that of the Duane soils. In a few areas the surface layer is a loamy sand, loamy fine sand, sand, fine sand, gravelly loamy sand, gravelly loamy fine sand, gravelly sand, or gravelly fine sand.

Hay, trees, and pasture are the main uses of this mapping unit. A small part is idle.

Surface runoff is rapid. Overdrainage of these soils results in droughtiness. The hazard of water erosion is severe where these soils are not vegetated. Soil blowing is a concern on these soils where not vegetated. Surface water from soils lying adjacent and at higher elevations should be kept off these soils. Properly located diversion ditches keep these soils drier than they normally are late in fall and early in spring. The diversions make earlier tillage possible and retard erosion by water. The steeper slopes make the use of modern farm machinery hazardous.

These soils have severe limitations for many nonfarm uses, especially those for which steepness and wetness are considerations. (Duane soils, capability unit IVe-6, woodland suitability group 4r5; Deerfield soils, capability unit IVe-6, woodland suitability group 4r5)

Eldridge Series

The Eldridge series consists of soils that are deep, moderately well drained, and nearly level to moderately steep. These soils formed in sandy outwash underlain by medium-textured lacustrine materials at a depth of less than 40 inches. They are in the Champlain Valley in areas that start in the town of Shelburne and continue northward to the Franklin County Line.

In a plowed field, the surface layer of a representative profile is dark-brown loamy fine sand about 9 inches thick. The subsoil is about 7 inches thick and is yellowish-brown, friable loamy fine sand. Yellowish-red mottles are in the lower part of the subsoil. The substratum starts at a depth of about 16 inches. The upper 2 inches of the substratum is friable, olive very fine sandy loam. The rest of the substratum extends to a depth of 60 inches or more and is gray, friable silt loam. Many mottles are throughout the substratum.

The Eldridge soils have low natural fertility. They are rapidly permeable in the sandy layers and moderately slowly permeable in the underlying loamy material. The mottled subsoil indicates that these soils are saturated with water for extended periods. A seasonal high water table keeps them saturated from late in fall to early in spring. Many areas of these soils are farmed, but in spring farming operations usually are delayed because of wetness. Some artificial drainage is needed. These soils are slow to warm in the spring. The finer textured layers in the substratum hold a significant amount of moisture available for plants, and they also keep the sandy material above them moist. These layers give an otherwise droughty soil a higher available moisture capacity to plants. Because of the moderately low available moisture capacity of the sandy material, lack of moisture slows the growth of plants in midsummer. These soils are easily tilled and can be cultivated throughout a wide range of moisture content without clodding or crusting. Shrink-swell potential is low.

Eldridge soils are used mainly for cultivated crops, hay, and pasture. A few areas are idle or in trees.

In Chittenden County the Eldridge soils were not mapped separately but were mapped with Belgrade soils in undifferentiated groups. The undifferentiated groups are described under the Belgrade series.

Representative profile of an Eldridge loamy fine sand, about 2.55 miles south of Checkerberry Village along U.S. Highway No. 7 and then 275 feet east into a hayfield:

- Ap—0 to 9 inches, dark-brown (10YR 3/3) loamy fine sand; weak, very fine and fine, granular structure; friable; many roots; neutral; abrupt, smooth boundary.
- B21ir—9 to 12 inches, yellowish-brown (10YR 5/4) loamy fine sand; weak, fine, granular structure; friable; common roots; neutral; clear, smooth boundary.
- B22ir—12 to 16 inches, yellowish-brown (10YR 5/6) loamy fine sand; common, fine and medium, distinct, yellowish-red (5YR 5/6) mottles; weak, fine, granular structure; friable; common roots; neutral; clear, smooth boundary.
- IIC1—16 to 18 inches, olive (5Y 5/3) very fine sandy loam; common, fine and medium, distinct, strong-brown (7.5YR 5/6 and 5/8), olive-brown (2.5Y 4/4), and olive (5Y 5/6) mottles; weak, medium and thick, platy structure parting to weak, medium, granular; friable; common roots; neutral; clear, smooth boundary.

IIC2—18 to 60 inches, gray (5Y 5/1) silt loam; many, fine to coarse, prominent, dark-brown (7.5YR 4/4), yellowish-brown (10YR 5/6), dark grayish-brown (2.5Y 4/2), and olive-brown (2.5Y 4/4) mottles; weak, medium, platy structure; friable; few roots to depth of 25 inches; neutral.

The solum ranges from 12 to 28 inches in thickness. Depth to the contrasting finer textured material ranges from 16 inches to 40 inches. Coarse fragments are less than 1.0 percent, by volume.

The A horizon has a hue of 10YR, value of 3, and chroma of 2 or 3. It is medium acid to neutral.

The B horizon is 7.5YR to 2.5Y in hue, 4 or 5 in value, and 3 to 6 in chroma. It ranges from loamy fine sand to sand. It is mottled in the lower part. The B horizon ranges from medium acid to neutral.

The C horizon is 10YR to 5Y in hue, 4 or 5 in value, and 1 to 3 in chroma. It is silt loam or very fine sandy loam.

In most places the Eldridge soils occur near the Munson, Raynham, Belgrade, Deerfield, Windsor, and Hinesburg soils. Eldridge soils are more sandy in the solum than the Munson, Raynham, and Belgrade soils. They have mottling in the lower part of the subsoil and the Windsor soils do not. Eldridge soils are mottled closer to the surface than the Hinesburg soils. The C horizon of Eldridge soils is more silty or loamy than that of the Deerfield and Windsor soils.

Enosburg Series

The Enosburg series consists of soils that are deep and poorly drained. These soils formed in sandy deltas, beaches, and terraces underlain by medium-textured lacustrine materials at a depth of less than 40 inches. They are level to gently sloping. These soils are mainly in the northern half of the Champlain Valley. Areas start in the town of South Burlington and continue northward to the Franklin County line.

A representative Enosburg soil in formerly cultivated woodland has a very dark grayish-brown loamy sand surface layer about 8 inches thick. The surface layer is strongly acid. The upper part of the substratum starts at a depth of about 8 inches and continues to 32 inches below the soil surface. It is a very friable to loose, olive-gray and grayish-brown, strongly acid to slightly acid sand and coarse sand that is mottled. The lower part of the substratum extends to a depth of 60 inches. It is friable, gray, slightly acid silt that is mottled.

The Enosburg soils have low natural fertility and a moderately low available moisture capacity. Their permeability is rapid in the sandy materials and moderately slow in the silty materials. A normally high water table keeps these soils wet from early in fall to late in spring. The mottles indicate that these soils have a fluctuating water table that is less than 12 inches below the soil surface during the wettest part of the year and is below 24 inches during the driest part. The moderately slowly permeable silty layer restricts internal drainage. During the wetter part of the year, following rains with above normal precipitation, water ponds for short periods on the soil surface in the nearly level areas. Crops in the ponded areas are subject to drowning. The normally high water table restricts plant rooting depth. Tillage operations, weed control, and harvesting crops are hampered unless the water table is lowered.

These soils are slow to warm in the spring. Artificial drainage is needed for good crop growth. The finer textured layers hold a significant amount of moisture available for the plants, and they also keep the sandy material

above them moist. They give an otherwise droughty soil a higher available moisture capacity. During the usually dry summer, crops are affected by a lack of water. These soils are easily tilled and can be cultivated throughout a wide range of moisture without clodding or crusting. Because of their position, they receive runoff water from higher adjacent soils in addition to that received in precipitation. Shrink-swell potential is low.

The Enosburg soils are used mainly for hay and pasture. A few areas are in trees, are idle, or are used for corn.

In Chittenden County, the Enosburg soils were not mapped separately but were mapped with Whately soils in undifferentiated groups. The Whately soils are described under the Whately series.

Representative profile of a wooded Enosburg loamy sand, about 4,000 feet directly east of Lamoille River Bridge where U.S. Highway No. 2 crosses the bridge in a north-south direction:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loamy sand; common, fine, prominent, brown (7.5YR 4/4) mottles; clods separate to weak, fine and medium, granular structure; very friable; many roots; dark reddish-brown (2.5YR 3/4) iron-manganese concretions 5 to 40 millimeters in size; 5 percent coarse fragments; strongly acid; abrupt, smooth boundary.

C1g—8 to 16 inches, olive-gray (5Y 5/2) sand; common, fine, prominent, yellowish-brown (10YR 5/4 and 5/6), brown (7.5YR 4/4), and reddish brown (5YR 4/4) mottles; weak, fine, granular structure; very friable; common roots; dark reddish-brown (2.5YR 3/4) iron-manganese concretions 5 to 40 millimeters in size; 5 percent coarse fragments; strongly acid; clear, wavy boundary.

C2—16 to 32 inches, grayish-brown (10YR 5/2) coarse sand; many, fine and medium, prominent, yellowish brown (10YR 5/4 and 5/6), brown (7.5YR 4/4), and reddish-brown (5YR 4/4) mottles; single grain; loose; few roots; 7 percent coarse fragments; medium acid in the upper part and slightly acid in the lower part; abrupt, smooth boundary.

IIC3g—32 to 60 inches, gray (N 5/0) silt; many, fine to coarse, prominent, light olive-brown (2.5Y 5/4 and 5/6) mottles; massive separating to weak, medium to very coarse, platy structure; friable; few roots; no coarse fragments; slightly acid.

Depth to contrasting finer textured materials ranges from more than 16 inches to 40 inches. Coarse fragments are less than 10 percent, by volume.

The A horizon is 10YR in hue, 2 or 3 in value, and 1 or 2 in chroma. It ranges from strongly acid to neutral.

The sandy C2 horizon is 10YR to 5Y in hue, 4 or 5 in value, and 1 to 2 in chroma. Mottles are distinct or prominent. The C2 horizon is coarse sand to loamy fine sand. It ranges from strongly acid to neutral.

The loamy IIC3 horizon is 10YR to 5Y in hue, 3 to 5 in value, and 1 to 2 in chroma or colors are neutral and have a value of 4 or 5. Mottles are distinct or prominent. The IIC3 horizon is silt, silt loam, or very fine sandy loam. It is slightly acid or neutral.

Most areas of Enosburg soils are near the Belgrade, Eldridge, Hinesburg, Deerfield, and Windsor soils. Enosburg soils are more sandy in the upper part of the profile than the Belgrade soils and are lower in the landscape. The Enosburg soils are the wetter associates of the Eldridge and Hinesburg soils. The material in the lower part of the subsoil of Enosburg soils is finer textured than that of the Deerfield and Windsor soils. In most places Enosburg soils are lower in the landscape than Deerfield and Windsor soils.

Enosburg and Whately soils, 0 to 3 percent slopes (EwA).—This is an undifferentiated group of Enosburg

and Whately soils. Any given area may consist of Enosburg soils, Whately soils, or some of both. These soils are depressional to nearly level. They occupy elongated areas, and in a few places the length of the areas is nearly a mile. The areas range from 2 to 150 acres in size. The profiles of the Enosburg and Whately soils are the ones described as representative for the respective series.

Included with these soils in mapping are small areas of very poorly drained soils and soils that have slopes of more than 3 percent. Also included are areas of soils that formed in less than 16 inches of coarse textured or moderately coarse textured materials over finer textured materials. Other included soils have less than 25 inches of coarse textured or moderately coarse textured materials over silty clay loam, silty clay, or clay and intervening strata of silt loam or very fine sandy loam that are thicker than 5 inches. In a few areas the surface layer of the Enosburg soils is sandy loam, fine sandy loam, or loamy fine sand, and that of the Whately soils is sandy loam, loamy sand, or loamy fine sand.

These soils are used mainly for hay and pasture. A few areas are in trees, are idle, or are used for corn.

Overdrainage of the Enosburg soil results in droughtiness. Surface runoff is very slow. Because areas mapped as these soils have more inclusions of wetter soils than areas of steeper Enosburg and Whately soils, tillage is delayed longer in the spring and following heavy rains. The erosion hazard is very slight where these soils are being prepared for seeding or where cultivated crops are grown. These soils have severe limitations for many non-farm uses, especially those uses for which wetness is a consideration. (Both soils, capability unit IIIw-3; Enosburg soils, woodland suitability group 4w1; Whately soils, woodland suitability group 5w3)

Enosburg and Whately soils, 3 to 8 percent slopes (EwB).—An individual area of this mapping unit may be all Enosburg soils, all Whately soils, or some of both. These soils occupy elongated areas 2 to 40 acres in size.

Included with these soils in mapping are small areas of very poorly drained soils and soils that have slopes of less than 3 percent. Also included are areas of soils formed in less than 16 inches of coarse textured or moderately coarse textured materials over finer textured materials. Other included soils have less than 25 inches of coarse textured or moderately coarse textured materials over silty clay loam, silty clay, or clay and intervening strata of silt loam or very fine sandy loam that are more than 5 inches thick. In a few included areas the surface layer of the Enosburg soils is sandy loam, fine sandy loam, or loamy sand and that of the Whately soils is sandy loam, loamy sand, or loamy fine sand.

These soils are used mainly for hay, pasture, and corn. A few areas are in trees or are idle.

Overdrainage of the Enosburg soil results in droughtiness. Surface runoff is slow. Since areas mapped as these soils have fewer inclusions of wetter soils than areas of more nearly level Enosburg and Whately soils, tillage is not delayed so long in the spring and following heavy rains. The erosion hazard is slight where these soils are being prepared for seeding or where cultivated crops are grown. These soils have severe limitations for many non-farm uses, especially those uses for which wetness is a consideration. (Both soils, capability unit IIIw-3; Enos-

burg soils, woodland suitability group 4w1; Whately soils, woodland suitability group 5w3)

Farmington Series

The Farmington series consists of soils that are shallow to bedrock, rocky or extremely rocky, somewhat excessively drained, and loamy throughout their profile. These soils are sloping to steep. They are mainly in scattered areas in the western part of the county. These soils formed in glacial till that contains a considerable amount of limestone. The underlying bedrock is quartzite or limestone (fig. 7). These soils are easy to dig above the hard bedrock. The coarse fragments throughout the soil profile are shale, slate, quartzite, and weathered limestone.

A representative profile of a cultivated Farmington soil has a very dark grayish-brown loam surface layer about 7 inches thick. The upper part of the subsoil is a friable, dark yellowish-brown silt loam about 6 inches thick. The lower part of the subsoil is a friable, dark yellowish-brown loam about 4 inches thick. Bedrock is at a depth of about 17 inches.

The Farmington soils have medium natural fertility and a moderately low available moisture capacity. They are moderately permeable. The bright color of the subsoil indicates that these soils are well aerated most of the time. They are saturated with water during rainy periods in the spring, but the water disappears quickly after the rains stop. Water moves through the soil and flows downslope on the top of the bedrock if the bedrock is not fractured and jointed.

These soils dry out quickly in spring and are ready for planting earlier than most soils in the county. They normally are filled nearly to capacity with available moisture at the start of the growing season. As the growing season progresses, these soils cannot supply the moisture needed by plants during extended dry periods. Plant growth, therefore, is slowed during midsummer. The bedrock restricts plant rooting depth. Shrink-swell potential is low.

Farmington soils are used mainly for hay, pasture, and trees. A small acreage is idle. The limestone bedrock that underlies the Farmington soils is a potential source of lime for crop use and of material for road surfacing (fig. 8).

In Chittenden County, only the extremely rocky Farmington soils were mapped as separate units. The rocky Farmington soils were mapped in complexes with Stockbridge soils. These soils are intermingled in such an intricate pattern that the two could not be separated at the scale of the soil map. A representative profile of the Stockbridge soils is described under the Stockbridge series.

Representative profile of a Farmington extremely rocky loam in a field in the town of Charlotte, approximately 1.7 miles north of East Charlotte and 1,300 feet east of road.

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) loam; light brownish gray (10YR 6/2) when dry; moderate, very fine, granular structure; friable; many roots; 10 percent coarse fragments; medium acid; abrupt, smooth boundary.



Figure 7.—Profile of a Farmington soil that has limestone bedrock at a depth of about 17 inches.

B21—7 to 13 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, very fine, granular structure; friable; common roots; 5 percent coarse fragments; neutral; gradual, wavy boundary.

B22—13 to 17 inches, dark yellowish-brown (10YR 4/4) loam; weak, fine and medium, granular structure; friable; few roots; 10 percent coarse fragments; neutral; abrupt, wavy boundary.

R—17 inches +, bedrock.

The thickness of the solum and depth to bedrock range from 10 to 20 inches. The content of coarse fragments in the A and B horizons ranges from less than 5 to 35 percent.

The A horizon is 10YR or 7.5YR in hue, 3 in value, and 2 or 3 in chroma. It ranges from strongly acid to neutral. The B horizon has a hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It ranges from medium acid to neutral. The C horizon where present, is 10YR in hue, 3 or 4 in value, and 2 or 3 in chroma. It is slightly acid or neutral. The underlying bedrock is limestone, shaly limestone, or quartzite.

Farmington soils are near the well drained Stockbridge and Nellis soils, the moderately well drained Vergennes and Georgia soils, and the poorly drained Covington soils. Farmington soils have bedrock at a depth of less than 20 inches, but the soils near them do not. In the lower part of the subsoil, Farmington soils are less acid than are Lyman soils.

Farmington extremely rocky loam, 5 to 20 percent slopes (FaC).—This soil occupies irregularly shaped areas that have convex slopes and are 2 to 75 acres in size.

Slopes range from 100 to 1,000 feet in length. Where this soil borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two soils. This soil is on ridges in the western part of the county. The ridges are oriented in a north-south direction. Gravel roads through areas of this soil are very crooked as they wind around outcrops of rock and areas that are very shallow to bedrock.

Included in mapping are small areas of soils that are fine sandy loam or gravelly fine sandy loam throughout the soil profile. Also included in a few areas are deeper soils that are more than 35 percent pebbles, channery material, and cobblestones at a depth of 10 to 40 inches. In other included areas are soils that have bedrock at a depth of less than 10 inches and soils that have bedrock at more than 20 inches. In a few areas the soil is more acid than is typical for the Farmington soil. Other inclusions are of soils that have slopes of less than 5 percent and soils that have slopes of more than 20 percent. Some areas are only rocky and very rocky instead of extremely rocky.

This soil is used mainly for trees and unimproved pasture. A small acreage is idle.



Figure 8.—Limestone bedrock that underlies the Farmington soils.

This soil is too rocky and, in some places, too steep to be farmed. The bedrock outcrops prohibit the use of modern farm machinery. Management of this soil is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for cropping and are in brush and weeds. The hazard of water erosion is only slight in protected areas, but in unvegetated areas it is moderate to severe. Because bedrock is impermeable to water in many places, absorption of water into the rock during a rain is negligible. The closer the bedrock is to the soil surface, the more quickly the soil above the bedrock is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. Surface runoff, however, is reduced by small hummocks or mounds resulting from tree windthrow. This soil has severe limitations for many nonfarm uses, especially those uses for which shallowness to bedrock, steepness of slope, and bedrock outcrops are considerations. (Capability unit VII_s-2; woodland suitability group 5x1)

Farmington extremely rocky loam, 20 to 60 percent slopes (F_oE).—This soil occupies irregularly shaped areas that have convex slopes and are 2 to 125 acres in size. Slopes range from 100 to more than 1,000 feet in length. Where this soil borders mapped areas of rocky or stony soils, a straight stone fence or wall is on the boundary separating the two soils. Gravel roads through this soil are very crooked as they wind around bedrock outcrops and areas where the soil is very shallow to bedrock. This soil is on ridges in the western part of the county. The ridges are oriented in a north-south direction. The profile of this soil is the one described as representative for the Farmington series.

Included in mapping are small areas of soils that are fine sandy loam or gravelly fine sandy loam throughout the soil profile. Also included are a few areas of deeper soils that are more than 35 percent pebbles, channery material, and cobblestones at a depth of 10 to 40 inches below the soil surface. Also included in mapping are soils that have bedrock at a depth of less than 10 inches and soils that have bedrock at a depth more than 20 inches. Soils in a few areas are more acid than is typical for this Farmington soil. Other inclusions are of Farmington soils that are only rocky or very rocky instead of extremely rocky. In some areas are included soils that have slopes of less than 20 percent.

This soil is used mainly for trees. The lower slopes are used for unimproved pasture, and a small acreage is idle.

This soil is too rocky and steep to be used for farming. Bedrock outcrops prohibit the use of modern farm machinery, and steep slopes make the use of modern farm machinery very hazardous. Management of this soil is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fires, are clear cut, or have been abandoned for cropping and are in brush and weeds. The hazard of water erosion is slight except in areas not vegetated, where it is very severe. Surface runoff is rapid, but it is reduced by small hummocks or mounds resulting from tree windthrow. Because bedrock is not fractured and is impermeable to water in many places, absorption of water into the rock during a rain is negligible. The closer the bedrock is to the soil surface, the more quickly the soil above the bedrock is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. This soil has severe limitations for many nonfarm uses, especially those uses for which steepness of slope, rockiness, and shallowness to bedrock are considerations. (Capability unit VII_s-2; woodland suitability group 5x2)

Farmington-Stockbridge rocky loams, 5 to 12 percent slopes (F_sB).—This is a complex of Farmington and Stockbridge soil. These soils generally occur together in such intricate patterns that they could not be mapped separately at the scale used in mapping. Farmington soils make up about 60 percent of the complex, Stockbridge soils about 20 percent, and other soils the remaining 20 percent.

These soils have convex slopes and occupy irregularly shaped areas that are 2 to 120 acres in size. Slopes range from 100 to more than 1,000 feet in length. Commonly the cobblestones and stones have been removed from the soil surface and piled along the edges of the fields to form stone fences and walls. Where these soils border mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two mapping units. Gravel roads through these soils are crooked as they wind around bedrock outcrops and areas where soils are very shallow to bedrock. These soils are on ridges in the western part of the county. The ridges are oriented in a north-south direction.

Included with these soils in mapping are small areas of moderately deep soils that have bedrock at a depth of 20 to 40 inches. Also included are a few areas of soils that are more than 35 percent pebbles, channery

material, and cobblestones at a depth of 10 to 40 inches. Some included soils have slopes of less than 5 percent and some have slopes of more than 12 percent. Some areas have bedrock outcrops more than 300 feet apart. Other inclusions are of shallow soils that are more acid than the Farmington soils. In a few included areas the Farmington soils are fine sandy loam or gravelly fine sandy loam throughout the soil profile. In a few areas the surface layer of the Stockbridge soil is fine sandy loam, silt loam, gravelly fine sandy loam, or gravelly silt loam.

The soils of this complex are used mainly for hay and pasture. A small acreage is idle.

Surface runoff is medium. The hazard of water erosion is moderate where the soils are being prepared for seeding or where cultivated crops are grown. The cobblestones, stones, and bedrock outcrops are troublesome in tillage and harvesting operations, but they do not prevent farming. These soils have limitations for many nonfarm uses, especially those for which shallowness to bedrock, bedrock outcrops, stoniness, and steepness are considerations. (Capability unit IIIe-3; woodland suitability group 4d1)

Farmington-Stockbridge rocky loams, 12 to 20 percent slopes (FsC).—These soils occur together in such intricate patterns that they could not be mapped separately at the scale used in mapping. Farmington soils occupy about 65 percent of the complex, Stockbridge soils about 15 percent, and other soils the remaining 20 percent.

These soils have convex slopes and occupy irregularly shaped areas that are 2 to 25 acres in size. Slopes range from 100 to 600 feet in length. In many places the cobblestones and stones have been removed from the soil surface and piled along the edges of fields to form stone fences and walls. Where these soils border mapped areas of extremely stony soils or extremely rocky soils, a straight stone fence or wall is on the boundary separating the two areas. Gravel roads through these soils are crooked as they wind around bedrock outcrops and areas that have soils very shallow to bedrock. This mapping unit is on ridges that are oriented in a north-south direction.

Included with these soils in mapping are small areas of soils that have bedrock at a depth of 20 to 40 inches. Also included are a few areas of soils that are more than 35 percent pebbles, channery material, and cobblestones at a depth of 10 to 40 inches. Some included soils have slopes of less than 12 percent, and others have slopes of more than 20 percent. In some areas bedrock outcrops are more than 300 feet apart. Shallow included soils are more acid than is typical for the Farmington series. Some shallow soils are fine sandy loam or gravelly fine sandy loam throughout the profile. In a few areas the surface layer of the Stockbridge soils is fine sandy loam, silt loam, gravelly fine sandy loam, gravelly silt loam, or gravelly loam.

The soils of this mapping unit are used mainly for pasture. They are used for hay where they are less sloping. A few areas are in trees.

Surface runoff is rapid. The hazard of water erosion is severe where the soils are being prepared for seeding or where cultivated crops are grown. Cobblestones, stones, and bedrock outcrops are troublesome to tillage and har-

vesting operations, but they do not prevent farming. The steeper slopes make the use of modern farm machinery hazardous. Management of these soils for woodland is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for cropping and are in brush and weeds. These soils have severe limitations for many nonfarm uses, especially those for which steepness of slope, spacing of bedrock outcrops, shallowness to bedrock, and stoniness are considerations. (Capability unit IVe-3; woodland suitability group 4d2)

Farmington-Stockbridge rocky loams, 20 to 60 percent slopes (FsE).—These soils occur together in such intricate patterns that they cannot be mapped separately at the scale of the soil map. Farmington soils make up about 65 percent of the complex, Stockbridge soils about 10 percent, and other soils the remaining 25 percent.

These soils have convex slopes and occupy irregularly shaped areas that are 2 to 10 acres in size. Slopes range from 100 to 350 feet in length. Where this mapping unit borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two areas. These soils are on ridges that are oriented in a north-south direction.

Included with these soils in mapping are small areas of soils that have bedrock at a depth of 20 to 40 inches. Also included are a few areas of soils that are more than 35 percent pebbles, channery material, and cobblestones at a depth of 10 to 40 inches. In some areas bedrock outcrops are less than 100 feet apart. Soils that have slopes of less than 20 percent are included in some areas. A few areas of this mapping unit contain inclusions of shallow soils that are fine sandy loam or gravelly fine sandy loam throughout the soil profile. Also included in mapping are shallow soils that are more acid than is typical for the Farmington series. In a few areas the surface layer of the Stockbridge soil is fine sandy loam, silt loam, gravelly sandy loam, gravelly silt loam, or gravelly loam.

Soils in this mapping unit are used mainly as woodland. A small acreage where the soils are less sloping is used for unimproved pasture. A few areas are idle.

The steep slopes make use of modern farm machinery hazardous. Surface runoff is rapid, but it is reduced by small hummocks or mounds resulting from tree windthrow. Woodland management is mainly for preventing forest fires, maintaining logging roads, controlling erosion on logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for cropping and are in brush and weeds. The hazard of water erosion is slight where these soils are protected by vegetation and is very severe where they are not. These soils have severe limitations for many nonfarm uses, especially those for which steepness of slope, shallowness to bedrock, spacing of outcrop, and stoniness are considerations. (Capability unit VIIe-2; woodland suitability group 4d3)

Fill Land

Fill land (Fu) is near highways, airports, and built-up areas. In some areas it is where soil material, normally

sand or gravel, has been removed for construction purposes and the original surface soil or new topsoil has been spread over the borrow area. Many of these areas are then farmed. In some other places Fill land consists of 1 to 10 feet or more of soil that has been brought in from other areas and spread over a very rough area to level it or to build up a low area even with the surrounding land. In some areas of Fill land, the soil material at the site has been moved by equipment to reshape the landscape. Fill land material ranges from sand to clay. Most areas are used for buildings, airports, highways, rest areas, parks, and parking lots. (Capability unit and woodland suitability group not assigned)

Fresh Water Marsh

Fresh water marsh (fw) consists of flat areas that are covered by shallow water most of the year. When the water is low in summer and fall, a few areas of this marsh are not under water for periods of a few weeks, but in these places the water table is at or near the surface. The soil material under the shallow water in some areas generally ranges from sand to clay, but in some places it is peat and muck. Fresh water marsh is mainly in coves along Lake Champlain and at the mouth of the Lamoille and La Platte Rivers. Large areas of this mapping unit are in the Sand Bar Waterfowl Management Area near Lake Champlain.

Fresh water marsh supports sedges, reeds, marsh grasses, and other water-tolerant plants. Trees grow in only a very few places where the water is shallowest.

Fresh water marsh is not suited to farm crops or forestry, though it is a good habitat for waterfowl and muskrats. Large areas in the Sand Bar Waterfowl Area are managed by the Vermont Department of Fish and Game. (Capability unit VIIIw-1; woodland suitability group not assigned)

Georgia Series

The Georgia series consists of soils that are deep, stony and extremely stony, and are loamy throughout their profile. These soils are moderately well drained. They are gently sloping to steep. Georgia soils are mainly in the southwestern part of Chittenden County. They are in a belt starting at Burlington and continuing southward to the Addison County line. This belt is west of the towns of Hinesburg, St. George, and Williston. These soils formed in glacial till that was derived from limestone and calcareous shale. Pebbles and stones are in all soil layers.

A representative profile of a Georgia soil in a pasture that has been plowed has a very dark grayish-brown loam surface about 8 inches thick. The subsoil is friable loam about 18 inches thick. It is brown in the upper part and olive brown in the lower part. Mottles occur in the lower two-thirds of the subsoil. The substratum starts at a depth of about 26 inches and is gray to olive-brown loam to a depth of 48 inches or more.

Georgia soils have very high natural fertility and a medium available moisture capacity. Permeability is moderate in the surface layer and subsoil and moderately slow or slow in the substratum. From late in fall to late

in spring, a seasonal water table is near the soil surface. As summer approaches, the water table recedes to a depth of 2 feet or more. The middle part of the subsoil has a few mottles, but mottles increase in number and intensity with depth. This pattern of mottling indicates that the upper part of these soils is not frequently wet, but the lower part is saturated for significant periods.

These soils occupy positions that receive runoff from higher adjacent soils. The soils are slow to warm in the spring. They become cloddy if tilled when too wet. Wetness delays farming in the spring and following rains. Some artificial drainage is needed for best crop growth. Shrink-swell potential is low.

Georgia soils originally were too stony to farm with modern machinery, but in most places the stones have been removed. The soils cleared of stones are used mainly for hay and pasture. A small acreage is in corn grown for silage. The soils not cleared of stones are in trees or pasture or are idle.

Representative profile of a pastured Georgia stony loam, about 1.89 miles north-northeast of North Ferrisburg, Vermont, and 275 feet west of road into pasture:

- Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine and medium, granular structure; friable; many roots; 5 percent coarse fragments; neutral; abrupt, smooth boundary.
- B21—8 to 14 inches, brown ped interiors (10YR 4/3) and dark-brown ped exteriors (10YR 3/3) loam; moderate, medium, granular structure; friable; many roots; 5 percent coarse fragments; neutral; clear, smooth boundary.
- B22—14 to 21 inches, brown (10YR 4/3) loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, very fine and fine, subangular blocky structure; friable; common roots; 5 percent coarse fragments; neutral; clear, smooth boundary.
- B23—21 to 26 inches, olive-brown (2.5Y 4/4) loam; many, fine, distinct, olive-brown (2.5Y 5/4) and grayish-brown (2.5Y 5/2) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; 5 percent coarse fragments; neutral; clear, smooth boundary.
- C1—26 to 36 inches, mixed gray (N 5/0), olive-brown (2.5Y 4/4), dark grayish-brown (2.5Y 4/2), and light olive-brown (2.5Y 5/4 and 5/6) loam; weak, thick, platy structure; slightly sticky and slightly plastic; few roots; 10 percent coarse fragments; neutral; clear, smooth boundary.
- C2—36 to 48 inches, olive (5Y 4/3) loam; many, fine, distinct, grayish-brown (2.5Y 5/2) and light olive-brown (2.5Y 5/4) mottles; weak, fine and medium, angular blocky structure; friable; few roots; 10 percent coarse fragments; neutral.

The solum ranges from 16 to 32 inches in thickness. Content of coarse fragments ranges from 5 to 35 percent throughout the soil.

The A horizon has a hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is medium acid to neutral. The B horizon is 10YR or 2.5Y in hue, 4 or 5 in value, and 2 to 4 in chroma. It ranges from medium acid to neutral. This horizon is loam or silt loam, and in places it is gravelly. The C horizon has a hue of 10YR to 5Y, value of 3 to 5, and chroma of 2 to 4, or it is neutral and has a value of 4 or 5. Reaction ranges from slightly acid to neutral. This horizon is fine sandy loam to silt loam and may be gravelly.

In most places Georgia soils are near the somewhat poorly drained and poorly drained Massena soils, the well-drained Nellis and Stockbridge soils, and the somewhat excessively drained Palatine soils. Georgia soils generally have brighter colors in the subsoil than the Massena soils. Mottles are in the lower part of the soil profile of Georgia soils but are lacking in the Nellis and Stockbridge soils. Bedrock is more than 40 inches below the soil surface of Georgia soils but

less than 40 inches in the Palatine soils. A fragipan is lacking in the Georgia soils but is present in the Peru soils.

Georgia stony loam, 3 to 8 percent slopes (GeB).—This soil has slightly concave slopes and occupies irregularly shaped areas that are 2 to 30 acres in size. Slopes range from 50 to 600 feet in length. The cobblestones and stones cleared off the soil surface have been piled along the edges of fields to form stone fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two soils.

Included with this soil in mapping are small areas of the Massena, Stockbridge, and Nellis soils. The Massena soils are in very slight depressions and drainageways. Stockbridge and Nellis soils are on the higher mounds or slightly elongated rises. Also included are small areas of soils that are calcareous within 40 inches of the soil surface. In other included areas, soils have slopes of less than 3 percent or of more than 8 percent. In a few areas the soils are more than 35 percent pebbles and cobblestones between depths of 10 and 40 inches. In a few included areas, the surface layer is fine sandy loam, silt loam, gravelly fine sandy loam, gravelly silt loam, or gravelly loam.

This soil is used mainly for hay and pasture. A small acreage is in corn grown for silage.

Surface runoff is medium. The hazard of water erosion is slight where this soil is being prepared for seeding or where cultivated crops are grown. Because areas mapped as this soil have more inclusions of wetter soils than areas of steeper Georgia soils, tillage is delayed longer in the spring and following heavy rains. Although pebbles, cobblestones, and stones are present on the soil surface, they do not prohibit the operation of farm machinery. The addition of organic matter helps in maintaining good soil structure and in increasing the infiltration of precipitation. This soil has limitations for many nonfarm uses, especially those for which wetness, permeability, and steepness are considerations. (Capability unit IIw-2; woodland suitability group 3o1)

Georgia stony loam, 8 to 15 percent slopes (GeC).—This soil has slightly concave slopes and occupies irregularly shaped areas that are 2 to 30 acres in size. Slopes range from 50 to 600 feet in length. The cobblestones and stones removed from the soil surface have been piled along the edges of fields to form a stone fence and wall. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two soils. The profile of this soil is the one described as representative for the Georgia series.

Included with this soil in mapping are small areas of Massena, Nellis, and Stockbridge soils. The Massena soils occupy very slight depressions and drainageways. Stockbridge and Nellis soils are on the higher mounds or slightly elongated rises. Also included are soils that are calcareous at a depth of less than 40 inches. In some included areas slopes are less than 8 percent, and in other areas they are more than 15 percent. In a few areas the soils are more than 35 percent pebbles and cobblestones at a depth of 10 to 40 inches. The surface layer is fine sandy loam, silt loam, gravelly fine sandy loam, gravelly silt loam, or gravelly loam in a few places.

This soil is used mainly for hay and pasture. A small acreage is in corn grown for silage.

Surface runoff is medium. The hazard of water erosion is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Since areas mapped as this soil have fewer inclusions of wetter soils than areas of less sloping Georgia soils, tillage is not delayed so long in the spring and following heavy rains. Although pebbles, cobblestones, and stones are on the soil surface, they do not prohibit the operation of farm machinery. The addition of organic matter helps in maintaining good soil structure and in increasing infiltration of precipitation. This soil has limitations for many nonfarm uses, especially those for which steepness, permeability, and wetness are considerations. (Capability unit IIIe-5; woodland suitability group 3o1)

Georgia extremely stony loam, 0 to 15 percent slopes (GgC).—This soil has slightly concave slopes and occupies irregularly shaped areas that are 2 to 50 acres in size. Slopes range from 50 to 800 feet in length. Where this soil borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two soils. The profile of this soil is similar to that described as representative for the series but, in most places, has a thinner surface layer.

Included with this soil in mapping are small areas of Massena, Nellis, and Stockbridge soils. The Massena soils occupy very slight depressions and drainageways. Stockbridge and Nellis soils are on the higher mounds or slightly elongated rises. Also included are soils that are calcareous within 40 inches of the soil surface. Some included soils have slopes of more than 15 percent. In a few areas the soil is more than 35 percent pebbles and cobblestones at a depth of 10 to 40 inches. In a few areas the surface layer is fine sandy loam, silt loam, gravelly fine sandy loam, gravelly silt loam, or gravelly loam. Small areas of stony soils also are included with this extremely stony soil.

This soil is used mainly for trees or unimproved pasture. A small acreage is idle.

Surface runoff is slow to medium. It is reduced by small hummocks caused by cattle trampling soft ground between stones and mounds resulting from tree windthrow. The hazard of water erosion is very slight to moderate in areas not vegetated. This soil is too stony for cultivation. Removal of stones ordinarily is impractical. This soil has severe limitations for many nonfarm uses, especially those for which wetness, stoniness, permeability, and steepness are considerations. (Capability unit VIIs-2; woodland suitability group 3x1)

Georgia extremely stony loam, 15 to 60 percent slopes (GgE).—This soil occupies irregularly shaped areas that are 2 to 50 acres in size. Slopes range from 50 to 800 feet in length. Where this soil borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two areas. The profile of this soil is similar to that described as representative for the series but, in most places, has a thinner surface layer.

Included with this soil in mapping are small areas of Nellis and Stockbridge soils. Also included are soils that have slopes of less than 15 percent. In places seep spots are near the base of the slope. Bedrock crops out in some places. In a few areas the soil is more than 35 percent

pebbles and cobblestones at a depth of 10 to 40 inches. In a few places the surface layer is a fine sandy loam, silt loam, gravelly fine sandy loam, gravelly silt loam, or gravelly loam. Stony soils are included with this extremely stony soil.

This soil is used mainly for trees. The less sloping areas commonly are used for unimproved pasture. A few areas are idle.

Surface runoff is rapid, and the hazard of water erosion is moderate to very severe where this soil is not vegetated. This soil is too stony for cultivation, and the steep slopes make the use of modern farm machinery hazardous. Removal of stones ordinarily is impractical. This soil has severe limitations for many nonfarm uses, especially those for which stoniness, permeability, wetness, and steepness are considerations. (Capability unit VIIIs-2; woodland suitability group 3x3)

Groton Series

The Groton series consists of soils that are excessively drained and that formed in deep, moderately coarse textured over coarse textured materials. These soils are nearly level to steep and occur in small, scattered areas in the Champlain Valley. They are on gravelly beaches, deltas, and stream terraces and are calcareous within 40 inches of the soil surface.

A representative profile has a surface layer that is a very dark grayish-brown gravelly fine sandy loam about 9 inches thick. The subsoil is dark yellowish-brown, very friable gravelly sandy loam about 6 inches thick. The upper part of the substratum is dark grayish-brown gravelly loamy coarse sand about 9 inches thick. The lower part of the substratum is grayish-brown and olive very gravelly coarse sand to a depth of 41 inches or more.

The bright colors and lack of mottles in the Groton soils indicate that they are well aerated and porous. These soils have medium natural fertility. They have moderately rapid permeability in the upper part of the soil and very rapid permeability in the lower part. Their available moisture capacity is moderately low. The Groton soils are filled to capacity with available moisture at the start of the growing season. As the growing season progresses, rain normally is not adequate to replenish the soil moisture used by plants. Crops, therefore, show signs of lack of moisture during the growing season. These soils warm up early and can be worked earlier in spring and sooner after rains than most soils in the county. Shrink-swell potential is low.

The Groton soils are used mainly for hay, pasture, and corn grown for silage. They are a good source of gravel, and borrow pits are common.

Representative profile of a Groton gravelly fine sandy loam in an idle field in the town of Williston, 2 miles southwest of the village of Williston and 1 mile east of State Route 2A:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) gravelly fine sandy loam; moderate, fine and very fine, granular structure; friable; many grass roots; 20 percent pebbles and channery fragments of quartzite and limestone; medium acid; abrupt, smooth boundary.

B2—9 to 15 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; weak, fine and very fine, granular structure; very friable; common grass roots; 30 per-

cent pebbles and channery fragments of quartzite and limestone; medium acid; abrupt, irregular boundary.

IIC1—15 to 24 inches, dark grayish-brown (2.5Y 4/2) gravelly loamy coarse sand; single grain; loose where disturbed; few grass roots; 40 percent pebbles and channery fragments; neutral; abrupt, wavy boundary.

IIC2—24 to 36 inches, grayish-brown (2.5Y 5/2) very gravelly coarse sand; single grain; loose; few grass roots; 60 percent pebbles and quartzite and limestone; mildly alkaline; slightly effervescent in cold dilute hydrochloric acid; abrupt, smooth boundary.

IIC3—36 to 41 inches, olive (5Y 5/3) very gravelly coarse sand; single grain; loose; very few grass roots; 80 percent pebbles of quartzite and limestone; moderately alkaline; strongly effervescent in cold dilute hydrochloric acid.

The solum ranges from 12 to 16 inches in thickness. Depth to sandy and gravelly material ranges from 13 to 25 inches. Depth to calcareous material ranges from 20 to 30 inches.

The A horizon has a hue of 10YR, value of 3, and chroma of 2 or 3. It ranges from medium acid to neutral.

The B horizon is 10YR or 2.5Y in hue, 4 or 5 in value, and 2 to 4 in chroma. The upper B horizon is fine sandy loam, sandy loam, gravelly fine sandy loam, or gravelly sandy loam. The lower B horizon, if present, is loamy sand, loamy coarse sand, sand, or coarse sand, and in places it is gravelly or very gravelly. Reaction ranges from medium acid to neutral.

The C horizon has a hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or 3. Its textures are the same as in the lower B horizon. Reaction ranges from neutral to moderately alkaline.

The Groton soils are near the Munson, Raynham, Nellis, and Vergennes soils and are more sandy throughout than all those soils. The Groton soils are calcareous within 40 inches of the soil surface, and the Stetson, Colton, and Agawam soils are not.

Groton gravelly fine sandy loam, 0 to 5 percent slopes (GrA).—This soil occupies irregularly shaped areas that are 2 to 15 acres in size. It is in small areas throughout the Champlain Valley. The largest areas are in the town of Williston.

Included with this soil in mapping are small areas of soils that have thin layers of finer textured material in the substratum. In a few included areas, the surface layer is loam. Also included are soils that are not calcareous within 40 inches of the soil surface. In a few areas cobblestones and stones are on the soil surface. This soil commonly has an average of less than 35 percent content of pebbles and cobblestones at a depth of 10 to 40 inches.

This Groton soil is used mainly for hay, pasture, and corn grown for silage. It is a good source of gravel, and borrow pits are common. A few areas are idle.

Water erosion is slight because this soil absorbs water rapidly and has slow surface runoff. Soil blowing is a hazard in areas not vegetated. Trees and pasture plants that resist drought are better suited to this soil than row crops. Drought-resistant forage plants are better suited than other kinds of plants. This soil has slight limitations for many nonfarm uses. (Capability unit IIIs-1; woodland suitability group 5s1)

Groton gravelly fine sandy loam, 5 to 12 percent slopes (GrB).—This soil occupies irregularly shaped areas that are 2 to 30 acres in size. Its profile is the one described as typical for the Groton series.

Included with this soil in mapping are small areas of soils that have thin layers of finer textured material in the substratum. In a few areas the surface layer is loam. Also included in mapping are soils that are not cal-

careous within 40 inches of the soil surface. A few areas have cobblestones and stones on the soil surface. This soil commonly averages less than 35 percent in content of pebbles and cobblestones at a depth of 10 to 40 inches.

This soil is used mainly for hay and pasture. A few areas are idle or are in corn grown for silage. This soil is a good source of gravel, and borrow pits are common.

Surface runoff is medium. The hazard of water erosion is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Soil blowing is a hazard in areas not vegetated. Trees and pasture plants that resist drought are better suited to this soil than row crops. Drought-resistant forage plants are better suited than other kinds of plants. This soil has limitations for many nonfarm uses, especially those for which steepness is a consideration. (Capability unit IVs-1; woodland suitability group 5s1)

Groton gravelly fine sandy loam, 12 to 20 percent slopes (GrC).—This soil occupies irregularly shaped areas that are 2 to 15 acres in size.

Included with this soil in mapping are small areas of soils that have thin layers of finer textured material in the substratum. Also included are eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. In a few included areas the surface layer is loam. Also included are soils that are not calcareous within 40 inches of the soil surface. A few areas have cobblestones and stones on the soil surface. This soil commonly averages less than 35 percent in content of pebbles and cobblestones at a depth of 10 to 40 inches.

This soil is used mainly for hay and pasture. This soil is a good source of gravel, and borrow pits are common. A few areas are in trees or are idle.

Surface runoff is rapid, and the erosion hazard is severe where this soil is being prepared for seeding. Soil blowing is a hazard in areas not vegetated. Trees that resist drought are best suited to this soil. Drought-resistant forage plants are better suited than other kinds of plants. This soil has limitations for many nonfarm uses, especially those for which steepness is a consideration. (Capability unit VIs-1; woodland suitability group 5s2)

Groton gravelly fine sandy loam, 20 to 30 percent slopes (GrD).—This soil occupies roughly circular areas that are 2 to 15 acres in size. It commonly occupies the walls of ravines.

Included with this soil in mapping are small areas of soils that have thin layers of finer textured material in the substratum. Also included are areas of eroded soils and soils that have slopes of less than 30 percent. In a few included areas the surface layer is loam. In some areas are soils that are not calcareous within 40 inches of the soil surface. A few included areas have cobblestones and stones on the soil surface. At a depth of 10 to 40 inches, the content of pebbles and cobblestones commonly is less than 35 percent.

This soil is used mainly for trees. A few areas are used for pasture or are idle. This soil is a good source of gravel, and gravel and borrow pits are common.

Surface runoff is rapid. The steep slopes limit the use of modern farm machinery. Trees that resist drought are best suited to this soil. Erosion is a severe hazard

in areas not vegetated. This soil has severe limitations for most nonfarm uses, especially those for which steepness is a consideration. (Capability unit VIIs-2; woodland suitability group 5s2)

Groton gravelly fine sandy loam, 30 to 60 percent slopes (GrE).—This soil occupies narrow elongated areas that are 2 to 8 acres in size. It commonly occupies the walls of ravines.

Included with this soil in mapping are small areas of soils that have thin layers of finer textured material in the substratum. Also included are eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. Other included soils have slopes of less than 20 percent or more than 30 percent. In a few areas the surface layer is loam. Some included areas are of soils that are not calcareous within 40 inches of the soil surface. A few areas have cobblestones and stones on the soil surface. At a depth of 10 to 40 inches, the content of pebbles and cobblestones commonly is less than 35 percent.

This soil is used mainly for trees. A few areas are in pasture or are idle.

Surface runoff is rapid. The steep slopes prohibit the use of conventional farm machinery. Trees that resist drought are best suited to this soil. The erosion hazard is very severe where this soil is unvegetated. If this soil is disturbed to a considerable depth, it is difficult to stabilize, and considerable work is needed to prevent sloughing. This soil has severe limitations for most nonfarm uses, especially those for which steepness is a consideration. (Capability unit VIIs-2; woodland suitability group 5s3)

Hadley Series

The Hadley series consists of soils that are deep, level or nearly level, well drained, and loamy throughout their profile. These soils are mainly along the Winooski, Lamoyille, Browns, and La Platte Rivers and the tributaries to these streams. These soils formed in silt loam or very fine sandy loam on the flood plains. Nearly all areas of Hadley soils have been plowed.

A typical cultivated Hadley soil has a very dark grayish-brown very fine sandy loam surface layer about 6 inches thick. The material under the surface layer is dark grayish-brown very fine sandy loam to a depth of about 27 inches and is dark grayish-brown silt loam below this depth.

Hadley soils have a moderately high available moisture capacity and high natural fertility. Their permeability is moderate. Although these soils are saturated during the rainy periods in spring, the water disappears quickly after the rains stop. The soils dry out quickly and are ready for planting earlier than many of the soils in the county. These soils remain moist below the surface layer during most growing seasons. The erosion hazard is severe when floodwater flows swiftly across the areas. Deposition or removal of soil materials during flooding is a problem. Manure spread from the stable commonly is removed from the bottom lands by floodwaters. Hadley soils have a low shrink-swell potential.

Hadley soils are used mainly for hay, corn grown for

silage, and pasture. A small acreage is used for grain corn.

Representative profile of Hadley very fine sandy loam, frequently flooded, in a hayfield 50 feet west of State Route 117 and about 15 feet east of the Essex-Jericho town line:

- Ap—0 to 6 inches, very dark grayish-brown (2.5Y 3/2) very fine sandy loam; weak, very fine, granular structure; very friable; many grass roots; neutral; abrupt, smooth boundary.
- C1—6 to 14 inches, dark grayish-brown (2.5Y 4/2) very fine sandy loam; weak, very fine, granular structure; very friable; many grass roots; neutral; abrupt, smooth boundary.
- C2—14 to 27 inches, dark grayish-brown (10YR 4/2) very fine sandy loam; weak, very fine, granular structure; very friable; common grass roots; neutral; abrupt, wavy boundary.
- IIC3—27 to 41 inches +, dark grayish-brown (2.5Y 4/2) silt loam; weak, very fine, granular structure; very friable; few grass roots; slightly acid.

The A horizon has a hue of 2.5Y or 10YR, value of 3 or 4, and chroma of 2. It is slightly acid or neutral. The C horizon is 5Y, 2.5Y, or 10YR in hue, 3 to 5 in value, and 2 to 4 in chroma. It is very fine sandy loam, silt loam, or loamy very fine sand.

The Hadley soils are mostly near the Winooski and Limerick soils. Hadley soils lack mottles throughout, but mottles occur in the Winooski and Limerick soils in some parts of the profile.

Hadley very fine sandy loam (Hf).—This soil has slopes of 0 to 3 percent. It occupies irregularly shaped areas that are 2 to 50 acres in size. The profile of this soil is similar to that described as representative for the series but is browner in the subsoil.

Included with this soil in mapping are small areas of Hadley soils, frequently flooded, and of the Winooski and Agawam soils. The more nearly level areas of this soil have a higher proportion of wetter soils included than the more sloping areas. In a few areas sand and gravel have been deposited on the soil surface by floodwaters. Small areas of soils that have slopes of more than 3 percent are also included. Other included areas are of soils that have layers of coarser textured material beneath the surface layer. Included in a few areas are soils that are coarser textured throughout.

A large acreage of this soil is used for corn grown for silage, hay, and pasture. A very small acreage is in corn for grain. A few areas are woodland or are idle. Roads and a railroad occupy much of this soil in the Winooski River Valley.

Surface runoff is slow. The hazard of water erosion is very slight. This soil responds to good management and is suited to all crops commonly grown in the county. It can be farmed intensively without risk of damage. Because it is high enough above the stream, this soil is under water for only a short time. Flooding usually is in spring and rarely damages crops. This soil is seldom flooded every year for several years, but flooding is a limitation for nonfarm uses. (Capability unit I-1; woodland suitability group 3o2)

Hadley very fine sandy loam, frequently flooded (Hh).—This soil has slopes of 0 to 3 percent. It occupies irregularly shaped areas that are 2 to 100 acres in size. The profile of this soil is the one described as representative for the Hadley series.

Included in mapping are small areas of the Hadley

very fine sandy loam that is not frequently flooded and of Winooski and Limerick soils. The Hadley and Winooski soils are on the higher mounds or slight elongated rises. Limerick soils are in depressions. In a few areas, sand and gravel have been deposited on the soil surface by swiftly flowing streams. Also included are small areas of soils that have slopes of more than 3 percent. Other inclusions are of soils that have layers of coarser textured material beneath the surface layer. In some areas the soils are coarser throughout.

A large acreage of this soil is used for corn grown for silage, hay, and pasture. A few areas are woodland or are idle.

Surface runoff is slow, and hazard of water erosion is slight. This soil responds to good management and is suited to all crops commonly grown in the county. It can be farmed intensively without risk of damage to the soils. Flooding is in spring in most areas. Lime, manure, or commercial fertilizer spread on the soil surface or stockpiled may be removed or damaged by floodwaters. Also, farm equipment left on this soil during floods may be damaged or ruined. In a few areas, considerable debris is left by the floodwater. Flooding is a limitation for nonfarm uses. (Capability unit IIw-1; woodland suitability group 3o2)

Hartland Series

The Hartland series consists of soils that are deep, well drained, and loamy throughout their profile. These soils formed in water-laid or wind-laid deposits of silt loam or very fine sandy loam that are more than 4 feet deep. Under these deposits are coarser textured material at a depth of more than 4 feet. These soils range from gently sloping to steep. They are mainly along the edges of high terraces near the Winooski and Lamoille Rivers.

A representative wooded Hartland soil is covered with about an inch of undecomposed and partly decomposed needles and leaves. This organic layer is underlain by grayish-brown, very fine sandy loam about 1 inch thick. The upper part of the subsoil is very friable, yellowish-brown very fine sandy loam about 6 inches thick. In plowed areas the upper part of the subsoil is mixed into the plow layer. The lower part of the subsoil is very friable, light yellowish-brown and pale-olive very fine sandy loam about 16 inches thick. The substratum is olive and olive-brown silt loam and very fine sandy loam to a depth of 41 inches or more.

The bright color in the subsoil and lack of mottles throughout the soil indicate that these soils are well aerated. They have a high natural fertility. Permeability is moderate in the surface layer and subsoil and moderately slow in the substratum. The available moisture capacity is moderately high. These soils remain moist beneath the surface layer during most growing seasons. Although these soils are saturated during rainy periods in spring, the water disappears quickly after the rain stops. The soils dry out quickly and are ready for planting earlier than most soils in the county. Shrink-swell potential is low.

The less sloping areas of Hartland soils are used mainly for hay and pasture. The steeper areas are woodland or are idle.

A representative profile of a wooded Hartland very fine sandy loam, 1 mile north of the junction of Snipe Island Road and U.S. Highway No. 2, in the town of Richmond:

- O1—1 to $\frac{3}{4}$ inch, hemlock and white pine needles and gray birch and maple leaves.
 O2— $\frac{3}{4}$ inch to 0, partly decomposed needles and leaves.
 A2—0 to 1 inch, grayish-brown (2.5Y 5/2) very fine sandy loam; weak, very fine, granular structure; very friable; many tree roots; very strongly acid; abrupt, smooth boundary.
 B21r—1 to 7 inches, yellowish-brown (10YR 5/6) very fine sandy loam; weak, very fine, granular structure; very friable; many tree roots; strongly acid; abrupt, smooth boundary.
 B22r—7 to 16 inches, light yellowish-brown (2.5Y 6/4) very fine sandy loam; weak, very fine, granular structure; very friable; many tree roots; medium acid; abrupt, smooth boundary.
 B3—16 to 23 inches, pale-olive (5Y 6/3) very fine sandy loam; weak, very fine, granular structure; very friable; many tree roots; medium acid; abrupt, smooth boundary.
 C1—23 to 26 inches, olive (5Y 5/3) silt loam; moderate, thin, platy structure; friable; common tree roots; strongly acid; abrupt, smooth boundary.
 C2—26 to 41 inches, olive-brown (2.5Y 4/4) mixed with pale olive (5Y 6/3) very fine sandy loam; weak, very thin, platy structure; very friable; common tree roots; medium acid.

Thickness of the solum ranges from 14 to 30 inches. The A1 horizon, where present, has a hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 3. It ranges from very strongly acid to neutral. The A2 horizon has a hue of 2.5Y, value of 5, and chroma of 1 or 2.

The B horizon is 10YR to 5Y in hue, 4 to 6 in value, and 2 to 6 in chroma. It is silt loam or very fine sandy loam and ranges from strongly acid to neutral.

The C horizon has a hue of 2.5Y or 5Y, value of 3 to 6, and chroma of 2 to 4. It is silt loam, very fine sandy loam, loamy very fine sand, and very fine sand. Reaction ranges from strongly acid to neutral.

The Hartland soils are mainly near the Adams, Agawam, and Hadley soils. Hartland soils are finer textured than the Adams and Agawam soils. The subsoil of Hartland soils is more distinct than that of the Hadley soils.

Hartland very fine sandy loam, 2 to 6 percent slopes (H1B).—This soil is in areas that are irregularly shaped and about 2 to 10 acres in size. It occupies terraces. The slopes range from 50 to 200 feet in length.

The profile of this soil is similar to that described as representative for the series but, in most places, has a plow layer about 5 to 10 inches thick. This layer is a mixture of the surface layer, subsurface layer, and upper part of the subsoil.

Included with this soil in mapping are small areas of Agawam and Belgrade soils. Belgrade soils are in slight depressions. Agawam soils are in areas where the Hartland soils join the coarser textured soils on the terraces. In a few included areas the surface layer is silt loam. The subsoil and substratum are sandy loam and fine sandy loam in a few areas. Also included are soils that have a redder subsoil than this Hartland soil.

This soil is used for hay, pasture, and intertilled crops. A very small acreage is woodland or is idle.

This soil responds to good management and is suited to the crops commonly grown in the county. Surface runoff is slow. The hazard of water erosion is slight where this soil is being prepared for seeding or where cultivated crops are grown. Because of the gentle slopes, water ordi-

narily does not stand on the surface. Exceptions are in the small depressions. This soil has limitations for a few nonfarm uses, especially those for which slope is a consideration. (Capability unit IIe-4; woodland suitability group 3o2)

Hartland very fine sandy loam, 6 to 12 percent slopes (H1C).—This soil is in irregularly shaped areas that are about 2 to 25 acres in size. It occupies terraces above the flood plain of rivers and smaller streams. Slopes range from 50 to 200 feet in length.

The profile of this soil is similar to that described as representative for the series but, in most places, has a plow layer about 5 to 10 inches thick. This layer is a mixture of the surface layer, subsurface layer, and upper part of the subsoil.

Included with this soil in mapping are small areas of Agawam and Belgrade soils. Agawam soils are in areas where the Hartland soils join the coarser textured soils on the terraces. Belgrade soils are near the bottom of slopes and are level or slightly depressional. In a few included areas, the soils have a reddish-brown or yellowish-red subsoil. Also included are eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. In a few areas the subsoil and substratum are sandy loam and fine sandy loam. The surface layer is silt loam in a few places.

This soil is used mainly for hay, pasture, and intertilled crops. A few small areas are woodland or are idle.

This soil responds to good management and is suited to the crops commonly grown in the county. Surface runoff is medium. The hazard of water erosion is moderate where this soil is being prepared for seeding or where cultivated crops are grown. The main hazard in cultivated areas is erosion, especially sheet erosion. Diversions help to protect long slopes. The addition of organic matter to this soil helps to maintain good soil structure and to increase infiltration. Because the soil is sloping, water ordinarily does not stand on the surface. This soil has limitations for many nonfarm uses, especially those for which steepness is a consideration. (Capability unit IIIe-4; woodland suitability group 3r2)

Hartland very fine sandy loam, 12 to 25 percent slopes (H1D).—This soil is in irregularly shaped areas about 2 to 30 acres in size. It occupies terraces above the flood plains of rivers and smaller streams. Slopes range from 50 to 300 feet in length.

The profile of this soil is similar to that described as representative for the series but, in most places, has a plow layer about 5 to 10 inches thick. This layer is a mixture of the surface layer, subsurface layer, and upper part of the subsoil.

Included with this soil in mapping are small areas of Agawam and Belgrade soils. The Agawam soils occur where the Hartland soils join the coarser textured soils on terraces and gully walls. Belgrade soils are in concave areas. A few areas on terrace breaks have short steep slopes. Also included are eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. In a few areas are soils that have a reddish-brown or yellowish-red subsoil. The subsoil and substratum are sandy loam or fine sandy loam in a few areas. The surface layer is silt loam in a few places.

This soil is used mainly for pasture, hay, and trees. A few areas on the lesser slopes are in intertilled crops. A small acreage is idle.

This soil responds to good management and is suited to the crops commonly grown in the county. Surface runoff is rapid. The erosion hazard is severe where this soil is being prepared for seeding or where cultivated crops are grown. The steeper slopes make use of modern farm machinery hazardous. The main hazard in cultivating this soil is erosion, especially sheet erosion. Long slopes should be protected with diversions. The addition of organic matter is a help in maintaining good soil structure and increasing infiltration. Because of the moderately steep slopes, water ordinarily does not stand on the soil surface. This soil has severe limitations for many nonfarm uses, especially those for which steepness of slope is a consideration. (Capability unit IVe-2; woodland suitability group 3r5)

Hartland very fine sandy loam, 25 to 60 percent slopes (HIE).—This soil is in irregularly shaped areas about 2 to 70 acres in size. It occupies terrace edges, gully walls, knolls, ridges, or hills. Its slopes range from 50 to 300 feet in length. The profile of this soil is the one described as representative for the Hartland series.

Included with this soil in mapping are small areas of Agawam, Adams, and Windsor soils. Agawam, Adams, and Windsor soils occur where the Hartland soils join the coarser textured soils on the terraces. These included soils also occupy the walls of stabilized gullies. Also included are eroded areas that have not been vegetated. In a few areas the subsoil and substratum are fine sandy loam or sandy loam. The surface layer is silt loam in a few places.

This soil is used mainly for unimproved pasture and trees. A small acreage is idle.

Surface runoff is very rapid. The hazard of water erosion is very severe where this soil is unvegetated. The steep slopes makes the use of modern farm machinery difficult and hazardous. This soil has severe limitations for many nonfarm uses, especially those for which steepness of slope is a consideration. (Capability unit VIIe-2; woodland suitability group 3r6)

Hinesburg Series

The Hinesburg series consists of soils that are deep and well drained. They are nearly level to steep. These soils formed in sandy deltas, on beaches, and on terraces underlain by medium-textured lacustrine materials at a depth of less than 40 inches. Hinesburg soils are mainly in the northern half of the Champlain Valley. Areas start in the town of South Burlington and continue north to the Franklin County line. A small acreage is in the town of Shelburne.

A representative profile of a Hinesburg soil has a very dark grayish-brown fine sandy loam surface layer about 8 inches thick. The upper part of the subsoil is a very friable, olive-brown loamy fine sand about 12 inches thick. The lower part of the subsoil is loose, brown to light olive-brown fine sand or loamy fine sand about 8 inches thick. The substratum, between a depth of about 28 and more than 48 inches, is friable, dark-gray to brown fine sandy loam or very fine sandy loam. It is

mottled with yellowish red, olive brown, and yellowish brown.

The Hinesburg soils have low natural fertility and a moderately low available moisture capacity. Permeability is rapid in the sandy material and moderately slow in the silty material. The finer textured layers hold a significant amount of moisture available for plants, and they also keep the sandy material above them moist. These layers give an otherwise droughty soil a higher available moisture capacity. The bright colors in the subsoil indicate these soils are well aerated most of the time. These soils are saturated with water during periods in the spring, but this water disappears quickly after the rains stop. Since these soils dry out quickly, they are ready for planting earlier than most soils in the county.

These soils are filled to capacity with available moisture at the start of the growing season. As the growing season progresses, rainfall normally is not adequate to replenish the soil moisture used by plants. Crops, therefore, show signs of lack of moisture during extended dry periods. These soils warm faster in spring than the more silty, more clayey, or wetter soils in the county. They are easily tilled and can be cultivated throughout a wide range of moisture content without puddling, crusting, or becoming cloddy. The Hinesburg soils can be worked sooner after rains than most soils in the county. These soils are susceptible to soil blowing where not vegetated. Shrink-swell potential is low.

The Hinesburg soils are used mainly for corn grown for silage, hay, and pasture. A small acreage is woodland or is idle.

Representative profile of a Hinesburg fine sandy loam in a hayfield in Milton, approximately 1.5 miles south-southeast of Chimney Corner on U.S. Highway No. 7, then approximately 500 feet northeast of this highway:

- Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; moderate, very fine and fine, granular structure; friable; many roots; less than 1.0 percent coarse fragments; neutral; clear, smooth boundary.
- B21r—8 to 11 inches, olive-brown (2.5Y 4/4) loamy fine sand; moderate, very fine and fine, granular structure; very friable; many roots; less than 1.0 percent coarse fragments; neutral; clear, smooth boundary.
- B22—11 to 20 inches, olive-brown (2.5Y 4/4) loamy fine sand; weak, very fine, granular structure; very friable; common roots; less than 1.0 percent coarse fragments; neutral; clear, smooth boundary.
- IIB23—20 to 26 inches, light olive-brown (2.5Y 5/4) fine sand; few, fine, faint, light olive-brown (2.5Y 5/6) mottles; single grain; loose; common roots; less than 1.0 percent coarse fragments; neutral; clear, smooth boundary.
- IIIB3—26 to 28 inches, mixed brown (7.5YR 4/4) and light olive-brown (2.5Y 5/4) loamy fine sand; single grain; loose; few roots; less than 1.0 percent coarse fragments; neutral; clear, smooth boundary.
- IVC1—28 to 32 inches, dark-gray (5Y 4/1) fine sandy loam; few, fine, prominent, yellowish-red (5YR 4/6) mottles and many, fine, distinct, olive-brown (2.5Y 4/4) mottles; massive; friable; few roots; less than 1.0 percent coarse fragments; neutral; clear, smooth boundary.
- VC2—32 to 48 inches, brown (10YR 4/3) very fine sandy loam; many, fine, distinct mottles of yellowish brown (10YR 5/6 and 5/8); massive; friable; few roots; less than 1.0 percent coarse fragments; neutral; clear, smooth boundary.

The solum ranges from 16 to 28 inches in thickness. Depth to moderately coarse textured and medium-textured materials

ranges from 16 inches to less than 40 inches. Reaction ranges from medium acid to neutral in the sandy material and is slightly acid or neutral in the finer textured material.

The A horizon has a hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. The B horizon is 7.5YR to 2.5Y in hue, 4 or 5 in value, and 4 to 6 in chroma. The C horizon has a hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 4.

Hinesburg soils generally are near the moderately well drained Belgrade, Eldridge, and Vergennes soils, the somewhat poorly drained Munson and Raynham soils, and the poorly drained Enosburg, Covington, and Whately soils. The Hinesburg soils have a coarser textured surface layer and subsoil than the Belgrade soils. Mottles are at a greater depth in the Hinesburg soils than in the Eldridge soils. Hinesburg soils have generally brighter color in the subsoil than the Enosburg and Whately soils. The upper part of the Hinesburg soils is sandier than the Munson, Raynham, Vergennes, and Covington soils.

Hinesburg fine sandy loam, 0 to 3 percent slopes (HnA).—This soil occupies irregularly shaped areas that are 2 to 25 acres in size. Slopes range from 50 to 300 feet in length.

Included with this soil in mapping are areas of Belgrade, Deerfield, Duane, and Eldridge soils in slight depressions. At lower elevations, there are a few included areas where silty clay loam, silty clay, or clay instead of very fine sandy loam or silt loam is under the sandy materials. In a few areas the surface layer is fine sand or loamy fine sand.

This soil is used mainly for hay, corn grown for silage, truck crops, and pasture. A small acreage is woodland or is idle.

Because areas mapped as this soil have more inclusions of wetter soils than areas of steeper Hinesburg soils, tillage is delayed longer in the spring and following heavy rains. This soil can be farmed intensively without risk of damage if the fertility and good structure are maintained. Surface runoff is very slow. The erosion hazard is slight where this soil is being prepared for seeding or when cultivated crops are grown. This soil has limitations for many nonfarm uses, especially those for which permeability, texture of the surface layer, and texture of substratum are considerations. (Capability unit IIs-2; woodland suitability group 4s4)

Hinesburg fine sandy loam, 3 to 8 percent slopes (HnB).—This soil occupies irregularly shaped areas 2 to 20 acres in size. Slopes range from 50 to 300 feet in length.

Included with this soil in mapping are areas of Belgrade, Deerfield, Duane, and Eldridge soils in slight depressions. Also included are a few eroded spots that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. At lower elevations, a few mapped areas have silty clay loam, silty clay, or clay instead of very fine sandy loam and silt loam under the sandy material. In a few areas the surface layer is fine sand or loamy fine sand.

This soil is used mainly for hay, corn grown for silage, and pasture. A small acreage is woodland or is idle.

Because areas mapped as this soil have fewer inclusions of wetter soils than areas of less sloping Hinesburg soils, tillage is not delayed so long in the spring and following heavy rains. This soil responds to good management and is suited to the crops commonly grown in the county. Surface runoff is slow. The erosion hazard is slight where this soil is being prepared for seeding or where cultivated crops are grown. The addition of

organic matter helps in maintaining good soil structure. This soil has limitations for many nonfarm uses, especially those for which steepness, permeability, and texture of the surface layer and of the substratum are considerations. (Capability unit IIs-2; woodland suitability group 4s4)

Hinesburg fine sandy loam, 8 to 15 percent slopes (HnC).—This soil has smooth, convex slopes and occupies irregularly shaped areas. Areas are 2 to 20 acres in size. The profile of this soil is the one that is described as representative for the series.

Included with this soil in mapping are small areas of moderately well drained Belgrade, Deerfield, Duane, and Eldridge soils and well drained Adams and Windsor soils. The moderately well drained inclusions are more nearly level than this soil or are in slight depressions. In many places the Adams and Windsor soils are included on the higher mounds or slight elongated rises. Also in many places, Adams and Windsor soils are at the same elevation as this Hinesburg soil. In a few areas, there are included eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. The surface layer is fine sand or loamy fine sand in a few areas. At lower elevations, a few areas have silty clay loam, silty clay, or clay instead of very fine sandy loam and silt loam under the sandy material. A few areas have gullies that are crossable with farm machinery.

This soil is used mainly for hay, corn grown for silage, and pasture. A small acreage is woodland or is idle.

This soil responds to good management and is suited to the crops commonly grown in the county. Surface runoff is medium. The hazard of water erosion is moderate where this soil is being prepared for seeding or where cultivated crops are grown. The addition of organic matter helps in maintaining good soil structure and in increasing the water-holding capacity of the surface layer. The main hazard in cultivating this soil is water erosion, especially sheet erosion. Long slopes should be protected by diversions. This soil has limitations for many nonfarm uses, especially those for which steepness, permeability, and texture of the surface layer are considerations. (Capability unit IIIe-8; woodland suitability group 4s4)

Hinesburg fine sandy loam, 15 to 25 percent slopes (HnD).—This soil has smooth, convex slopes and occupies irregularly shaped areas which are 2 to 20 acres in size. Slopes range from 50 to 200 feet in length. The profile of this soil is similar to that described as representative for the series.

Included with this soil in mapping are small areas of the moderately well drained Belgrade, Deerfield, Duane, and Eldridge soils and the well drained Adams and Windsor soils. The moderately well drained inclusions are more nearly level or are in slight depressions. In many places the well-drained inclusions are on the higher mounds or slight elongated rises. Also in many places, the well-drained inclusions are at the same elevation as this Hinesburg soil. In a few places, there are eroded areas that have not been vegetated or have been in cultivated crops too frequently without conservation practices. At lower elevations a few areas have silty clay loam, silty clay, or clay instead of very fine sandy

loam and silt loam under the sandy material. In a few places the surface layer is fine sand or loamy fine sand. A few areas are gullied. The gullies are crossable with farm machinery in some places and uncrossable in others.

This soil is used mainly for pasture and trees. A small acreage is used for hay, and a few areas are idle.

Surface runoff is medium. The erosion hazard is severe where this soil is being prepared for seeding. Because of the steep slopes, water does not stand on the soil surface. These slopes make the use of modern farm machinery hazardous. This soil has limitations for many nonfarm uses, especially those for which steepness and permeability are considerations. (Capability unit IVE-6; woodland suitability group 4s5)

Hinesburg fine sandy loam, 25 to 60 percent slopes (HnE).—This soil occupies irregularly shaped, long, narrow, smooth areas that are 2 to 20 acres in size. Slopes range from 50 to 200 feet in length.

Included with this soil in mapping are small areas of Adams and Windsor soils. A few included areas have not been vegetated and are eroded. At the lower elevations, a few areas have silty clay loam, silty clay, or clay instead of very fine sandy loam and silt loam under the sandy material. In a few areas the surface layer is fine sand or loamy fine sand.

This soil is used mainly for trees. A small acreage is in unimproved pasture, and a few areas are idle.

Surface runoff is rapid. The hazard of water erosion is very severe where this soil is not vegetated. Steep slopes make the use of modern farm machinery hazardous. This soil has severe limitations for many nonfarm uses, especially those for which steepness and permeability are considerations. (Capability unit VIIe-2; woodland suitability group 4s5)

Limerick Series

The Limerick series consists of soils that are deep, poorly drained, and loamy throughout their profile. These soils range from depressional to level. They are most extensive near the mouths of the Winooski, Lamoille, and La Platte Rivers. A smaller acreage is near the Browns River in the towns of Jericho, Essex, and Westford and near most other small streams in the county. Limerick soils formed in silt loam and very fine sandy loam. These soils are flooded or ponded at least once a year, and the kind of sediment often differs with each flood. In most places sediment has not been in place long enough for a strongly developed soil profile to form.

A representative profile of a Limerick soil has a very dark grayish-brown silt loam surface layer about 3 inches thick. The subsoil is friable, olive-gray silt loam about 8 inches thick. It is mottled throughout with dark red, dusky red, and very dusky red. The substratum starts at a depth of about 11 inches and continues to more than 72 inches below the soil surface. It is friable, dark-gray to olive-gray, stratified silt loam and very fine sandy loam. Mottles, mostly of dark reddish brown and dusky red, occur throughout the substratum.

Limerick soils have high natural fertility and a moderately high available moisture capacity. Permeability

is moderate in the upper part of the soil profile and moderately slow in the lower part. Limerick soils have low shrink-swell potential.

In most areas Limerick soils are low enough in relation to stream level that they are often under water for periods of 1 to 2 weeks in the spring and fall. A few areas are flooded for periods of only a few days. The dull colors and mottles in the soil profile indicate that these soils are saturated with water for extended periods. A normally high water table keeps them wet from late in fall to late in spring. During the wetter part of the year, water stands at or near the soil surface. Water ponds on the surface of the more nearly level areas during the wetter part of the year and following heavy rains.

These soils occupy positions that receive runoff water from other adjacent soils at higher elevations. Limerick soils remain wet for significant periods after rains. These soils warm slower in the spring than the other soils in the county. They remain moist beneath the surface layer during the growing season. The normally high water table restricts plant rooting depth. The hazard of erosion is severe when swift floodwater flows across areas of these soils. Deposition or removal of soil material during flooding is a problem. Removal of manure spread from the stable commonly occurs. Farm machinery is easily bogged down when these soils are wet. Weed control is a concern on these wet soils. Cultivating and spraying are hampered unless the water table is lowered. Artificial drainage is necessary for best growth of crops.

Limerick soils are used mainly for hay and pasture. A small acreage is in corn grown for silage. The wetter areas and areas not practical to drain because of lack of suitable outlets are idle or are woodland.

A representative profile of a pastured Limerick silt loam in the town of Colchester, about 2.2 miles northwest of the city of Winooski, 600 yards southwest of Pine Island, and 500 yards north of the Winooski River:

- Ap—0 to 3 inches, very dark grayish-brown (2.5Y 3/2) silt loam; moderate, fine, granular structure; friable; many grass roots; strongly acid; abrupt, smooth boundary.
- B21g—3 to 7 inches, olive-gray (5Y 4/2) silt loam; few, fine, prominent, dark-red (2.5YR 3/6) and dusky-red (2.5YR 3/2) mottles; weak, fine, subangular blocky and weak, thin, platy structure; friable; many grass roots; a few concretions less than 3 millimeters in diameter cemented with iron; strongly acid; clear, wavy boundary.
- B22g—7 to 11 inches, olive-gray (5Y 4/2) silt loam; few, fine, prominent, very dusky red (2.5YR 2/2) mottles and many, fine and medium, prominent, dark-red (2.5YR 3/6) mottles; weak, medium, platy structure; friable; common grass roots; strongly acid; clear, wavy boundary.
- IC1g—11 to 18 inches, dark-gray (5Y 4/1) silt loam; common, fine, prominent, dark reddish-brown (5YR 3/4) mottles; horizon contains layers of olive-gray (5Y 4/2) loamy very fine sand that are one-half inch thick and have few, fine, distinct, light olive-brown (2.5Y 5/6) mottles; average texture for entire horizon is very fine sandy loam; massive; friable; common grass roots; strongly acid; clear, wavy boundary.
- IC2g—18 to 28 inches, olive-gray (5Y 4/2) very fine sandy loam that has few, fine, distinct, dark yellowish-

brown (10YR 4/4) mottles; horizon contains a few layers of olive-gray (5Y 4/2) very fine sand that are one-half inch thick and have common, medium, prominent, dark reddish-brown (5YR 3/4) mottles; average texture for entire horizon is very fine sandy loam; massive; friable; common grass roots; strongly acid; clear, wavy boundary.

IIIC3g—28 to 40 inches, dark-gray (5Y 4/1) silt loam that has thin bands of coarser material; many, fine and medium, prominent, dark reddish-brown (2.5YR 2/4 and 3/4) mottles; massive; friable; few grass roots; medium acid; clear, wavy boundary.

IVC4g—40 to 50 inches, dark-gray (5Y 4/1) silt loam; common, coarse, prominent, dusky-red (10R 3/3) mottles on ped faces and dusky-red (10R 3/3) coatings in root and worm channels; weak, coarse, prismatic structure; friable; few grass roots; slightly acid; gradual, smooth boundary.

VC5g—50 to 58 inches, dark-gray (5Y 4/1) very fine sandy loam; many, coarse, prominent, dusky-red (10R 3/3) and few, fine, distinct, dark-brown (10YR 4/3) mottles; massive; friable; few grass roots; medium acid; clear, wavy boundary.

VIC6g—58 to 65 inches, dark-gray (5Y 4/1) silt loam; common, coarse, prominent, dusky-red (10R 3/3) mottles and common, coarse, distinct, weak-red (10R 4/4) mottles; weak, coarse, prismatic structure; friable; slightly acid; clear, wavy boundary.

VIC7g—65 to 72 inches, dark-gray (N 4/0) silt loam; olive (5Y 4/3) stains in old root channels; massive; friable; neutral.

These soils are dominantly silt loam or very fine sandy loam to a depth of 40 inches. Lenses of loamy very fine sand and very fine sand are present in a few profiles, but average content of fine sand and coarser material is less than 15 percent.

The A horizon is 10YR to 5Y in hue, 2 to 4 in value, and 2 to 3 in chroma. It ranges from strongly acid to neutral. The B and C horizons have a hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2, or colors are neutral and have a value of 4 or 5. The B and C horizons range from strongly acid to neutral.

In most places Limerick soils are near the well drained Hadley soils, the moderately drained Winooski soils, and the very poorly drained Muck and peat. Limerick soils have distinct and prominent mottles mainly beneath the surface layer, but the Winooski and Hadley soils do not. The parent material of Limerick soils is mineral, but that of Muck and peat is organic.

Limerick silt loam (le).—This soil has slopes of 0 to 3 percent. It occupies irregularly shaped areas that are 2 to 200 acres in size. The profile of this soil is the one described as typical for the Limerick series.

Included with this soil in mapping are the Winooski soils on the higher mounds or slightly elongated rises. Also included are small areas of soils that are sandy loam or fine sandy loam in the subsoil and substratum. In other included areas, sandy material commonly is within 40 inches of the soil surface. Where sandy material is in the soil profile, the soils are commonly in the small areas and are in the smaller stream valleys. In a few included areas, slopes are more than 3 percent. Included in some areas are soils that have thin layers of organic material, silty clay loam, or silty clay in the subsoil and substratum. In a few areas the surface layer is fine sandy loam, very fine sandy loam, mucky fine sandy loam, or mucky very fine sandy loam.

This soil is used mainly for hay and pasture. A small acreage is in corn grown for silage or is idle.

Artificial drainage is necessary for best growth of crops but, in many places, is difficult because suitable outlets are lacking. This soil can be farmed intensively

without risk of damage if the fertility and good soil structure are maintained. The addition of organic matter helps in maintaining good soil structure and in increasing infiltration. Surface runoff is very slow. The erosion hazard is very slight. Lime, manure, or commercial fertilizer spread on the soil surface or stockpiled is likely to be removed or damaged by floodwater. Also, farm equipment left on this soil may be damaged or ruined by floods. In most areas considerable time is needed to remove the debris left by the floodwater. This soil has severe limitations for many nonfarm uses, especially those for which flooding and wetness are considerations. (Capability unit IIIw-2; woodland suitability group 4w3)

Limerick silt loam, very wet (lf).—This soil is depressional or level and has slopes of less than 1 percent. It occupies irregularly shaped areas that are 2 to 100 acres in size. The profile of this soil is similar to that described as representative for the series, but it has organic material in the subsoil, the substratum, or both.

Included with this soil in mapping are soils on the higher mounds and slightly elongated rises that are not flooded for such long periods as is this soil. In a few included areas, slopes are more than 1 percent. Also included are small areas of soils that are sandy loam or fine sandy loam in the subsoil and substratum. A few areas have sandy material within 40 inches of the soil surface. The soils that have sandy material in their profile are commonly in small areas and in the smaller stream valleys. In a few areas the surface layer is fine sandy loam, very fine sandy loam, mucky fine sandy loam, or mucky silt loam. Included in some areas are soils that have thin layers of finer textured material in the subsoil and substratum.

This soil is idle or is in woodland. If it is drained, it is used for hay and pasture. The potential for the development of habitat for wetland wildlife is good.

Artificial drainage is necessary for best growth of crops. Water commonly ponds on this soil, but drainage is difficult because suitable outlets are lacking in many areas. This soil can be farmed intensively without risk of damage if the fertility and good structure are maintained. The addition of organic matter helps in maintaining good structure. The hazard of water erosion is slight. Lime, manure, or commercial fertilizer spread on the soil surface or stockpiled is likely to be removed or damaged by floodwater. Also, farm equipment left on this soil may be damaged or ruined by floods. In most areas considerable time is needed to remove the debris left by the floodwater. Because of the flooding in many areas, planting is late and harvesting is hindered where corn for silage or a similar crop is grown. This soil has severe limitations for many nonfarm uses, especially those for which wetness and flooding are considerations. (Capability unit VIIw-1; woodland suitability group not assigned)

Livingston Series

The Livingston series consists of soils that are deep, very poorly drained, and clayey throughout their profile. These soils are depressional or level. They occur through-

out the Champlain Valley, where they formed in lacustrine clay. The clay has a high content of lime.

A representative profile of a Livingston soil has a black clay surface layer about 9 inches thick. The subsoil is a gray clay that is about 18 inches thick and is mottled with dark yellowish brown. The substratum starts at a depth of about 27 inches and continues to more than 40 inches below the soil surface. It is gray, calcareous silty clay.

The Livingston soils have a very high natural fertility and a moderately high available moisture capacity. Permeability is very slow. The thick, dark surface layer and the mottled subsoil indicate that these soils are saturated with water for extended periods. The normally high water table keeps these soils wet. It is at or near the soil surface most of the year. Crops in ponded areas are subject to drowning. The normally high water table restricts plant rooting depth. Because of their position, these soils receive runoff water from adjacent soils at higher elevations.

These soils warm more slowly in the spring than many other soils in the county. Farm machinery is easily bogged down when these soils are wet. Application of fertilizer and harvesting are hampered unless the water table is lowered. These soils are sticky, and they puddle if worked when wet. They crust and become cloddy when they dry. The dry clods are very hard and very difficult to crush. Artificial drainage, though essential in most places for crop growth, may be impractical or impossible because suitable outlets are lacking. Livingston soils have a moderate or high shrink-swell potential.

These soils are mainly in woodland. A small acreage is in pasture or is idle.

Representative profile of a Livingston clay in an idle field in the town of Shelburne, $1\frac{3}{4}$ miles east of Shelburne Falls and two-thirds mile north of the Shelburne-Charlotte town line:

- A1—0 to 9 inches, black (10YR 2/1) clay; moderate, very fine and fine, granular structure; sticky and plastic; many fibrous roots; neutral; abrupt, smooth boundary.
- B21g—9 to 18 inches, gray (5Y 5/1) clay; common, medium, prominent, dark yellowish-brown (10YR 4/4) mottles; moderate, fine, subangular blocky structure; slightly sticky and very plastic; few fibrous roots; neutral; abrupt, smooth boundary.
- B22g—18 to 27 inches, gray (10YR 5/1) clay; many, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive in places separating to moderate, fine, subangular blocky structure; firm; sticky and plastic when wet; very few fibrous roots; neutral; abrupt, smooth boundary.
- IICg—27 to 40 inches +, gray (N 5/0) silty clay; many, medium and coarse, distinct, olive-gray (5Y 4/2) and olive (5Y 4/3) mottles; moderate, very fine, angular blocky structure; firm; few to no roots; slightly effervescent in cold, dilute hydrochloric acid.

The solum ranges from 22 to 36 inches in thickness. Depth to calcareous material ranges from 20 to more than 48 inches.

The A horizon has a hue of 5YR to 5Y, value of 2, and chroma of 1, or it is neutral and has a chroma of 2. It is a silty clay or clay and ranges from medium acid to neutral. The B horizon is 10YR to 5Y in hue, 4 or 5 in value, and 1 or 2 in chroma, or it is neutral and has a value of 4 or 5. Reaction ranges from medium acid to mildly alkaline. The

C horizon is similar to the B horizon in color. It is silty clay or clay and ranges from neutral to moderately alkaline.

In most places Livingston soils are near the moderately well drained Vergennes soils and the poorly drained Covington and Scantic soils. The surface layer of Livingston soils has a more mucky appearance than that of the Vergennes, Covington, and Scantic soils. The Livingston soils have more clay in the subsoil than the Scantic soils.

Livingston clay (lh).—This soil is depressional or level and has slopes of 0 to 2 percent. It occupies elongated and elliptical areas 2 to 50 acres in size. The profile of this soil is the one described as representative for the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 2 percent. In a few included areas, the surface layer is a fine sandy loam, very fine sandy loam, loam, silt loam, clay loam, or silty clay loam, or it is mucky and of these textures.

This soil is mostly wooded, pastured, or idle.

Artificial drainage is necessary for crops commonly grown in the county. Water commonly ponds on this soil, and in many places drainage is difficult because suitable outlets are lacking. If fertility and good structure are maintained, this soil can be farmed intensively without risk of damage. The addition of organic matter helps in maintaining good soil structure and in increasing the infiltration. The hazard of water erosion is very slight. This soil has severe limitations for many nonfarm uses, especially those for which wetness is a consideration. (Capability unit IVw-4; woodland suitability group not assigned because of unsuitability for commercial timber)

Livingston silty clay, occasionally flooded (lk).—This soil is level or depressional and has slopes of 0 to 2 percent. It occupies elongated areas 2 to 10 acres in size. The profile of this soil is similar to that described as representative for the series, but its surface layer contains less clay.

Included with this soil in mapping are small areas of clay soils that are moderately well drained. A few included areas have slopes of more than 2 percent. In a few areas the surface layer is a sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, clay loam, silty clay loam, or clay.

This soil is in woodlands or pasture, or it is idle.

Flooding usually is in spring. Lime, manure, or commercial fertilizer spread on the soil surface or stockpiled is likely to be removed or damaged by the floodwater. Artificial drainage is necessary for producing crops commonly grown in the county. Water commonly ponds on this soil, and drainage is difficult because suitable outlets are lacking in many areas. This soil can be farmed intensively after flooding without risk of damage if fertility and good structure are maintained. The addition of organic matter helps in maintaining good soil structure and in increasing infiltration. The hazard of water erosion is slight where this soil is being prepared for seeding or where cultivated crops are grown. This soil has severe limitations for many nonfarm uses, especially those for which flooding and wetness are considerations. (Capability unit VIIw-1; woodland suitability group not assigned because of unsuitability for production of commercial timber)

Lyman Series

The Lyman series consists of soils that are shallow, rocky and very rocky, somewhat excessively drained, and loamy throughout their profile. These soils are sloping to steep. They are in the Green Mountains and the foothills of those mountains to the east of the Champlain Valley. They formed in glacial till derived from mica schist.

A representative Lyman soil returning to woodland is covered with undecomposed litter, about one-half inch thick, consisting of birch, ash, and sugar maple leaves. The uppermost mineral surface layer is very dark gray loam about 1 inch thick. The rest of the plow layer is very dark grayish-brown channery loam about 5 inches thick. The subsoil is a friable, dark reddish-brown channery loam about 13 inches thick. The mica schist bedrock starts at a depth of about 19 inches.

The Lyman soils have very low natural fertility and moderately low available moisture capacity. They are moderately permeable. The bright color of the subsoil indicates that these soils are well aerated most of the time. They are saturated with water during rainy periods in the spring, but the water disappears quickly after the rains stop. Water moves through the soil and flows down-slope on the top of the bedrock. These soils dry out quickly and are ready for planting earlier than most soils in the county. Normally, these soils are filled nearly to capacity with available moisture at the start of the growing season. As the growing season progresses, they cannot supply the moisture needed by plants during extended dry periods. Plant growth, therefore, is slowed during midsummer. The bedrock restricts plant rooting depth. Lyman soils have a low shrink-swell potential.

These soils are mainly wooded. A few areas are used for pasture and hay. Many areas cleared of trees and stones were farmed years ago, but these areas were allowed to return to woodland.

The Lyman soils in Chittenden County were not mapped in individual areas but were mapped in complexes that contain both Lyman and Marlow soils. These soils are intermingled in such intricate patterns that they cannot be separated at the scale of the soil map. A representative profile of the Marlow soils is described under the Marlow series.

Representative profile of a Lyman rocky loam in a stand of young hardwood trees in an old field in Underhill, on the east side of the Pleasant Valley Road, 4½ miles north of Underhill Center:

- O1—½ inch to 0, undecomposed litter of birch, ash, and sugar maple leaves.
- A1—0 to 1 inch, very dark gray (10YR 3/1) loam; moderate, very fine, granular structure; very friable; many tree roots; 10 percent channery fragments; very strongly acid; abrupt, smooth boundary.
- Ap—1 to 6 inches, very dark grayish-brown (10YR 3/2) channery loam; weak, fine, granular structure; friable; many tree roots; 20 percent channery fragments; strongly acid; abrupt, smooth boundary.
- B2ir—6 to 19 inches, dark reddish-brown (5YR 3/4) channery loam; weak, fine, granular structure; friable; many tree roots; 30 percent channery fragments; strongly acid; abrupt, wavy boundary.
- R—19 inches +, greenish-gray mica schist bedrock.

Thickness of the solum ranges from 10 to 20 inches and coincides with the depth to bedrock. Content of coarse frag-

ments ranges from 10 to 35 percent. Reaction ranges from very strongly acid to medium acid throughout the soil.

The A1 and Ap horizons have a hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. The A2 horizon, if present, is light gray (10YR 6/1), dark reddish gray (5YR 4/2), or dark gray (N 4/0).

The upper B horizon, where present, has a hue of 5YR to 10YR and a value and chroma of 3 or 4. The lower B horizon, where present, is 10YR to 5Y in hue, 3 or 4 in value, and 2 to 4 in chroma. The B horizon is sandy loam, very fine sandy loam, or loam, or it is gravelly or channery and of these textures.

Lyman soils are near the somewhat poorly drained and poorly drained Cabot soils, the moderately well drained Peru soils, and the well drained Marlow soils. Lyman soils have bedrock at a depth of less than 20 inches, and the Cabot, Peru, and Marlow soils do not. Lyman soils are similar to the Farmington soils but are more acid in the lower part of the profile.

Lyman-Marlow rocky loams, 5 to 12 percent slopes (LmB).—This is a complex of Lyman and Marlow soils. These soils generally occur together in such intricate patterns that they cannot be mapped separately at the scale used in mapping. Lyman soils occupy about 60 percent of the complex, Marlow soils about 20 percent, and other soils occupy the remaining 20 percent.

These soils have convex slopes and occupy irregularly shaped areas that are 2 to 20 acres in size. Slopes range from 100 to 450 feet in length. In places cobblestones and stones have been removed from the soil surface and piled up along the edges of fields to form fences and walls. Where this mapping unit borders mapped areas of extremely stony or very rocky soils, a straight stone fence or wall is on the boundary separating the two areas. The Marlow soil has a fragipan at a depth of 15 to 30 inches.

Included with these soils in mapping are small areas of Cabot and Peru soils and some areas of moderately deep soils. Cabot soils are in natural draws or near springs, and Peru soils are in the slightly concave areas. The moderately deep soils are in various natural drainage classes and have bedrock from 20 to 40 inches below the soil surface. In a few areas are inclusions of Rock land. Also included are soils that have a fragipan at a depth of less than 15 inches or of more than 30 inches, commonly more than 40 inches. A few included areas consist of soils that are more than 35 percent pebbles and cobblestones at a depth of 10 to 40 inches. Some included soils have slopes of less than 5 percent or of more than 12 percent. In a few areas of Lyman soil, the surface layer is fine sandy loam, gravelly fine sandy loam, channery fine sandy loam, gravelly loam, or channery loam. In a few areas of Marlow soil, the surface layer is loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This mapping unit is used mainly for hay and pasture. A small acreage is in corn grown for silage. A few areas are idle or are reverting to woodland.

Surface runoff is medium. Because the bedrock underlying the Lyman soil and the fragipan in the Marlow soil are impermeable or slowly permeable, absorption of water into them during a rain is negligible. The closer the fragipan or bedrock is to the soil surface, the more quickly the soil above this layer is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. The hazard of water erosion is moderate where these soils are being prepared for seeding or where cultivated crops are grown. The cobblestones, stones, and rock

outcrops are troublesome in tillage and harvesting operations, but they do not prohibit farming. These soils have limitations for many nonfarm uses, especially those for which slow permeability, shallowness to bedrock, rock outcrops, stoniness, and steepness are considerations. (Capability unit IIIe-3; woodland suitability group 4d1)

Lyman-Marlow rocky loams, 12 to 20 percent slopes (I_mC).—These soils generally occur together in areas and are in such intricate patterns that they cannot be mapped separately at the scale used in mapping. Lyman soils occupy about 65 percent of the complex, Marlow soils about 15 percent, and other soils the remaining 20 percent.

These soils have convex slopes and occupy irregularly shaped areas that are 2 to 10 acres in size. Slopes range from 100 to 400 feet in length. In most places cobbles and stones have been cleared off the soil surface and piled up along the edges of the fields to form fences and walls. Where areas of these soils border mapped areas of extremely stony or very stony soils, a straight stone fence or wall is on the boundary separating the two areas. Gravel roads through areas of these soils are very crooked as they wind around bedrock outcrops and areas that are very shallow to bedrock. The profile of this Lyman soil is the one described as typical for the Lyman series. Marlow soil has a fragipan at a depth of 15 to 30 inches.

Included with these soils in mapping are small areas of Cabot and Peru soils and some moderately deep soils. The Cabot and Peru soils are in the more level areas, in natural draws, or near springs. The moderately deep soils are in various natural drainage classes and have bedrock at a depth of 20 to 40 inches. In a few areas, there are inclusions of Rock land. Also included in mapping are soils that have a fragipan at a depth of less than 15 inches or more than 30 inches. This fragipan commonly is more than 40 inches below the soil surface. In a few included areas, the soil is more than 35 percent gravel and cobbles at a depth of 10 to 40 inches. In some included areas, slopes are less than 12 percent, and in others they are more than 20 percent.

In a few areas of Lyman soil, the surface layer is fine sandy loam, gravelly fine sandy loam, gravelly loam, or channery fine sandy loam. In a few areas of Marlow soil, the surface layer is loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This mapping unit is used mainly for hay and pasture. A few areas are wooded or are idle.

Surface runoff is medium to rapid. Because the bedrock and fragipan are impermeable or slowly permeable, absorption of water into them during a rain is negligible. The closer the bedrock and fragipan are to the soil surface, the more quickly the soil above them is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. The hazard of water erosion is severe where these soils are being prepared for seeding or where cultivated crops are grown. The cobbles, stones, and rock outcrops are troublesome in tillage and harvesting operations, but they do not prohibit farming. The use of modern farm machinery is hazardous on the steeper slopes. Management of these soils for woodland consists mainly of preventing

forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. These soils have limitations for many nonfarm uses, especially those for which steepness, rock outcrops, stoniness, and slow permeability are considerations. (Capability unit IVe-3; woodland suitability group 4d2)

Lyman-Marlow very rocky loams, 5 to 30 percent slopes (I_yD).—These soils are generally together in such intricate patterns that they could not be mapped separately at the scale of the soil map. Lyman soils occupy about 65 percent of the complex, Marlow soils about 20 percent, and included soils the remaining 15 percent.

These soils have convex slopes and occupy irregularly shaped areas that are 5 to 600 acres in size. Slopes range from 100 to more than 1000 feet in length. Where this mapping unit borders mapped areas of stony or rocky soils, a straight stone fence or wall is on the boundary separating the two areas. Gravel roads through areas of these soils are very crooked as they wind around bedrock outcrops and areas that are very shallow to bedrock. The Marlow soil in this complex has a fragipan at a depth of 15 to 30 inches.

Included in mapping are small areas of the Peru, Cabot, Stetson, and Colton soils, and some areas are moderately deep soils. The Peru and Cabot soils are in the more nearly level areas, in natural draws, or near springs. The moderately deep soils are in various natural drainage classes and have bedrock at a depth of 20 to 40 inches. In a few areas, there are inclusions of Rock land. Also included are small areas of soils that have a fragipan at a depth of less than 15 inches or of more than 30 inches, and commonly more than 40 inches. In a few included areas, the soil is more than 35 percent pebbles and cobbles at a depth of 10 to 40 inches. Slopes are less than 5 percent or more than 30 percent in some included areas. In a few areas of Lyman soil, the surface layer is fine sandy loam, gravelly fine sandy loam, channery fine sandy loam, gravelly loam, or channery loam. In a few areas the surface layer of Marlow soil is a loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This mapping unit is mainly wooded. A few areas are used for unimproved pasture or are idle. Camps and summer homes are built near many streams, lakes, and ski areas.

The soils in this mapping unit are too rocky and in many areas are too steep to be used for cultivated crops. Bedrock outcrops and loose cobbles interfere with tillage and make preparation of seedbeds difficult. Use of farm machinery is hazardous on the steeper slopes. Surface runoff is medium to rapid, but it is reduced by small hummocks resulting from tree windthrow. Because the bedrock and fragipan are impermeable or slowly permeable, absorption of water into them during a rain is negligible. The closer the bedrock and fragipan are to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. Management of these soils for woodland is mainly

preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. The hazard of water erosion is slight unless these soils are not vegetated, but in unvegetated areas it is moderate to severe, depending on slope. These soils have severe limitations for many nonfarm uses, especially those for which steepness, shallowness to bedrock, slow permeability, and bedrock outcrops are considerations. (Capability unit VI_S-1; woodland suitability group 4x3)

Lyman-Marlow very rocky loams, 30 to 60 percent slopes (LyE).—These soils are generally so closely intermingled that they cannot be mapped separately at the scale used in mapping. Lyman soils make up about 70 percent of this complex, Marlow soils about 20 percent, and included soils the remaining 10 percent.

These soils have convex slopes and occupy irregularly shaped areas that range from 5 to 1,000 acres in size. Slopes range from 100 to more than 1,000 feet in length. Where this mapping unit borders mapped areas of stony or rocky soils, a stone fence or wall is on the boundary separating the two mapped areas. Gravel roads through areas of these soils are very crooked as they wind around bedrock outcrops and areas that are very shallow to bedrock. The profile of the Marlow soil has a slightly thinner surface layer than the one described as representative for the Marlow series. This soil has a fragipan at a depth of 15 to 30 inches.

Included with these soils in mapping are small areas of Cabot, Peru, Stetson, and moderately deep soils. The Cabot and Peru soils are in the more level areas, in natural draws, or near springs. The moderately deep soils are in various natural drainage classes and have bedrock at a depth of 20 to 40 inches. In a few areas, there are inclusions of Rock land. Also included are small areas of soils in which the fragipan is at a depth of less than 15 inches or of more than 30 inches, and commonly more than 40 inches. In a few included areas, the soils are more than 35 percent pebbles and cobbles from 10 to 40 inches below the soil surface. Soils that have slopes of less than 30 percent are also included. In a few included areas of Lyman soil, the surface layer is fine sandy loam, gravelly fine sandy loam, channery fine sandy loam, gravelly loam, or channery loam. Also in a few areas, the surface layer of Marlow soil is a loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

The soils of this complex are used mainly for trees. A few areas on the lesser slopes are used for unimproved pasture. A small acreage is idle.

These soils are too rocky, too steep, and, in many places, too stony to be cultivated. The rock outcrops and stones interfere with tillage and preparing a seedbed. Because slopes are steep or very steep, use of modern farm machinery is very hazardous. Surface runoff is very rapid, but it is reduced by small hummocks resulting from tree windthrow. Because the bedrock and fragipan are impermeable or slowly permeable, absorption of water by these soils during a rain is negligible. The closer the bedrock and fragipan are to the soil

surface, the more quickly the soil above them is saturated. As soon as this zone is saturated, much of the rainwater runs off. Woodland management is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. The hazard of water erosion is slight in vegetated areas and is very severe in areas not vegetated. These soils have severe limitations for many nonfarm uses, especially those for which steepness, shallowness to bedrock, permeability, and bedrock outcrops are considerations. (Capability unit VII_S-2; woodland suitability group 4x4)

Marlow Series

The Marlow series consists of soils that are deep, stony and extremely stony, rocky and very rocky, and well drained. These soils are loamy throughout their profile. They have a fragipan starting at 15 to 30 inches below the soil surface. Water moves slowly through the fragipan but flows readily downhill on top of it. Marlow soils are sloping to steep. These soils are in the Green Mountains, their foothills, and the western hill part of the county. In most places they occupy elongated hills that have smooth slopes. Marlow soils formed in glacial till that was derived from schistose rocks. In a few places, these soils are underlain by gravel, sand, silt, or bedrock at depths of 4 to 6 feet.

A representative profile of a cultivated Marlow soil has a dark grayish-brown loam surface layer about 8 inches thick. The subsurface layer is a pale-brown loam about 3 inches thick. The friable fine sandy loam subsoil is about 13 inches thick and consists of three layers. The upper layer of the subsoil is yellowish brown, the middle layer is reddish brown, and the lower part is grayish brown. The upper part of the substratum is a fragipan consisting of firm, olive gravelly fine sandy loam about 30 inches thick. The lower part of the substratum is not part of the fragipan. It is friable, olive gravelly fine sandy loam extending to a depth below 66 inches. In the lower part below the fragipan, the substratum is mottled with light olive brown.

The Marlow soils have low natural fertility and a medium available moisture capacity. Permeability is moderate above the fragipan and slow in it. The bright color in the upper part of the subsoil and lack of mottles in the surface layer and subsoil indicate that these soils are well aerated most of the time. Early in spring and following heavy rains, the soil layers above the fragipan are saturated with water. Although these soils are saturated at times, the water disappears quickly after the thaws in spring and after the rains stop. Normally, these soils are filled nearly to capacity with available moisture at the start of the growing season. Because the fragipan impedes the growth of roots, plants cannot use the moisture available in it. These soils cannot supply as much moisture to plants during extended dry periods. Because of this lack of moisture, plant growth is less during dry periods on Marlow soils than it is

on similar loamy soils that do not have a fragipan. Marlow soils have low shrink-swell potential.

Marlow soils were too stony for crops, but in many places stones have been removed and crops are grown. These soils are mainly wooded or are idle where the stones have not been removed.

In Chittenden County, Marlow soils were mapped individually and in complexes of Marlow and Lyman soils. The Lyman-Marlow complexes are described under the Lyman series.

Representative profile of a Marlow stony loam in a field in the town of Underhill, approximately 1.2 miles east-southeast of Underhill Center:

- Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; friable; many grass roots; 10 percent coarse fragments; neutral; abrupt, smooth boundary.
- A2—8 to 11 inches, pale-brown (10YR 6/3) loam; weak, fine, granular structure; friable; many grass roots; 15 percent coarse fragments; neutral; abrupt, broken boundary.
- B21ir—11 to 16 inches, yellowish-brown (10YR 5/6) fine sandy loam; very weak, fine, subangular blocky structure; friable; many grass roots; 15 percent coarse fragments; slightly acid; abrupt, wavy boundary.
- B22ir—16 to 20 inches, reddish-brown (2.5YR 5/4) fine sandy loam; very weak, fine, subangular blocky structure; friable; many grass roots; 15 percent coarse fragments; neutral, clear, wavy boundary.
- B3—20 to 24 inches, grayish-brown (2.5Y 5/2) fine sandy loam; weak, medium, platy structure; friable; common grass roots; 15 percent coarse fragments; neutral, abrupt wavy boundary.
- C1x—24 to 35 inches, olive (5Y 5/3) gravelly fine sandy loam; moderate, medium and thick, platy structure; firm; few grass roots; 20 percent coarse fragments; neutral; clear, wavy boundary.
- C2x—35 to 54 inches, olive (5Y 5/3) gravelly fine sandy loam; few, coarse, distinct, light olive-brown (2.5Y 5/6) mottles; moderate, medium and thick, platy structure; firm; 20 percent coarse fragments; neutral; clear, wavy boundary.
- C3—54 to 66 inches, olive (5Y 5/3) gravelly fine sandy loam; few spots or mottles of light olive brown (2.5Y 5/4); weak, medium, platy structure; friable; 25 percent coarse fragments; slightly acid.

Depth to the fragipan ranges from 15 to 30 inches below the soil surface. The content of coarse fragments ranges from 5 to 35 percent throughout the profile. The reaction ranges from strongly acid to neutral.

The A1 or Ap horizon has a hue of 5YR to 10YR, value of 2 to 4, and chroma of 1 to 3. The A2 horizon is 7.5YR to 10YR in hue, 4 to 6 in value, and 1 to 3 in chroma.

The B2 horizons are 2.5YR to 10YR in hue, 3 to 5 in value, and 2 to 6 in chroma. The B3 horizon has a hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. The B horizons are loam, fine sandy loam, or gravelly or channery loam.

The C and Cx horizons have a hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or 3. The C horizons range from sandy loam to loam or are gravelly or channery sandy loam or loam. The Cx horizons are firm or very firm. The C3 horizon is friable.

The reaction of these soils is less acid than in the range defined for the series, but this does not alter their usefulness or behavior.

Marlow soils are near the somewhat poorly drained and poorly drained Cabot soils, the moderately well drained Peru soils, and the somewhat excessively drained Lyman soils. Marlow soils are generally brighter in the subsoil than the Cabot soils. Mottles are lacking in the lower part of the subsoil in Marlow soils, but not in the Peru soils. Marlow soils have bedrock at a depth of more than 40 inches, but bedrock is less than 20 inches below the surface in Lyman soils.

Marlow stony loam, 5 to 12 percent slopes (MaB).—

This soil has convex slopes and occupies irregularly shaped areas that are 2 to 20 acres in size. Slopes range from 100 to 500 feet in length. The cobblestones and stones removed from the soil surface have been piled up along the edges of fields to form fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two areas. This soil is on hillsides or ridges. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Peru soils and moderately deep soils. Peru soils are in the more nearly level areas, slight depressions, or natural draws. The moderately deep soils are in various natural drainage classes; they have bedrock at a depth of 20 to 40 inches. A few included areas are of a soil that is more than 35 percent gravel and cobblestones from 10 to 40 inches below the soil surface. Also included are soils that have a fragipan at a depth of less than 15 inches or of more than 30 inches, and commonly more than 40 inches. Soils that have slopes of less than 5 percent are included in some areas. Other inclusions are of soils that are non-stony. In a few areas, the surface layer is a loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This soil is used mainly for hay and pasture. A small acreage is in corn grown for silage. A few areas are wooded or are idle.

Surface runoff is medium. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. The hazard of water erosion is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Cobblestones and stones are troublesome in tillage and harvesting operations, but they do not prohibit the farming of this soil. This soil has limitations for many nonfarm uses, especially those uses where slow permeability, stoniness, and steepness of slope are considerations. (Capability unit IIIe-2; woodland suitability 3o2)

Marlow stony loam, 12 to 20 percent slopes (MaC).—

This soil has convex slopes and occupies irregularly shaped areas that are 2 to 20 acres in size. Slopes range from 100 to 500 feet in length. The cobblestones and stones cleared off the soil surface have been piled along edges of the fields to form fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two areas. This soil is on hillsides, ridges, or knolls.

Included with this soil in mapping are small areas of Peru and Lyman soils and of moderately deep soils. Peru soils are in the more nearly level areas, slight depressions, or natural draws. In most areas the Lyman soils are on the higher mounds or slightly elongated rises. The moderately deep soils are in various natural drainage classes and have bedrock at a depth of 20 to 40 inches. In a few included areas, the soil is more than 35 percent gravel and cobblestones from 10 to 40 inches below the soil surface. Also included are soils that have a fragipan at a depth of less than 15 inches or of more than 30 inches; commonly, the fragipan is at a depth of more than 40

inches. Some included soils have slopes of less than 12 percent, and others have slopes of more than 20 percent. Nonstony soils also are included. In a few areas, the surface layer is a loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This soil is used mainly for hay and pasture. A small acreage of the less sloping areas is used for corn grown for silage. The steeper slopes are commonly wooded, and a few areas are idle.

Surface runoff is medium to rapid. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. The hazard of water erosion is severe where this soil is being prepared for seeding or where cultivated crops are grown. The cobbles and stones are troublesome in tillage and harvesting operations, but they do not prohibit farming. Use of modern farm machinery is hazardous on the steeper slopes. Woodland management on the steeper slopes is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. This soil has limitations for many nonfarm uses, especially those uses for which slow permeability, stoniness, and steepness are considerations. (Capability unit IVe-2; woodland suitability group 3r4)

Marlow stony loam, 20 to 30 percent slopes (McD).—This soil has convex slopes and occupies irregularly shaped areas that are 2 to 10 acres in size. Slopes range from 100 to 400 feet in length. The cobbles and stones cleared off the soil surface have been piled along the edges of the fields to form fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two areas. This soil is on hillsides or ridges.

Included with this soil in mapping are small areas of Peru and Lyman soils and some areas of moderately deep soils. The Peru soils are in the more nearly level areas, in natural draws, or near springs. In most places the Lyman soils are on the higher mounds or slightly elongated rises. The moderately deep soils are in various natural drainage classes and have bedrock at a depth of 20 to 40 inches. In a few included areas, the soil is more than 35 percent gravel and cobbles from 10 to 40 inches below the soil surface. Also included are soils that have a fragipan at a depth of less than 15 inches or of more than 30 inches; commonly, the fragipan is at a depth of more than 40 inches. Soils that have slopes of less than 20 percent or of more than 30 percent are included in some areas. Nonstony or very stony soils also are included. In a few areas, the surface layer is loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This soil is used mainly for trees and unimproved pasture. A small acreage in the less sloping areas is occasionally used for hay. A few areas are idle.

This soil has severe limitations for farming. The moderately steep slopes make the use of modern farm machinery hazardous. Surface runoff is rapid, but it is reduced

by small hummocks resulting from tree windthrow. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above it is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. Woodland management is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. The hazard of water erosion is slight where this soil is vegetated and severe where it is not. This soil has severe limitations for many nonfarm uses, especially those for which slow permeability, steepness, and stoniness are considerations. (Capability unit VIe-2; woodland suitability group 3r4)

Marlow extremely stony loam, 5 to 20 percent slopes (MeC).—This soil has convex slopes and occupies irregularly shaped areas that are 5 to 40 acres in size. Slopes range from 100 to 700 feet in length. Where this soil borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two areas. This soil is on hillsides or ridges.

Included with this soil in mapping are small areas of Peru, Lyman, and Stetson soils, and of moderately deep soils. The Peru soils are in the more nearly level areas, slight depressions, or natural draws. In most places the Lyman soils are on the higher mounds or slightly elongated rises. The Stetson soils are in the higher valleys and on lower slopes. The moderately deep soils are in various natural drainage classes and have bedrock at a depth of 20 to 40 inches. In a few areas the soil is more than 35 percent gravel and cobbles at a depth of 10 to 40 inches. Also included are soils that have a fragipan at a depth of less than 15 inches or of more than 30 inches, and commonly more than 40 inches. In some included areas, slopes are less than 5 percent or are more than 20 percent. Nonstony or very stony soils also are included. In a few areas, the surface layer is loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This soil is used mainly for trees and unimproved pasture. A few areas are idle.

This soil is too stony to be used for farming. Loose stones interfere with the operation of modern farm machinery. Surface runoff ranges from medium to rapid, but it is slowed by hummocks resulting from tree windthrow. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. Woodland management of this soil is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. The erosion hazard is slight where this soil is vegetated and moderate to severe where it is not. This soil has limitations for many nonfarm uses, especially those for which slow permeability, stoniness, and steepness are consider-

ations. (Capability unit VIIIs-2; woodland suitability group 3x2)

Marlow extremely stony loam, 20 to 60 percent slopes (MeE).—This soil has convex slopes and occupies irregularly shaped areas that are 5 to 60 acres in size. Slopes range from 100 to 900 feet in length. Where this soil borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two areas. This soil is on hillsides or ridges.

Included with this soil in mapping are small areas of Peru, Lyman, Stetson soils, and of moderately deep soils. The Peru soils are mainly in small wet areas in natural draws or near springs. In most places the Lyman soils are on the higher mounds or slightly elongated rises. The Stetson soils are in the higher valleys and on the lower slopes. The moderately deep soils are in various natural drainage classes and have bedrock at a depth of 20 to 40 inches. In a few included areas, the soil is more than 35 percent pebbles and cobblestones at a depth of 10 to 40 inches. Also included are soils that have a fragipan at a depth of less than 15 inches or of more than 30 inches; commonly, the fragipan is at a depth of more than 40 inches. Soils that have slopes of less than 20 percent are included in some areas. Nonstony and very stony soils are also included. In a few areas, the surface layer is loam, gravelly loam, channery loam, gravelly fine sandy loam, or channery fine sandy loam.

This soil is used mainly for trees. A small acreage where the soil is less sloping is used for unimproved pasture. A few areas are idle.

This soil is too stony and steep to be used for farming. Loose stones interfere with the operation of modern farm machinery. The steep slopes make the use of modern farm machinery very hazardous. Surface runoff is very rapid, but it is reduced by small hummocks resulting from tree windthrow. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. Woodland management is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and brush and weeds. The hazard of water erosion is slight where this soil is vegetated and very severe where it is not. This soil has severe limitations for many nonfarm uses, especially those for which steepness, stoniness, and slow permeability are considerations. (Capability unit VIIIs-2; woodland suitability group 3x4)

Massena Series

The Massena series consists of soils that are deep, stony and extremely stony, and somewhat poorly drained to poorly drained, and loamy throughout their profile. These soils are level to sloping. Massena soils are mainly between State Route 116 and U.S. Highway No. 7, south of the city of Burlington. They formed in glacial till that was derived from siliceous rocks mixed with various proportions of limestone. Massena soils are

neutral in reaction throughout the soil. All soil layers contain pebbles, cobblestones, and stones.

A representative profile of a cultivated Massena soil has a dark-brown silt loam surface layer about 9 inches thick. The subsoil is friable silt loam about 16 inches thick. It is grayish brown in the upper part and dark brown in the lower part. The subsoil is mottled with yellowish brown throughout. The substratum, from a depth of 25 inches to more than 40 inches, is firm, grayish-brown very fine sandy loam mottled with dark yellowish brown.

Massena soils have very high natural fertility and a medium available moisture capacity. Permeability is moderate in the upper part of the soil and moderately slow to slow in the lower part. The dark-colored surface layer and mottled subsoil indicate that these soils are saturated with water for extended periods. A normally high water table keeps them wet from late in fall to late in spring. During the wetter part of the year, water stands at less than a foot below the soil surface. The water passes through the soil until it reaches the firm layer. Then, movement through this layer is impeded, but the water accumulates on the surface of the firm layer and flows downslope. During the wetter part of the year and following heavy rains, water ponds on the soil surface of the more nearly level areas. These soils receive runoff water from adjacent soils at higher elevations. Massena soils remain wet for significant periods after rains. They warm more slowly in spring than many other soils in the county, and remain moist beneath the surface layer during most growing seasons. The normally high water table restricts plant rooting depth. Farm machinery is easily bogged down when these soils are wet. Unless the water table is lowered, weed control is more difficult and spraying and harvesting are hampered. These soils puddle and become cloddy and compact if tilled when too wet. Some artificial drainage is needed for continued good crop growth. Massena soils have a low shrink-swell potential.

In most places the Massena soils are too stony for farm crops, but a few areas have been cleared of stones. The stone-cleared areas are used mainly for hay and pasture, though a few areas are idle. The areas not cleared of stones are used as woodland or for unimproved pasture.

Representative profile of a Massena stony silt loam in a pasture in the town of Charlotte, 1 mile east of U.S. Highway No. 7:

- Ap—0 to 9 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; friable; many grass roots; less than 5 percent fragments; neutral; abrupt, smooth boundary.
- B21g—0 to 14 inches, grayish-brown (2.5Y 5/2) silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, angular blocky structure; friable; common grass roots; 5 percent coarse fragments of quartzite and limestone; neutral; abrupt, smooth boundary.
- B22—14 to 25 inches, dark-brown (10YR 4/3) silt loam; many, coarse, faint, yellowish-brown (10YR 5/6) mottles and common, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, thin, platy structure; friable; few grass roots; less than 5 percent coarse fragments of quartzite and limestone; neutral; abrupt, smooth boundary.
- 11Cg—25 to 40 inches +, grayish-brown (10YR 5/2) very fine sandy loam; many, coarse, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, thin, platy structure; firm in place, friable when removed; few to no roots; less than 5 percent coarse fragments of quartzite and limestone; neutral.

The solum ranges from 18 to 33 inches in thickness. The content of coarse fragments ranges from less than 5 to 35 percent throughout the profile. These soils are medium acid to neutral in the solum and slightly acid to neutral in the substratum. A few profiles are calcareous within 40 inches of the soil surface.

The A horizon has a hue of 10YR, value of 3 or 4, and chroma of 1 to 3. The B horizon is 10YR or 2.5Y in hue, 4 or 5 in value, and 2 to 4 in chroma. It is fine sandy loam, loam, or silt loam, or is gravelly fine sandy loam, gravelly sandy loam, or gravelly loam. The C horizon has a hue of 10YR to 5Y, value of 4 or 5, chroma of 1 to 4. It is fine sandy loam, very fine sandy loam, gravelly fine sandy loam, or gravelly very fine sandy loam.

In most places Massena soils are near the moderately well drained, Georgia soils, the well drained Nellis and Stockbridge soils, and the somewhat excessively drained Palatine and Farmington soils. The subsoil of Massena soils is generally duller in color than that of the Georgia, Nellis, Stockbridge, Palatine, and Farmington soils. Also, Massena soils are deeper to bedrock than the Palatine and Farmington soils. Massena soils do not have a fragipan, but the Cabot soils do.

Massena stony silt loam, 0 to 15 percent slopes (MnC).—This soil occupies circular areas 2 to 9 acres in size. Slopes range from 100 to 350 feet in length. The cobblestones and stones cleared off the soil surface have been piled along the edges of fields to form fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is the boundary separating the two areas. The profile of this soil is the one described as representative for the Massena series.

Included with this soil in mapping are small areas of Georgia and Peacham soils. Georgia soils are on the higher mounds or slightly elongated rises. Peacham soils occupy more nearly level or depressional areas or are in drainageways. A few included areas in the western part of the Champlain Valley contain soils that have a calcareous substratum. Also included is a soil that has a friable substratum. In a few areas, the soil is more than 35 percent pebbles and cobblestones at a depth of 10 to 40 inches. In a few included areas, the surface layer is fine sandy loam, loam, gravelly fine sandy loam, gravelly loam, or gravelly silt loam.

This soil is used mainly for hay, improved pasture, and corn grown for silage. A small acreage is wooded or is idle.

Surface runoff ranges from very slow to medium and depends on the steepness of the slope. Because the firm substratum has moderately slow or slow permeability, it absorbs only a negligible amount of water during a rain. The closer this firm layer is to the soil surface, the more quickly the soil above it is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. The erosion hazard depends on steepness. It ranges from very slight to moderate where this soil is being prepared for seeding or where cultivated crops are grown. In the more level areas, this soil has more inclusions of wetter soils than it has in steeper areas and tillage is delayed longer in spring and following heavy rains. Although pebbles and cobbles are common, they do not stop the operation of farm machinery. This soil has severe limitations for many nonfarm uses, especially those for which wetness and steepness are considerations. (Capability unit IIIw-4; woodland suitability group 4w4)

Massena extremely stony silt loam, 0 to 15 percent slopes (MoC).—This soil occupies circular depressions that

are 2 to 20 acres in size. Slopes range from 100 to 400 feet in length. Where this soil borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two areas. The profile of this soil is similar to that described as representative for the series but has a thinner surface layer.

Included in mapping are small areas of Georgia and Peacham soils. Georgia soils are on the higher mounds or slightly elongated rises. Peacham soils occupy the more nearly level or depressional areas and drainageways. Also included are soils that are very stony. A few included areas are of soils that are more than 35 percent pebbles and cobblestones at a depth of 10 to 40 inches. In some included areas, there is a soil that has a friable substratum. A few areas in the western part of the Champlain Valley contain soils that have a calcareous substratum. In a few included areas, the surface layer is fine sandy loam, loam, gravelly fine sandy loam, gravelly loam, or gravelly silt loam.

This soil is used mainly for trees and unimproved pasture. A small acreage is idle.

Surface runoff ranges from very slow to medium, depending on the steepness of slope. Surface runoff, however, is reduced by small hummocks resulting from tree windthrow and from cattle trampling soft ground between the stones. Because the substratum has moderately slow or slow permeability, water absorbed into it during a rain is negligible. The closer this firm layer is to the soil surface, the more quickly the soil above it is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. Depending on the steepness of slope, the erosion hazard is very slight to moderate where this soil is not vegetated. This soil is too stony to be used for the farm crops commonly grown in the county. Loose stones interfere with tillage and make preparation of seedbeds difficult. This soil has severe limitations for many nonfarm uses, especially those for which wetness, stoniness, and steepness are considerations. (Capability unit VIIs-2; woodland suitability group 4x2)

Muck and Peat

Muck and peat (Mp) consist of deposits of organic material that range from 18 inches to 30 feet or more in depth. These black or very dark brown organic deposits formed in what were once shallow ponds. The organic material consists of fairly well decomposed remains of reeds, sedges, and woody plants. In places they contain undecomposed pieces of wood. These soils are extremely wet. Water stands on the surface early in spring and late in fall. At other times the water table is at the surface or only a few inches below it. In the Champlain Valley, these organic soils are over clay or sand in most places. In the hills they are over loamy or sandy material. In a few areas Muck and peat are underlain by marl that is 2 or 3 feet thick.

These soils are too wet for farm crops and for most nonfarming purposes. Although water moves readily through them to a depth of several feet, they are difficult to drain because suitable outlets for drainage ditches are lacking. On the flood plain of the Winooski River, they are at approximately the same level as the water in the

stream during much of the growing season. In other places, constructing outlets for drainage ditches is costly and difficult. (Capability unit VIIw-1; woodland suitability group not assigned)

Munson Series

The Munson series consists of soils that are deep and somewhat poorly drained. These soils are gently sloping to moderately steep. They formed in thin deposits of loamy material and in the underlying clayey material. The largest acreage of Munson soils is in the towns of Colchester, Essex, Milton, and Westford. A smaller acreage is in most of the towns in Chittenden County. These soils developed in very fine sandy loam and silt loam underlain by heavy silty clay loam, silty clay, and clay within 40 inches of the soil surface. In a few places, Munson soils are underlain by bedrock or loamy glacial till that starts at a depth of 48 inches below the soil surface.

A representative profile of a Munson soil has a brown silt loam surface layer about 8 inches thick. The upper part of the subsoil is a friable, grayish-brown and olive silt loam that is mottled and about 7 inches thick. The lower part of the subsoil is a firm, olive-brown to greenish-gray silty clay loam and silty clay about 9 inches thick. The substratum starts at a depth of about 24 inches and continues to more than 56 inches below the soil surface. It is a firm, brown to greenish-gray silty clay.

Munson soils have high natural fertility and a moderately high available moisture capacity. Permeability is moderate or moderately slow in the loamy layers and slow or very slow in clayey layers. The mottled subsoil indicates that these soils are saturated with water for extended periods. These periods are from late in fall to late in spring. During spring the seasonal water table stands at less than a foot below the soil surface. During summer it recedes to a depth of 3 feet or more. These soils remain wet for a long time following heavy rains. The slowly and very slowly permeable clayey layers are a major factor in keeping these soils excessively wet during wet seasons. Plants have difficulty in developing a good root system in the clayey layers because these layers are wet and firm.

These soils remain moist beneath the surface layer during most growing seasons. They warm more slowly in the spring than most soils in the county. Their surface layer crusts and becomes cloddy if these soils are tilled when they are too wet. Wetness delays farm operations in spring and following rains. Farm machinery is easily bogged down. Weed control also is more difficult than for most soils in the county. The growth of farm crops is reduced unless these soils are artificially drained. Shrink-swell potential is low to moderate.

Munson soils are used mainly for hay and pasture. A small acreage is in corn grown for silage. The steeper areas are in trees or are idle.

The Munson soils were not mapped separately in Chittenden County. They were mapped with Belgrade soils and with Raynham soils in undifferentiated groups. Belgrade and Raynham soils are described under their respective series.

Representative profile of a Munson silt loam in a hay-

field, about 2 miles northeast of Essex Center (as the crow flies), then 60 feet east of State Route 128:

- Ap-0 to 8 inches, brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable; many roots; medium acid; abrupt, smooth boundary.
- B21g-8 to 11 inches, grayish-brown (2.5Y 5/2) silt loam; common, fine, prominent, yellowish-brown (10YR 5/4, 5/6, and 5/8) mottles, and common, fine, distinct, olive-brown (2.5Y 4/4) mottles; moderate, medium, subangular blocky structure; friable; many roots; medium acid; clear, smooth boundary.
- B22g-11 to 15 inches, olive (5Y 5/3) silt loam; common, fine, distinct, olive-brown (2.5Y 4/4) and yellowish-brown (10YR 5/4) mottles and common, fine, faint, olive-gray (5Y 5/2) mottles; weak, thin and medium, platy structure separating to weak, very fine, granular; friable; common roots; less than 1 percent coarse fragments; slightly acid; clear, smooth boundary.
- IIB23g-15 to 19 inches, grayish-brown (2.5Y 5/2) silty clay loam; common, fine, distinct, olive-brown (2.5Y 4/4), light olive-brown (2.5Y 5/6), brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) mottles; weak, medium, prismatic structure separating to moderate, fine and medium, angular blocky; firm; common roots; less than 1 percent coarse fragments; slightly acid; clear, smooth boundary.
- IIIB3g-19 to 24 inches, mixed greenish-gray (5G 6/1, 5GY 5/1, and 5GY 6/1), dark grayish-brown (2.5Y 4/2) and olive-brown (2.5Y 4/4) silty clay; weak, coarse, subangular blocky structure; firm; common roots; less than 1 percent coarse fragments; neutral; clear, smooth boundary.
- IIIC1g-24 to 38 inches, varves of olive (5Y 4/3) and dark-brown (7.5YR 3/2) silty clay; common, fine, distinct, greenish-gray (5GY 5/1 and 5G 5/1) mottles; moderate, fine and medium, platy structure; firm; few roots; less than 1 percent coarse fragments; neutral; gradual, smooth boundary.
- IIIC2g-38 to 56 inches, varves of olive (5Y 5/3 and 5Y 4/3), greenish-gray (5G 5/1), and brown (7.5YR 5/4) silty clay; moderate, thin and medium, platy structure; firm; few roots to depth of 45 inches, no roots below 45 inches; less than 1 percent coarse fragments; neutral.

The solum ranges from 14 to 30 inches in thickness. Depth to the clayey material ranges from 13 to 38 inches.

The A horizon has a hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is medium acid to neutral. The B and C horizons are 5G or 5GY in hue, 5 or 6 in value, and 1 in chroma; 2.5Y or 5Y in hue, 4 or 5 in value, and 2 to 4 in chroma; or 7.5YR in hue, 5 in value, and 4 in chroma.

Munson soils are mostly near the somewhat excessively drained Lyman and Farmington soils, the well drained Hartland soils, the moderately well drained Belgrade soils, the somewhat poorly drained Raynham soils, the poorly drained Scantic soils, and the very poorly drained Livingston soils. Munson soils are deeper to bedrock than the Lyman and Farmington soils. Their content of clay is greater in the lower part of the soil than that in the lower part of the Hartland, Belgrade, and Raynham soils. Munson soils have less clay in the upper part of the subsoil than the Scantic and Livingston soils.

Munson and Belgrade silt loams, 12 to 25 percent slopes (MuD).—An individual area of this mapping unit may consist of the Munson soil, the Belgrade soil, or the two soils together. These soils occupy elliptical hillocks and stabilized gully walls. They also occupy elongated hillocks on old glacial lake plains and terraces. Areas of these soils range from about 2 to 40 acres in size. Slopes range from 50 to 200 feet in length. Areas of these soils in hay or intertilled crops have smooth surfaces. These soils have mounds resulting from tree windthrow in wooded areas and uneven sur-

faces caused by cattle trampling in areas of permanent pasture.

The profiles of these soils are similar to those described as representative for the two series but have a thinner surface layer. Also, the surface layer of the Belgrade soil is silt loam.

Included with these soils in mapping are small areas of Hartland, Peru, and Cabot soils. Hartland soils are on the higher mounds or slightly elongated rises. Cabot and Peru soils are in areas where the Munson and Belgrade soils join soils that formed in glacial till. In a few areas are soils that have short slopes of more than 25 percent. Also included are eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. In a few areas of Belgrade soils, included soils are sandy loam and fine sandy loam in the subsoil and substratum. Also in a few areas, the surface layer of Belgrade soils and of Munson soils is very fine sandy loam.

This mapping unit is used mainly for hay and pasture. A few of the steeper areas are idle or wooded.

Surface runoff is rapid, but it is reduced by the uneven surface caused by cattle trampling and tree windthrow. The erosion hazard is moderate where these soils are being prepared for seeding or where cultivated crops are grown. Steepness makes the use of modern farm machinery hazardous. These soils have severe limitations for many nonfarm uses, especially those for which wetness and steepness are considerations. (Both soils, capability unit IVE-1; Munson soil, woodland suitability group 4w6; Belgrade soil, woodland suitability group 3r5)

Munson and Raynham silt loams, 2 to 6 percent slopes (MyB).—These soils occupy irregularly shaped, elliptical hillocks and elongated hillocks on glacial lake plains and terraces. Areas range from 2 to 30 acres in size. Slopes range from 50 to 300 feet in length. These soils have a smooth surface where they are in hay or intertilled crops. In wooded areas, there are mounds resulting from tree windthrow. In permanent pasture the surface is uneven because of trampling cattle. The profiles of the Munson and Raynham soils are the ones described as representative for the respective series.

Included in this mapping unit are small areas of Hartland and Belgrade soils. Hartland and Belgrade soils are on the higher mounds or slightly elongated rises. Also included are eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. In a few areas of Belgrade soils, the subsoil and substratum are sandy loam and fine sandy loam. Included soils that are adjacent to soils formed in glacial till have pebbles, cobblestones, and stones on the soil surface. In a few included areas, the surface layer is very fine sandy loam.

Most areas of these soils are used for farming. Hay, intertilled crops, and pasture are the most important uses. A small acreage is wooded or is idle. Houses and roads are built in areas of changing land use.

Surface runoff is medium, but the erosion hazard is only slight where these soils are being prepared for seeding or where cultivated crops are grown. The addition of organic matter helps in maintaining good soil

structure and in increasing infiltration. Because areas mapped as these soils have more inclusions of wetter soils than areas of steeper Munson and Raynham soils, tillage is delayed longer in spring and following heavy rains. These soils have limitations for many nonfarm uses, especially those for which wetness, permeability, and texture are considerations. (Munson soil, capability unit IIw-3; Raynham soil, capability unit IIIw-1; both soils, woodland suitability group 4w5)

Munson and Raynham silt loams, 6 to 12 percent slopes (MyC).—These soils occupy irregularly shaped, elliptical hillocks and elongated hillocks on glacial lake plains and terraces. Areas of these soils range from 2 to 65 acres in size, and slopes range from 50 to 200 feet in length. Areas in hay and intertilled crops have a smooth soil surface. These soils have mounds resulting from tree windthrow in wooded areas and an uneven surface caused by cattle trampling in permanent pasture. The profiles of these soils are similar to those described as representative for the two series but have a thinner surface layer.

Included in this mapping unit are small areas of Belgrade and Hartland soils. They are on the higher mounds or slightly elongated rises. Also included are eroded areas that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. In a few areas, the Raynham soils are sandy loam and fine sandy loam in the subsoil and substratum. Also included, adjacent to soils formed in glacial till, are soils that have pebbles, cobblestones, and stones on the soil surface. In a few included areas, the surface layer is very fine sandy loam.

Most areas of these soils are used for farming. Hay, pasture, and intertilled crops are the most important uses. A few areas are idle or are wooded. In areas of changing land use, houses and roads are built.

Surface runoff is medium to rapid, but it is reduced by uneven soil surface caused by cattle trampling and by mounds resulting from tree windthrow. The hazard of water erosion is moderate where these soils are being prepared for seeding or where cultivated crops are grown. The addition of organic matter helps in maintaining good soil structure and in increasing infiltration. Since areas mapped as these soils have fewer inclusions of wetter soils than areas of less sloping Munson and Raynham soils on steeper slopes, tillage is not delayed so long in the spring and following heavy rains. These soils have limitations for many nonfarm uses, especially those for which wetness and steepness are considerations. (Both soils, capability unit IIIe-1; both soils, woodland suitability group 4w5)

Nellis Series

The Nellis series consists of soils that are deep, stony and extremely stony, and well drained. These soils are loamy throughout their profile. They are gently sloping to steep. Nellis soils generally occupy low, rounded hills and elongated hills in the Champlain Valley near Lake Champlain. They formed in glacial till that was derived from calcareous shale and limestone.

A representative profile of a cultivated Nellis soil has a dark grayish-brown loam surface layer about

9 inches thick. The upper part of the subsoil is friable, yellowish-brown silt loam about 5 inches thick. The lower part of the subsoil is friable, dark yellowish-brown silt loam about 7 inches thick. The substratum starts at a depth of about 21 inches and continues to more than 40 inches below the soil surface. It is friable, dark grayish-brown, channery loam that is calcareous.

Nellis soils have a medium available moisture capacity and very high natural fertility. Their permeability is moderate. The bright colors in the subsoil and lack of mottles throughout the soil indicate that these soils are well aerated most of the time. They are saturated with water in spring, though this water disappears quickly after the rain stops. Since these soils dry out quickly, they are ready for planting earlier than most soils in the county. Because these soils have no restrictive layers, plants develop a good root system. Shrink-swell potential is low.

Nellis soils are used mainly for hay, corn grown for silage, and improved pasture where the stones have been removed. They are mainly wooded and pastured where the stones have not been removed. A small acreage is idle.

The Nellis soils were not mapped separately in Chittenden County. They were mapped with Stockbridge soils in undifferentiated groups. These groups are described under the Stockbridge series.

Representative profile of a Nellis stony loam in a cultivated field in the town of Charlotte, 3 miles northwest of the village of Charlotte, 1 mile east of Lake Champlain, and two-thirds mile south of the Shelburne-Charlotte town line:

- Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam; moderate, fine, subangular and granular structure; friable; many grass roots; 10 percent coarse fragments of shale and limestone; neutral; abrupt, smooth boundary.
- B21—9 to 14 inches, yellowish-brown (10YR 5/4) silt loam; moderate, fine, granular structure; friable; common grass roots; 10 percent coarse fragments of shale and limestone; neutral; abrupt, smooth boundary.
- B22—14 to 21 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, fine, subangular blocky structure; friable; common grass roots; 15 percent coarse fragments of shale and limestone; neutral; abrupt, smooth boundary.
- C—21 to 40 inches +, dark grayish-brown (10YR 4/2) channery loam; moderate, fine and very fine, subangular blocky structure; friable; common grass roots; 30 percent coarse fragments of shale and limestone; effervesces violently in cold, dilute hydrochloric acid.

The depth to calcareous material and the thickness of the solum range from 15 to 30 inches. The content of coarse fragments ranges from 5 to 20 percent in the solum and from 15 to 35 percent in the substratum.

The A horizon has a hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is slightly acid or neutral. The B horizon is 10YR in hue, 4 or 5 in value, and 3 or 4 in chroma. It is loam, silt loam, gravelly loam, gravelly silt loam, channery loam, or channery silt loam. Reaction is slightly acid to neutral. The C horizon is 10YR or 2.5Y in hue, 3 or 4 in value, and 2 in chroma. It is loam, silt loam, channery loam, channery silt loam, gravelly loam, or gravelly silt loam. The C horizon is friable or firm.

Nellis soils are near the moderately well drained Georgia and Vergennes soils, the well drained Stockbridge soils, and the somewhat excessively drained Palatine soils. Nellis soils lack mottles in the subsoil, but Georgia soils do not. Texture is coarser in the Nellis soils than in the Vergennes. The sub-

stratum of Nellis soils is calcareous, whereas that of the Stockbridge soils is not. Bedrock is more than 40 inches below the soil surface of Nellis soils, but less than 40 inches in the Palatine soils.

Palatine Series

The Palatine series consists of soils that are moderately deep, somewhat excessively drained, and loamy throughout their profile. Rock outcrops range from none to very few. These soils are gently sloping to steep. They occupy low, rounded and elongated hills near Lake Champlain. Palatine soils formed in glacial till that was derived from calcareous shale and limestone. They are underlain by weakly consolidated shale at a depth of 20 to 40 inches.

A representative profile of a Palatine soil in an idle field has a dark-brown silt loam surface layer about 5 inches thick. The subsoil is friable, yellowish-brown shaly silt loam about 12 inches thick. The substratum is friable, dark grayish-brown very shaly silt loam about 8 inches thick. Bedrock is at a depth of about 25 inches and is calcareous, very dark grayish-brown shale.

Palatine soils have very high natural fertility and a moderately low available moisture capacity. Their permeability is moderate. The bright colors in the subsoil and lack of mottles throughout the soil indicate these soils are well aerated most of the time. They are saturated with water during periods in the spring, though this water disappears quickly after the rains stop. Since these soils dry out quickly, they are ready for planting earlier than most soils in the county. These soils normally are filled nearly to capacity with available moisture at the start of the growing season. As the growing season progresses, they cannot supply the moisture needed by plants during extended dry periods. The bedrock at a moderate depth restricts the growth of roots. Shrink-swell potential is low.

Palatine soils are used mainly for hay, pasture, and corn grown for silage. Most of the steeper areas are idle or in unimproved pasture.

Representative profile of a Palatine silt loam in an idle field in the town of Charlotte, on Jones Hill, 200 yards east of U.S. Highway No. 7 and about three-fourths mile northeast of the village of Charlotte:

- A1—0 to 5 inches, dark-brown (10YR 3/3) silt loam; strong, fine and medium, granular structure; friable; many roots; 5 percent coarse fragments; neutral; abrupt, smooth boundary.
- B2—5 to 17 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak, medium and coarse, granular structure; friable; common roots; 35 percent coarse fragments; moderately alkaline; strongly effervescent in cold, dilute hydrochloric acid; abrupt, wavy boundary.
- C1—17 to 25 inches, dark grayish-brown (10YR 4/2) very shaly silt loam; weak, thin, platy structure; friable; few roots; 50 percent coarse fragments; violently effervescent in cold, dilute hydrochloric acid; abrupt, smooth boundary.
- R—25 inches +, very dark grayish-brown (10YR 3/2) shale; effervesces violently in cold, dilute hydrochloric acid.

The solum ranges from 15 to 22 inches in thickness. Bedrock is at a depth ranging from more than 20 inches to less than 40 inches. The subsoil and substratum are loam, silt loam, or shaly or very shaly loam and silt loam.

The A horizon has a hue of 10YR, value of 2 or 3, and chroma of 2 or 3. The content of coarse fragments ranges from 5 to 30 percent. The A horizon ranges from slightly acid to mildly alkaline.

The B horizon is dark brown (10YR 4/3) or yellowish brown (10YR 5/4). It is massive or has granular structure. The content of coarse fragments ranges from 25 to 50 percent. The B horizon is neutral to moderately alkaline.

The C horizon has a hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 2 or 3. The content of coarse fragments ranges from 35 to 70 percent.

Palatine soils are mostly near the somewhat excessively drained Farmington soils, the well drained Nellis and Stockbridge soils, and the moderately well drained Vergennes and Georgia soils. Palatine soils have bedrock at a depth of more than 20 inches, but the Farmington soils do not. The clay content throughout the profile of Palatine soils is less than in the Vergennes soils. Bedrock is at a depth of less than 40 inches below the surface of Palatine soils, but it is at a greater depth in the Nellis, Georgia, and Stockbridge soils.

Palatine silt loam, 3 to 8 percent slopes (PaB).—This soil is smooth and slightly convex and occupies irregularly shaped tracts that are 2 to 125 acres in size. Slopes range from 50 to 800 feet in length. The profile of this soil is the one described as typical for the Palatine series.

Included with this soil in mapping are small areas of Nellis, Stockbridge, and Georgia soils. The very slight depressions and drainageways are occupied by the Georgia soils. Soils that have slopes of less than 3 percent or of more than 8 percent are included in some areas. A few included areas have bedrock outcrops and cobblestones and stones on the soil surface. In a few included areas, the soils are less than 35 percent shaly and flaggy materials at a depth of 10 to 40 inches. Also included are soils that have bedrock at less than 20 inches below the soil surface. In a few included areas, the surface layer is loam, shaly loam, or shaly silt loam.

This soil is used mainly for hay and pasture. A small acreage is in corn grown for silage.

Surface runoff is medium. The erosion hazard is slight where this soil is being prepared for seeding or where cultivated crops are grown. Although shaly and flaggy materials are on the soil surface, they do not prohibit the operation of farm machinery. Long slopes should be protected by diversions. This soil has limitations for many nonfarm uses, especially those for which depth to bedrock is a consideration. (Capability unit IIe-2; woodland suitability group 2o1)

Palatine silt loam, 8 to 15 percent slopes (PaC).—This soil has smooth and convex slopes and occupies irregularly shaped areas that are 2 to 40 acres in size. Slopes range from 50 to 700 feet in length.

Included with this soil in mapping are small areas of Nellis and Stockbridge soils. A few included areas have bedrock outcrops or shaly and flaggy material on the soil surface. Soils that have slopes of less than 8 percent or of more than 15 percent are included in some areas. In a few areas are soils that are less than 35 percent shaly or flaggy materials from 10 to 40 inches below the soil surface. Also included are soils that have bedrock at a depth of less than 20 inches. In a few areas, the surface layer is loam, shaly loam, or shaly silt loam.

This soil is used mainly for hay and pasture. A small acreage is in corn grown for silage. Surface runoff is

medium. The erosion hazard is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Although shaly and flaggy materials are on the soil surface, they do not prohibit the operation of farm machinery. Long slopes should be protected with diversions. This soil has limitations for nonfarm uses, especially those for which depth to bedrock and steepness are considerations. (Capability unit IIIe-2; woodland suitability group 2o1)

Palatine silt loam, 15 to 25 percent slopes (PaD).—This soil occupies irregularly shaped areas that have convex slopes and are 2 to 50 acres in size. Slopes range from 50 to 500 feet in length.

Included with this soil in mapping are small areas of soils that have slopes of less than 15 percent or of more than 25 percent. Bedrock crops out in a few included areas. Many included areas have shaly or flaggy materials on the soil surface. In a few areas are soils that are less than 35 percent shaly or flaggy materials from 10 to 40 inches below the soil surface. Also included are soils that are not calcareous in the soil profile. In some included areas, the soils have bedrock less than 20 inches below the soil surface. In a few areas, the surface layer is loam, shaly loam, or shaly silt loam.

This soil is used for pasture and trees. A small acreage is idle.

Surface runoff is rapid. The hazard of water erosion is moderate where this soil is being prepared for seeding. Although shaly and flaggy materials are on the soil surface, they do not prohibit the operation of farm machinery. The moderately steep slopes, however, make the use of modern farm machinery hazardous. This soil has severe limitations for many nonfarm uses, especially those for which depth to bedrock and steepness are considerations. (Capability unit IVe-2; woodland suitability group 2r1)

Palatine silt loam, 25 to 60 percent slopes (PaE).—This soil has convex slopes and occupies irregularly shaped areas that are 2 to 100 acres in size. Slopes range from 50 to 700 feet in length.

Included with this soil in mapping are small areas of soils that are not calcareous in some part of the soil profile. Bedrock crops out in a few areas. Included areas commonly have shaly or flaggy materials on the soil surface. Areas that have slopes of less than 25 percent also are included. A few areas contain soils that are less than 35 percent shaly and flaggy materials from 10 to 40 inches below the soil surface. Also included are soils that have bedrock at a depth of less than 20 inches. In a few areas, the surface layer is loam, shaly loam, or shaly silt loam.

This soil is used mainly for trees and unimproved pasture. A small acreage is idle.

Surface runoff is rapid, and the erosion hazard is very severe where this soil is not vegetated. The steep slopes make use of modern farm machinery hazardous. This soil has severe limitations for many nonfarm uses, especially those for which depth to bedrock and steepness are considerations. (Capability unit VIIe-2; woodland suitability group 2r2)

Peacham Series

The Peacham series consists of soils that are deep, stony, and very poorly drained. These soils are loamy throughout their profile. They have a fragipan starting at 6 to 24 inches below the soil surface. Peacham soils are depressional or level and occur in the Green Mountains and their foothills. They formed in glacial fill that was derived mainly from mica schist. These soils have pebbles, cobblestones, and stones throughout.

A representative profile of a wooded Peacham soil has organic layers that combined are about 5 inches thick. The uppermost organic layer is a litter of sedges, reeds, leaves, and twigs. The lower organic layer is a very dark grayish-brown silty muck. Immediately beneath the organic layers is a mineral layer about 9 inches thick. It is a black silt loam mottled with dark yellowish brown. The next layer is friable, black and olive-gray silt loam about 5 inches thick. The substratum starts at a depth of about 14 inches and continues to more than 40 inches. It is very firm, gray to light olive-gray loam and silt loam mottled with brown to dark brown.

Peacham soils have high natural fertility and a medium available moisture capacity. Because the fragipan restricts rooting depth, plants cannot use the moisture available in the fragipan. Permeability is moderate in the upper part of the soil profile and slow or very slow in the lower part. The mucky layer and the dark-colored mottled mineral surface layer indicate that these soils are saturated with water for extended periods. The water table is at or near the soil surface most of the year and keeps these soils wet. Crops in ponded areas are subject to drowning. The normally high water table and the fragipan restrict plant rooting depth.

These soils receive runoff water from other adjacent soils at higher elevations. Peacham soils warm more slowly in the spring than most other soils in the county. Farm machinery is easily bogged down when these soils are wet. Weed control is more difficult than on many other soils in the county. Spraying and cultivating for weeds are hampered unless the water table is lowered. Artificial drainage is necessary if farm crops are grown. Peacham soils have low shrink-swell potential.

These soils are used mainly for trees and unimproved pasture. A small acreage is drained, cleared of stones, and used as cropland.

Representative profile of wooded Peacham stony silt loam in the town of Westford, about 1 mile east of the Westford-Milton town line:

- O1—5 to 4 inches, litter of sedges, reeds, leaves, and twigs; many roots; neutral; abrupt, smooth boundary.
- O2—4 inches to 0, very dark grayish-brown (2.5Y 3/2) silty muck; moderate, fine, granular structure; friable when moist; slightly sticky and slightly plastic when wet; many roots; neutral; abrupt, smooth boundary.
- A11—0 to 9 inches, black (5Y 2/2) silt loam; few, medium, distinct, dark yellowish-brown (10YR 3/4) mottles; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; many roots; less than 5 percent coarse fragments, by volume; neutral; clear, wavy boundary.
- A12—9 to 14 inches, mixed black (10YR 2/1) and olive-gray (5Y 5/2) silt loam; moderate, fine, subangular blocky structure; friable when moist; slightly sticky

and slightly plastic when wet; many roots; less than 5 percent coarse fragments, by volume; neutral; abrupt, smooth boundary.

C1xg—14 to 19 inches, mixed olive-gray (5Y 5/2) and light olive-brown (2.5Y 5/6) loam; many, fine and medium, distinct, brown to dark-brown (7.5YR 4/4) mottles; massive; very firm when moist, slightly sticky and nonplastic when wet; common roots; 10 percent coarse fragments, by volume; neutral; clear, smooth boundary.

C2xg—19 to 34 inches, mixed light olive-brown (2.5Y 5/6) and gray (5Y 5/1) loam; many, medium, distinct, brown to dark-brown (7.5YR 4/4) mottles; weak, coarse, subangular blocky structure; very firm when moist, slightly sticky and nonplastic when wet; very few roots in the upper part of horizon, none in lower part; 15 percent coarse fragments, by volume; neutral; abrupt, smooth boundary.

C3xg—34 to 40 inches, mixed light olive-brown (2.5Y 5/6) and gray (5Y 5/1) silt loam that has thin bands of olive (5Y 5/3) sand; many, medium, distinct, brown to dark-brown (7.5YR 4/4) mottles; weak, coarse, subangular blocky structure; very firm when moist, slightly sticky and slightly plastic when wet; less than 5 percent coarse fragments, by volume; neutral.

Depth to the fragipan ranges from 6 to 24 inches. The content of coarse fragments ranges from less than 5 percent to 35 percent throughout the profile. The reaction is slightly acid to neutral throughout the profile.

The A horizon has a hue of 10YR to 5Y, value of 2, and chroma of 1 or 2. The C horizon is 2.5Y or 5Y in hue and 4 to 6 in value, or it is neutral and 4 or 5 in value. This horizon is fine sandy loam, silt loam, or gravelly silt loam. It is firm or very firm.

Peacham soils are mostly near the well drained Marlow soils, the moderately well drained Peru soils, and the somewhat poorly and poorly drained Cabot soils. They have a thicker, darker surface layer than the Marlow, Peru, and Cabot soils. The Peacham soils have pebbles, cobblestones, and stones throughout the soil, but these are lacking in the Livingston, Raynham, Scarborough, and Whately soils.

Peacham stony silt loam (Pc).—This soil is depressional to level. Slopes are from 0 to 1 percent. This soil occupies circular and elongated areas that are 2 to 20 acres in size. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two areas.

Included with this soil in mapping are the Cabot soils. The Cabot soils are on the higher mounds or slightly elongated rises. Also included are many areas where the soils are very stony or extremely stony. In a few included areas, the soils are more than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. Also in a few included areas, the surface layer is fine sandy loam, very fine sandy loam, or loam, or is gravelly or mucky fine sandy loam, very fine sandy loam, or silt loam. Also included is a soil that is friable to more than 40 inches below the soil surface.

This soil is used mainly for unimproved pasture and trees. A small artificially drained acreage is used for hay, improved pasture, and corn grown for silage. A few areas are idle. This soil has good potential for a wetland wildlife.

Water commonly ponds on this soil, and drainage is difficult because suitable outlets are lacking in many areas. Cobblestones and stones are troublesome in tillage and harvesting operations. This soil has severe limitations for many nonfarm uses, especially those for which wetness and stoniness are considerations. (Capability unit Vw-1; woodland suitability group not assigned)

Peru Series

The Peru series consists of soils that are deep, stony and extremely stony, and moderately well drained. These soils are loamy throughout their profile. A fragipan starts at 18 to 34 inches below the soil surface. These soils range from nearly level to steep. They are in the Green Mountains and their foothills and in the western, hilly part of the county. Slopes are long and smooth in most places (fig. 9). These soils formed in glacial till that was derived from quartzite, phyllite, and schistose. All soil layers contain pebbles, channery fragments, cobblestones, and stones.

A representative profile of a wooded Peru soil has organic layers that combined are about 1 inch thick. These layers consist of undecomposed and partly decomposed needles and leaves. The mineral surface layer is very dark grayish-brown loam about 3 inches thick. The upper part of the subsoil is friable, yellowish-brown gravelly loam about 6 inches thick. The lower part of the subsoil is friable, light olive-brown gravelly and channery fine sandy loam about 13 inches thick. The lower part of the subsoil is prominently mottled with strong brown. The fragipan starts at a depth of about 22 inches

and continues to more than 40 inches. It is firm, light olive-brown gravelly fine sandy loam mottled with reddish brown.

Peru soils have low natural fertility and a medium available moisture capacity. Their permeability is moderate above the fragipan and slow in it. Because the fragipan restricts plant rooting depth, plants cannot use the moisture available in the fragipan. These soils have mottles in the subsoil. The pattern of mottling indicates that the upper part of the subsoil is not frequently wet but that the lower part is saturated for significant periods. Water passes through the soil until it reaches the firm layer. Because its movement through the fragipan layer is impeded, water accumulates on the surface of the layer and flows downslope. Late in fall to early in spring, water stands at less than 2 feet below the soil surface. It recedes to a depth of 2 feet or more during drier periods.

These soils receive water from other adjacent soils at higher elevations. Peru soils remain wet for significant periods after heavy rains. These soils commonly are farmed, but, in spring, farming operations are delayed because of wetness. Growth of crops common in the



Figure 9.—A gently sloping Peru soil on glaciated landscape.

county is reduced at times unless artificial drainage is provided. Peru soils have low shrink-swell potential.

In almost all places, the Peru soils originally were too stony to be used for farm crops, but in many places the stones have been removed and the soils are farmed. In stone-cleared areas, these soils are used mainly for hay and pasture, but a small acreage is idle or wooded. The areas not cleared of stones are wooded or are idle.

Representative profile of a Peru extremely stony loam in a mixed forest of white pine, red maple, gray birch, and yellow birch in the town of Williston, about 3 miles southwest of Williston village and about one-half mile west of State Route 116A:

- O1—1 to ½ inch, litter of white pine needles and of red maple, alder, gray birch, and white birch leaves.
- O2—½ to 0, partly decomposed leaves, needles, and twigs.
- A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine and very fine, granular structure; friable; many tree roots; 5 percent pebbles and channery fragments; medium acid; abrupt, wavy boundary.
- B21r—3 to 9 inches, yellowish-brown (10YR 5/6) gravelly loam; weak, fine, granular structure; friable; many tree roots; 15 to 20 percent pebbles and channery fragments; medium acid; abrupt, wavy boundary.
- B22—9 to 17 inches, light olive-brown (2.5Y 5/6) gravelly fine sandy loam; weak, fine, subangular blocky structure; friable; many tree roots; 15 to 20 percent pebbles and channery fragments; medium acid; clear, wavy boundary.
- B23—17 to 22 inches, light olive-brown (2.5Y 5/4) channery fine sandy loam; common, fine and medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, fine, subangular blocky structure; friable; common tree roots; 20 percent fine channery fragments; medium acid; abrupt, smooth boundary.
- Cx—22 to 40 inches, light olive-brown (2.5Y 5/4) gravelly fine sandy loam; few, fine, prominent, reddish-brown (5YR 4/4) mottles; moderate, medium, platy structure; firm; few tree roots; 20 to 30 percent pebbles and channery fragments; medium acid.

Depth to the fragipan ranges from 18 to 34 inches. The content of coarse fragments in the soil layers ranges from 5 to 35 percent.

The A horizon has a hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It ranges from very strongly acid to slightly acid. The B horizon is 7.5YR to 5Y in hue, 4 or 5 in value, and 2 to 6 in chroma. It ranges from strongly acid to neutral. The C horizon has a hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 2 to 4. It ranges from strongly acid to neutral. In the B and C horizons, the texture is sandy loam, fine sandy loam, or loam, or it is gravelly or channery sandy loam, fine sandy loam, or loam.

Peru soils are, in most places, near the somewhat excessively drained Lyman soils, the well drained Marlow soils, the moderately well drained Winooski soils, the somewhat poorly drained Munson and Raynham soils, and the somewhat poorly and poorly drained Cabot soils. Bedrock is more than 40 inches below the surface of the Peru soils, but it is only 10 to 20 inches below the surface of the Lyman soils. Mottles are in the subsoil of the Peru soils but not in the Marlow soils. Peru soils have gravelly and channery particles and cobblestones throughout the soil that are lacking in the Munson, Raynham, and Winooski soils. Peru soils are brighter in the lower part of the subsoil than are the Cabot soils.

Peru stony loam, 0 to 5 percent slopes (PeA).—This soil has concave slopes and occupies irregularly shaped areas that are 2 to 10 acres in size. Slopes range from 100 to 450 feet in length. The cobblestones and stones cleared off the soil surface have been piled along the edges of fields to form fences and walls. Where this soil borders areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two areas.

The profile of this soil is similar to that described as representative for the series, but in most places it has a thicker surface layer. This layer is a mixture of the original surface layer, the subsurface layer, and part of the subsoil.

Included with this soil in mapping are small areas of the Cabot, Marlow, and Lyman soils. Cabot soils are in the more nearly level or slightly depressional areas. Marlow and Lyman soils are on the higher mounds or slightly elongated rises. Also included are small areas of soils that have a fragipan at a depth of less than 18 inches or of more than 40 inches below the soil surface. In a few included areas are soils that are more than 35 percent pebbles and cobblestones, from 10 to 40 inches below the soil surface. In a few areas, the soil layers are silt loam or very fine sandy loam or are gravelly or channery silt loam or very fine sandy loam. Also included in mapping are soils that are nonstony. A few areas have a surface layer of sandy loam or fine sandy loam or gravelly or channery sandy loam, fine sandy loam, or loam.

This soil is used mainly for hay and pasture. A small acreage is in trees or corn grown for silage, or it is idle.

Surface runoff is slow. Because the fragipan has slow permeability, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off.

The hazard of water erosion is slight where this soil is being prepared for seeding or where cultivated crops are grown. The cobblestones and stones are troublesome in tillage and harvesting operations, but they do not prevent cultivation. Because this soil has more inclusions of wetter soils than Peru soils that are steeper, tillage is delayed longer in the spring and following heavy rains. This soil has limitations for many nonfarm uses for which wetness, stoniness, slope, and permeability are considerations. (Capability unit IIw-2; woodland suitability group 3ol)

Peru stony loam, 5 to 12 percent slopes (PeB).—This soil has concave slopes and occupies irregularly shaped areas that are 2 to 40 acres in size. Slopes range from 100 to 780 feet in length. The cobblestones and stones cleared off the soil surface have been piled along the edges of fields to form fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone wall or fence is on the boundary separating the two areas.

The profile of this soil is similar to that described as representative for the series but, in most places, has a thicker surface layer. This layer is a mixture of the original surface layer, the subsurface layer, and part of the subsoil.

Included with this soil in mapping are small areas of the Cabot, Marlow, and Lyman soils. Cabot soils are in the more nearly level or slightly depressional areas. Marlow and Lyman soils are on the higher mounds or slightly elongated rises. Also included are soils that have a fragipan at less than 18 inches or at more than 40 inches below the soil surface. In some included areas, the soils are nonstony. In a few areas, the soil layers are silt loam or very fine sandy loam, or are gravelly or channery silt loam or very fine sandy loam. Also included are a few areas where the surface layer is sandy loam or fine sandy loam,

or is gravelly or channery sandy loam, fine sandy loam, or loam.

This soil is used mainly for hay and pasture. A small acreage is used for trees, corn grown for silage, or it is idle.

Surface runoff is medium. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above it is saturated with water. As soon as this zone is saturated, much of the rainwater runs off.

The hazard of water erosion is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Since this soil has fewer inclusions of wetter soils than less sloping Peru soils, tillage is not delayed so long in spring and following heavy rains. Cobblestones and stones are troublesome in tillage and harvesting operations, but they do not prevent cultivation. This soil has limitations for many nonfarm uses, especially those for which stoniness, wetness, slow permeability, and steepness are considerations. (Capability unit IIIe-5; woodland suitability group 3o1)

Peru stony loam, 12 to 20 percent slopes (PeC).—This soil has concave slopes and occupies irregularly shaped areas that are 2 to 30 acres in size. Slopes range from 100 to 700 feet in length. The cobblestones and stones cleared off the soil surface have been piled up along the edges of fields to form fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two areas.

The profile of this soil is similar to that described as representative for the series but, in most places, has a thicker surface layer. This layer is a mixture of the original surface layer, the subsurface layer, and part of the subsoil.

Included with this soil in mapping are small areas of Cabot, Marlow, and Lyman soils. The Cabot soils are mainly in small wet areas near springs and near or in natural drainageways. Marlow and Lyman soils are on the higher mounds or slightly elongated rises. Also included are soils that have a fragipan at less than 18 inches or more than 40 inches below the soil surface. In a few included areas, the soils are more than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. Nonstony soils also are included. In a few areas, the soil layers are silt loam or very fine sandy loam, or are gravelly or channery silt loam or very fine sandy loam. Also included are a few areas where the surface layer is sandy loam or fine sandy loam, or is gravelly or channery sandy loam, fine sandy loam, or loam.

This soil is used mainly for hay and pasture. In a few areas, the lesser slopes are used for corn silage. A small acreage is in trees or is idle.

Surface runoff is medium to rapid. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off.

The hazard of water erosion is severe where this soil is being prepared for seeding or where cultivated crops are grown. Cobblestones and stones are troublesome in tillage and harvesting operations, but they do not prohibit culti-

vation. The steeper slopes make the use of modern farm machinery hazardous. This soil has limitations for many nonfarm uses, especially those for which steepness, stoniness, slow permeability, and wetness are considerations. (Capability unit IVe-5; woodland suitability group 3r1)

Peru stony loam, 20 to 30 percent slopes (PeD).—This soil has slightly concave slopes and occupies irregularly shaped areas that are 2 to 10 acres in size. Slopes range from 100 to 450 feet in length. The cobblestones and stones cleared off the soil surface have been piled along the edges of fields to form fences and walls. Where this soil borders mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating the two areas.

The profile of this soil is similar to that described as representative for the series but, in many places, has a thicker surface layer. This layer is a mixture of the original surface layer, the subsurface layer, and part of the subsoil.

Included with this soil in mapping are small areas of Cabot, Marlow, and Lyman soils. The Cabot soils are mainly in small wet areas near springs and near or in natural drainageways. Marlow and Lyman soils are on the higher mounds or slightly elongated rises. Also included are soils that have a fragipan at less than 18 inches or at more than 40 inches below the soil surface. In a few included areas are soils that are more than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. Nonstony soils also are included. In a few areas are soils that have soil layers of silt loam or very fine sandy loam, or are gravelly or channery silt loam or very fine sandy loam. Soils that have slopes of less than 20 percent or of more than 30 percent are included in some areas. A few areas are included where the surface layer is sandy loam or fine sandy loam, or is gravelly or channery sandy loam, fine sandy loam, or loam.

This soil is used mainly for unimproved pasture and trees. A small acreage is idle. The moderately steep slopes make the use of modern farm machinery hazardous. Management of this soil is mainly for preventing forest fires, maintaining logging roads, controlling erosion on logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds.

The hazard of water erosion is slight where this soil is vegetated and is severe where it is not. Surface runoff is rapid, but it is reduced by small hummocks caused by tree windthrow. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. This soil has severe limitations for many nonfarm uses, especially those for which steepness, wetness, slow permeability, and stoniness are considerations. (Capability unit VIe-2; woodland suitability group 3r1)

Peru extremely stony loam, 0 to 20 percent slopes (PsC).—This soil has slight concave slopes and occupies irregularly shaped areas that are 5 to 200 acres in size. Slopes range from 100 to more than 1,000 feet in length.

Where this soil borders mapped areas of stony soils, a straight stone fence or wall is on the boundary separating the two areas. The profile of this soil is the one described as representative for the Peru series.

Included with this soil in mapping are small areas of Cabot, Marlow, and Lyman soils. The Cabot soils are mainly in small wet areas near springs and near or in natural drainageways or springs. Marlow and Lyman soils are on the higher mounds or slightly elongated rises. Also included are soils that have a fragipan at less than 18 inches or at more than 40 inches below the soil surface. In a few included areas are soils that are more than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. In some included areas, the soils are stony or very stony, or have bedrock outcrops. In a few areas, the soil layers are silt loam or very fine sandy loam, or are gravelly or channery silt loam or very fine sandy loam. Soils that have slopes of more than 20 percent are included in some areas. A few areas are included where the surface layer is sandy loam or fine sandy loam, or is gravelly or channery sandy loam or fine sandy loam.

This soil is used mainly for trees and unimproved pasture. A small acreage is idle.

This soil is too stony for farming. Loose stones prohibit the use of ordinary tillage machinery and mechanical equipment for harvesting hay. Removing stones ordinarily is impractical. The steeper slopes make the use of modern farm machinery hazardous. Management of this soil is mainly for preventing forest fires, maintaining logging roads, controlling erosion on logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds.

The hazard of water erosion is slight where this soil is vegetated and moderate to severe where it is not. Surface runoff is slow to rapid, but it is reduced by small hummocks caused by cattle trampling soft ground between the stones and by mounds resulting from tree windthrow. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above the fragipan is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. This soil has severe limitations for many nonfarm uses, especially those for which wetness, stoniness, steepness, and slow permeability are considerations. (Capability unit VII_s-2; woodland suitability group 3x1)

Peru extremely stony loam, 20 to 60 percent slopes (PsE).—This soil has slightly concave slopes and occupies irregularly shaped areas that are 5 to 150 acres in size. Slopes range from 100 to more than 1,000 feet in length. Where this soil borders areas of stony soils, a straight stone fence or wall is on the boundary separating the two areas.

Included in mapping are small areas of Cabot, Marlow, and Lyman soils. The Cabot soils are mainly in small wet areas near springs and near or in natural drainageways or springs. The Marlow and Lyman soils are on the higher mounds or slightly elongated rises. Also included are soils that have a fragipan at

less than 18 inches or more than 40 inches below the soil surface. In a few included areas are soils that are more than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. Stony or very stony soils and rock outcrops are included in some areas. In a few areas are soils that have soil layers that are silt loam or very fine sandy loam, or are gravelly or channery silt loam or very fine sandy loam. Soils that have slopes of less than 20 percent are included in some areas. A few areas are included where the surface layer is sandy loam or fine sandy loam, or is gravelly or channery sandy loam or fine sandy loam.

This soil is used mainly for trees.

This soil is too stony and steep for the use of modern farm machinery. Management of this soil is mainly for preventing forest fires, maintaining logging roads, controlling erosion on logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds.

The hazard of water erosion is slight where this soil is vegetated and very severe where it is not. Surface runoff is rapid, but it is reduced by small hummocks caused by tree windthrow. Because the fragipan is slowly permeable, absorption of water into it during a rain is negligible. The closer the fragipan is to the soil surface, the more quickly the soil above it is saturated with water. As soon as this zone is saturated, much of the rainwater runs off. This soil has severe limitations for many nonfarm uses, especially those for which steepness, wetness, stoniness, and slow permeability are considerations. (Capability unit VII_s-2; woodland suitability group 3x3)

Quarries

Quarries (Qd) consist of areas where limestone, quartzite, and schist are relatively near the surface. After the overlying soil material is removed, the rocks are mined for various uses.

Limestone quarries are throughout the Champlain Valley. Limestone is used for road construction, including road surfacing, and for buildings, other industrial uses, and ground lime that is used in farming. Abandoned quarries are used for recreation (fig. 10).

Quartzite quarries are in the city of Burlington and the town of South Burlington. Quartzite is used for road surfacing, road construction, and buildings. Schist quarries are in the town of Bolton. The schist mined is used for road construction.

Quarries range from less than 2 to about 14 acres in size. The quarries no longer used for mining can be planted to trees and other plants. The plants selected should be those that grow in shallow, rocky, acid, or limy soil material that has poor tilth. Many areas can be developed and used for recreation and wildlife. (Capability unit VIII_s-2; woodland suitability group not assigned)

Raynham Series

The Raynham series consists of soils that are deep, somewhat poorly drained, and gently sloping or sloping.

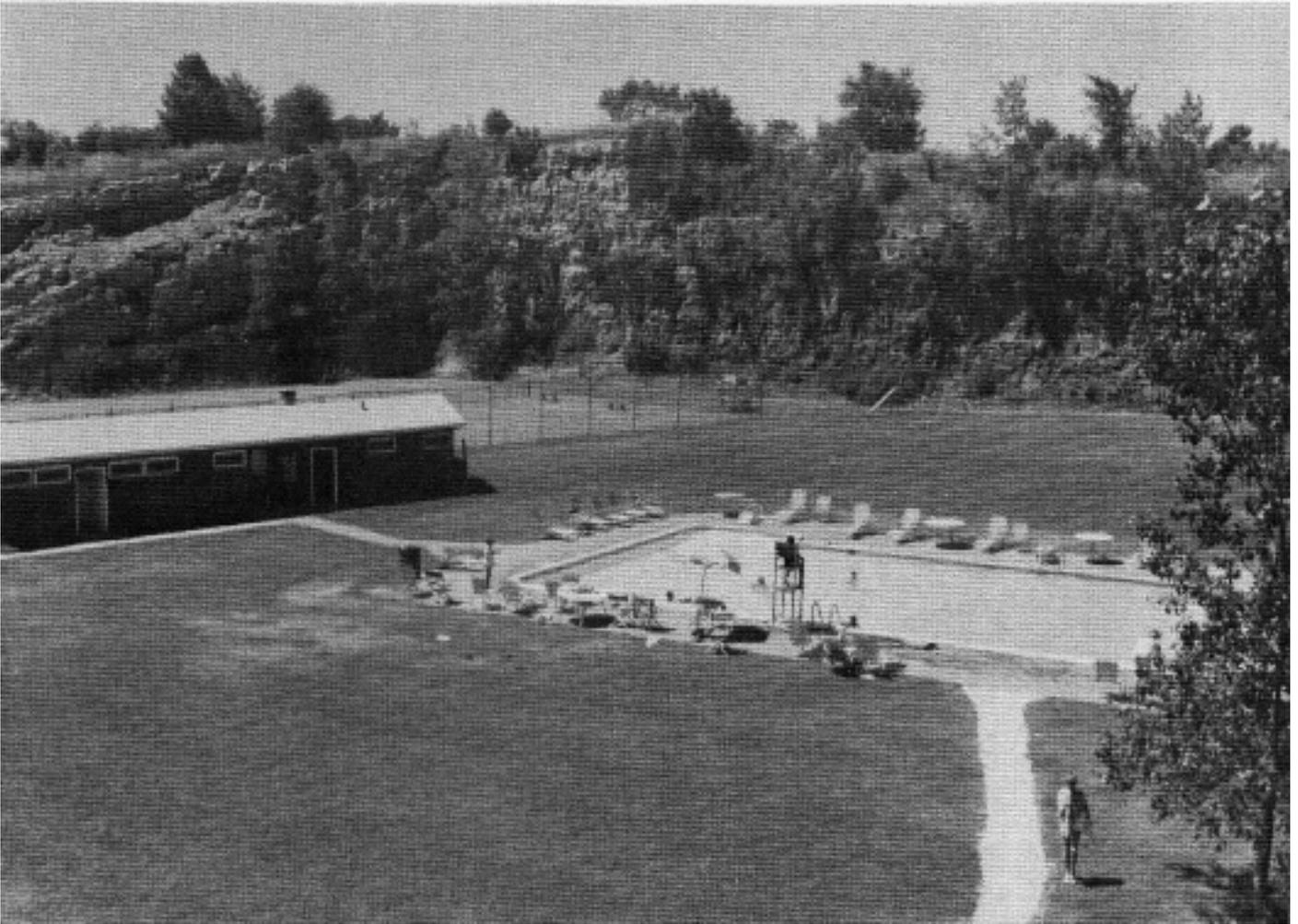


Figure 10.—A limestone quarry in South Burlington used for recreation.

These soils formed in deposits of loamy material. The largest acreage of the Raynham soils is in the towns of Milton, Westford, and Essex. A smaller acreage is in every town in the county. These soils formed in very fine sandy loam and silt loam containing less than 18 percent clay. In a few places, Raynham soils are underlain by bedrock, sand, gravel, or loamy glacial till at a depth of 48 inches.

A representative profile of a Raynham soil has a dark grayish-brown silt loam surface layer about 6 inches thick. The subsoil is friable, olive-gray to olive-brown silt loam about 16 inches thick. It is mottled with yellowish brown, dark yellowish brown, and light brownish-gray. The substratum starts at about 22 inches and continues to more than 72 inches below the soil surface. It is a friable, olive-gray to olive silt loam mottled with various shades of brown.

Raynham soils have high natural fertility and a moderately high available moisture capacity. Permeability is moderate and moderately slow in the surface layer and subsoil and slow in the substratum. The mottled subsoil indicates that these soils are saturated with water for extended periods. Saturation is from late in

fall to late in spring. During spring the seasonal water table stands at less than a foot below the soil surface, but it recedes to a depth of 3 feet or more in summer. These soils remain wet for a long time following heavy rains. The slowly permeable substratum is a major factor in keeping these soils excessively wet during wet seasons. Plants have difficulty in developing a good root system because of the seasonal high water table.

These soils remain moist beneath the surface layer during most growing seasons. They warm more slowly in the spring than most soils in the county. Wetness delays farm operations on these soils in the spring and following rains. Farm machinery is easily bogged down. Weed control also is more difficult than for most soils in the county. Growth of farm crops may be reduced unless artificial drainage is provided. These soils have a low shrink-swell potential.

Raynham soils are used mainly for hay and pasture. A small acreage is in corn grown for silage.

The Raynham soils were not mapped separately in Chittenden County. They were mapped with Munson soils in undifferentiated groups. The undifferentiated groups are described under the Munson series.

Representative profile of a Raynham silt loam in a hayfield in the town of Milton, about 4 miles north-northwest of the village of Milton:

- Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; slightly acid; abrupt, wavy boundary.
- B21—6 to 10 inches, light olive-brown (2.5Y 5/4) silt loam; few, fine, distinct, yellowish-brown (10YR 5/6 and 5/8) and light brownish-gray (2.5Y 6/2) mottles; weak, very fine and fine, granular structure; friable; common roots; slightly acid; clear, wavy boundary.
- B22g—10 to 17 inches, olive-gray (5Y 5/2) silt loam; many, fine to coarse, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6 and 5/8) mottles; weak, very fine and fine, subangular blocky structure; friable; common roots; slightly acid; clear, wavy boundary.
- B23—17 to 22 inches, olive-brown (2.5Y 4/4) silt loam; few, fine, distinct, yellowish-brown (10YR 5/4, 5/6, 5/8) mottles; weak, fine and medium, subangular blocky structure; friable; few roots; slightly acid; clear, wavy boundary.
- C1g—22 to 48 inches, mixed olive-gray (5Y 5/2) and dark grayish-brown (2.5Y 4/2) silt loam; many, fine, distinct, dark yellowish-brown (10YR 4/4), yellowish-brown (10YR 5/4 and 5/6), and olive-brown (2.5Y 4/4) mottles; weak, thick and very thick, platy structure; friable; few roots; no roots below depth of 30 inches; neutral; clear, wavy boundary.
- C2—48 to 72 inches +, olive (5Y 4/3) silt loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, thick and very thick, platy structure; friable; neutral.

The solum ranges from 14 to 30 inches in thickness. Texture is very fine sandy loam or silt loam throughout the soil. These soils range from medium acid to neutral throughout the profile. They are friable in the A and B horizons and friable or firm in the C horizon.

The A horizon has a hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. The B and C horizons are 2.5Y or 5Y in hue, 4 or 5 in value, and 2 to 4 in chroma.

Raynham soils mostly are near the somewhat excessively drained Lyman and Farmington soils, the well drained Hartland soils, the moderately well drained Belgrade soils, the somewhat poorly drained Munson soils, the poorly drained Scantic soils, and the very poorly drained Livingston soils. Raynham soils are deeper to bedrock than the Lyman and Farmington soils. Throughout their subsoil, Raynham soils have mottles that are lacking in the Hartland and Belgrade soils. Raynham soils have less clay in the lower part of the soil profile than the Munson soils. The clay content of Raynham soils is less throughout the profile than that of the Scantic and Livingston soils.

Rock Land

Rock land (Rk) consists of areas that are about 50 to 90 percent bare bedrock or that have less than 10 inches of soil over the bedrock. The bedrock is quartzite, slate, limestone, schist, or granite. Included in mapping are a few areas that are more than 90 percent bare bedrock. Most of these areas are at high elevations, such as those at the top of Mount Mansfield or Camels Hump. Alpine vegetation grows at the higher elevations. Rock land occurs on mountaintops, hilltops, and the sides of steep cliffs in many parts of the county. It is gently rolling to extremely steep. Vegetation is sparse and consists of moss, lichens, and small scrubby trees.

Rock land has no value for crops and very little for pasture. It is a poor site for forest trees. In a few places, it provides some food and cover for wildlife. It has

scenic value in many places. (Capability unit VIIIs-2; woodland suitability group not assigned)

Scantic Series

The Scantic series consists of soils that are deep, poorly drained, and level to gently sloping. These soils formed in lacustrine deposits of loamy material over clayey material. Scantic soils are mainly in the northern part of the county in the towns of Milton, Westford, and Essex. A small acreage is in nearly every town in the county.

A representative profile of a Scantic soil has a dark grayish-brown silt loam surface layer that is mottled with dark brown and is about 8 inches thick. The subsurface layer is olive-gray silt loam that is mottled with light olive brown and is about 5 inches thick. The subsoil is firm, olive-gray silty clay loam and silty clay about 13 inches thick. It is mottled with light olive brown and dark yellowish brown. The substratum starts at a depth of about 26 inches and continues to more than 40 inches below the soil surface. It is firm, gray silty clay mottled with yellowish brown.

Scantic soils have high natural fertility and a moderately high available moisture capacity. Their permeability is moderate or moderately slow in the upper part of the soil profile and moderately slow or slow in the lower part. The dark-colored surface layer and mottled horizons indicate that these soils are saturated with water for extended periods. A normally high water table keeps them wet from late in fall to late in spring. During the wetter part of the year, water stands less than a foot below the soil surface. Water passes through the soil until it reaches the clayey layers, which impede deeper percolation. Then the water accumulates at the surface of these layers. It also ponds on the soil surface of the more nearly level areas for a time during the wetter part of the year and following heavy rains.

These soils occupy positions that receive runoff water from adjacent soils at higher elevations. Scantic soils remain wet for significant periods after rains. They warm more slowly in the spring than many other soils in the county, and they remain moist beneath the surface layer during most growing seasons. The normally high water table restricts plant rooting depth. Farm machinery is easily bogged down when these soils are wet. Weed control also is more difficult and spraying and harvesting operations are hampered unless the water table is lowered. These soils puddle and become cloddy and compact if tilled when too wet. Artificial drainage is necessary for good growth of farm crops. Scantic soils have low and moderate shrink-swell potential.

Scantic soils are used mainly for hay and pasture. A small acreage is in crops and trees or is idle.

Representative profile of a Scantic silt loam in a hayfield in the town of Milton, about 4.5 miles northwest of the village of Milton:

- Ap—0 to 8 inches, dark grayish-brown (2.5Y 4/2) silt loam; common, fine, distinct, dark-brown (7.5YR 3/2) mottles in old root channels; moderate, fine and medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; many grass roots; neutral; abrupt, smooth boundary.
- A2g—8 to 13 inches, olive-gray (5Y 5/2) silt loam; common, fine, distinct, light olive-brown (2.5Y 5/4) mottles; moderate, fine, angular blocky structure; friable

when moist, slightly sticky and slightly plastic when wet; common grass roots; neutral; clear, smooth boundary.

IIB2g—13 to 18 inches, olive-gray (5Y 4/2) silty clay loam; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; moderate, fine, angular blocky structure; firm when moist, sticky and plastic when wet; few grass roots; few clay films on ped faces; neutral; abrupt, wavy boundary.

IIB3g—18 to 26 inches, olive-gray (5Y 5/2) silty clay; many, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, very coarse, angular blocky structure; firm when moist, sticky and plastic when wet; few grass roots; few clay films on ped faces and in pores; neutral; clear, wavy boundary.

IIC—26 to 40 inches +, gray (5Y 5/1) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4 and 10YR 5/6) mottles; moderate, very coarse, angular blocky structure; firm when moist, sticky and plastic when wet; neutral.

The solum ranges from 25 to 32 inches in thickness. These soils are medium acid to neutral in all horizons.

The A horizon has a hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. The B horizon is 10YR to 5Y in hue, 4 or 5 in value, and 1 or 2 in chroma. The upper part of the B horizon is silt loam or silty clay loam, and the lower part is silty clay loam or silty clay. The C horizon has a hue of 2.5Y to 5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or silty clay.

These soils are less acid than the defined range for the series, but this difference does not alter their usefulness or behavior.

Scantic soils are mostly near the somewhat poorly drained Munson and Raynham soils and the somewhat poorly drained and poorly drained Cabot soils. The upper part of the subsoil of Scantic soils contains more clay than that of the Munson soils. Scantic soils contain more clay throughout the profile than the Raynham soils. Pebbles, cobblestones, and stones are lacking in the Scantic soils but not in the Cabot soils.

Scantic silt loam, 0 to 2 percent slopes (ScA).—This soil occupies irregularly shaped areas that are 2 to 60 acres in size and occur in glacial lake plains. Slopes range from 50 to 500 feet in length. Areas in hay have a smooth soil surface. This soil has mounds resulting from tree windthrow in wooded areas and an uneven surface caused by cattle trampling in areas of permanent pasture. The profile of this soil is the one described as representative for the Scantic series.

Included with this soil in mapping are small areas of Munson, Raynham, and Livingston soils. The Munson and Raynham soils are on the higher mounds or slightly elongated rises. The Livingston soils occupy depressions and drainageways. Also included in mapping are soils that are poorly drained and are silt loam or very fine sandy loam from the soil surface to a depth of more than 40 inches. In a few areas the surface layer is silty clay loam or silty clay.

This soil is used mainly for hay and pasture. A small acreage is in trees or corn grown for silage, or it is idle.

This soil can be farmed intensively without risk of damage if artificial drainage, fertility, and good soil structure are maintained. Surface runoff is very slow. Water commonly ponds on this soil, and drainage is difficult because suitable outlets are lacking in many areas. The erosion hazard is very slight. Because this soil has more inclusions of wetter soils than steeper Scantic soils, tillage is delayed longer in the spring and following heavy rains. This soil has many limitations for many nonfarm uses, especially those for which wetness is a con-

sideration. (Capability unit IVw-3; woodland suitability group 5w1)

Scantic silt loam, 2 to 6 percent slopes (ScB).—This soil occupies irregularly shaped areas that are 2 to 40 acres in size. Slopes range from 50 to 350 feet in length. Areas in hay or intertilled crops have a smooth soil surface. This soil has mounds resulting from tree windthrow in wooded areas and an uneven surface caused by cattle trampling in areas of permanent pasture.

Included with this soil in mapping are areas of Raynham, Munson, Enosburg, Eldridge, and Covington soils. Also included are soils that are silt loam or very fine sandy loam from the soil surface to a depth of more than 40 inches. In a few included areas, the surface layer is silty clay loam or silty clay.

This soil is used mainly for hay and pasture. A small acreage is in corn silage. A few areas are idle or wooded.

Surface runoff is slow. The uneven soil surface caused by cattle trampling and by mounds resulting from tree windthrow reduces surface runoff. The erosion hazard is slight where this soil is being prepared for seeding or where cultivated crops are grown. The addition of organic matter helps in maintaining good soil structure and in increasing the infiltration. Since this soil has fewer inclusions of wetter soils than less sloping Scantic soils, tillage is not delayed so long in the spring and following heavy rains. This soil has many limitations for many nonfarm uses, especially those for which wetness is a consideration. (Capability unit IVw-3; woodland suitability group 5w1)

Scarboro Series

The Scarboro series consists of soils that are deep, very poorly drained, and sandy throughout their profile. These soils are depressional or level. They are in small scattered areas throughout the county. The largest acreage is in the towns of Colchester and Milton near the lower reaches of the Winooski and Lamoille Rivers. Scarboro soils formed in sandy glaciofluvial deposits and on deltas or beaches.

A representative profile of a Scarboro soil in woodland has a black loam surface layer about 10 inches thick. The soil layers underlying the surface layer are friable and very friable, dark-gray loamy fine sand and fine sand to a depth below 42 inches.

Scarboro soils have low natural fertility and a moderately low available moisture capacity. Their permeability is rapid. The thick, dark loam surface layer indicates that these soils are saturated with water for extended periods. The normally high water table keeps these soils wet. It is at or near the soil surface most of the year. Crops in ponded areas are subject to drowning. The normally high water table restricts plant rooting depth.

These soils receive runoff water from adjacent soils at higher elevations. They warm more slowly in the spring than most other soils in the county. Farm machinery is easily bogged down when these soils are wet. Artificial drainage is needed if farm crops are grown. Scarboro soils have low shrink-swell potential.

Scarboro soils are mainly in trees or are idle. A small acreage is used for hay and pasture. These soils are good potential wildlife habitats.

Representative profile of a wooded Scarborough loam in the town of Milton, 1½ miles northwest of the intersection of U.S. Highway No. 7 and Townes Corner School Road, 100 yards west of Interstate Highway No. 89:

- A1—0 to 10 inches, black (10YR 2/1) loam; moderate, medium, granular structure; friable; common roots; slightly acid; gradual, smooth boundary.
 C1g—10 to 15 inches, dark-gray (5Y 4/1) loamy fine sand; massive; firm in place, friable when removed; slightly acid; abrupt, smooth boundary.
 C2g—15 to 42 inches, dark-gray (5Y 4/1) fine sand; single grain; very friable; neutral.

The content of coarse fragments is less than 5 percent. A few profiles have a thin layer of muck over the mineral soil.

The A horizon has a hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is medium acid to slightly acid. The C horizon is 2.5Y or 5Y in hue, 4 or 5 in value, and 1 to 3 in chroma. It ranges from loamy fine sand to coarse sand and is slightly acid to neutral.

These soils are less acid than the defined range for the series, but this difference does not alter their usefulness or behavior.

Scarboro soils are near the somewhat excessively drained Windsor soils, the moderately well drained Duane and Deerfield soils, and the somewhat poorly and poorly drained Au Gres soils. Scarborough soils are generally duller throughout the profile than the Windsor, Duane, Deerfield, and Au Gres soils.

Scarboro loam (Sc).—This soil is depressional or level and has slopes of 0 to 2 percent. It occupies irregularly shaped areas that are 2 to 80 acres in size. This soil has mounds resulting from tree windthrow in the wooded areas.

Included with this soil in mapping are small areas of Au Gres and Enosburg soils and Muck and peat. The Au Gres and Enosburg soils are on the higher mounds or slightly elongated rises. Muck and peat are in the lower part of the mapped areas or in the more depressional areas. In a few included areas, the surface layer is sand, fine sand, loamy sand or loamy fine sand, or it is mucky. A few areas are included where the soils are more than 5 percent but less than 70 percent pebbles and cobblestones from 10 to 40 inches below the soil surface.

This soil is mainly in trees or is idle. A small acreage is used for hay and pasture.

Water commonly ponds on this soil, and drainage is difficult because suitable outlets are lacking in many areas. Overdrainage of this soil results in droughtiness. This soil can be farmed intensively without risk of damage if the fertility and the content of organic matter in the surface layer are maintained. The hazard of water erosion is very slight. After this soil is artificially drained, it must be protected from soil blowing. This soil has severe limitations for many nonfarm uses, especially those for which wetness is a consideration. (Capability unit Vw-1; woodland suitability group 5w3)

Stetson Series

The Stetson series consists of soils that are deep, very friable or loose, and somewhat excessively drained. These soils are loamy in the upper part and sandy in the lower part. They have cobblestones and pebbles in the profile. Stetson soils formed in poorly sorted glaciofluvial deposits that were mainly derived from schist and quartzite. They are nearly level to steep and are on the eastern edge of the Champlain Valley and in the foothills of the Green Mountains.

A representative profile of a cultivated Stetson soil has a very dark grayish-brown gravelly fine sandy loam surface layer about 8 inches thick. The upper part of the subsoil is very friable, dark-brown gravelly fine sandy loam about 8 inches thick. The lower part of the subsoil is loose, dark yellowish-brown very gravelly loamy coarse sand about 9 inches thick. The substratum starts at about 25 inches and continues to more than 72 inches below the soil surface. It is a loose, olive-brown very gravelly coarse sand.

The bright colors and lack of mottles in the Stetson soils indicate that they are well aerated and porous. The Stetson soils have low natural fertility. They are moderately rapidly permeable in the upper part of the soil and very rapidly permeable in the lower part. Their available moisture capacity is moderately low. The thinner the loamy layer is above the sand and gravel, the more droughty are these soils. The Stetson soils are filled to capacity with available moisture at the start of the growing season. As the growing season progresses, rain normally is not adequate to replenish the soil moisture used by plants. Crops, therefore, show signs of lack of moisture during the growing season. These soils warm up early in spring. The Stetson soils can be worked earlier in the spring and sooner after rains than most soils in the county. Their shrink-swell potential is low.

The Stetson soils are used mainly for cultivated crops, pasture, hay, and trees. A few areas are idle. Gravel pits and Borrow pits are many.

Stetson soils that have slopes of 20 percent or more were not mapped separately in Chittenden County. They were mapped with Colton soils in undifferentiated groups. These undifferentiated groups are described under the Colton series.

Representative profile of a Stetson gravelly fine sandy loam in a road cut on the Pleasant Valley Road, about 150 yards south of the Underhill Grammar School in the town of Underhill:

- Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly fine sandy loam; moderate, fine, granular structure; very friable; many roots; 15 percent coarse fragments, by volume; slightly acid; abrupt, smooth boundary.
 B21r—8 to 16 inches, dark-brown (7.5YR 4/4) gravelly fine sandy loam; moderate, fine, granular structure; very friable; common roots; 20 percent coarse fragments, by volume; medium acid; abrupt, wavy boundary.
 IIB22r—16 to 25 inches, dark yellowish-brown (10YR 4/4) very gravelly loamy coarse sand; single grain; loose; common roots; 60 percent coarse fragments, by volume; medium acid; clear, wavy boundary.
 IIC—25 to 72 inches +, olive-brown (2.5Y 4/4) very gravelly coarse sand; single grain; loose; few roots in the upper part, none below depth of 31 inches; 70 percent coarse fragments, by volume; slightly acid.

The solum ranges from 18 to 30 inches in thickness. The coarse fragments in the profile consist mainly of water-rounded pebbles and cobblestones of quartz and schist. In a few places stones are larger than 10 inches in diameter. In the A horizon, the content of cobblestones and pebbles ranges from 0 to 20 percent, by volume. In the B horizon, the content of cobblestones and pebbles ranges from 5 to 70 percent. The content of cobblestones and pebbles in the C horizon ranges from 15 to 80 percent. The profile ranges from medium acid to neutral.

The A1 horizon, where present, and the Ap horizon have a hue of 10YR, value of 2 or 3, and chroma of 1 to 3. A few profiles have an A2 horizon that is 1 to 3 inches thick and is grayish brown or dark gray.

The B horizon has a hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 to 6. It ranges from loamy sand to loam or gravelly loamy sand to gravelly loam.

The C horizon is 10YR to 5Y in hue, 3 to 5 in value, and 2 to 4 in chroma. In most places the C horizon is sand or coarse sand, or it is gravelly and very gravelly sand or coarse sand.

The Stetson soils are similar to the Colton soils but have loamy material rather than a sandy material above the sand and gravel. The Stetson soils have pebbles and cobblestones in the soil profile that are lacking in the Adams and Windsor soils. The Stetson soils are not calcareous within 40 inches below the soil surface, but the Groton soils are.

Stetson gravelly fine sandy loam, 0 to 5 percent slopes (StA).—This soil occupies irregularly shaped areas that are 2 to 100 acres in size.

Included with this soil in mapping are wetter soils that occupy the slight depressions. Colton and Berkshire soils also are included in some areas. In some included areas, the soils have been severely blown by the wind. A few included areas contain soils that are less than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. In some areas soils that have a cobbly and gravelly surface layer are included. In a few included areas, the surface layer is sandy loam, loam, gravelly sandy loam, or gravelly loam.

This soil is used mainly for cultivated crops, hay, and pasture. Many houses are built on this soil because it has few limitations for this use. Gravel pits and Borrow pits are common.

Water erosion is slight because this soil absorbs water rapidly and has slow surface runoff. Soil blowing is a hazard in areas not vegetated. Trees and pasture plants that resist drought are better suited to this soil than row crops. Drought-resistant forage plants are better suited than other kinds of plants. This soil has slight limitations for many nonfarm uses. (Capability unit IIs-2; woodland suitability group 4o1)

Stetson gravelly fine sandy loam, 5 to 12 percent slopes (StB).—This soil occupies irregularly shaped areas that are 2 to 30 acres in size. The profile of this soil is the one described as typical for the Stetson series.

Included with this soil in mapping are small areas of Colton and Berkshire soils. Also included are areas eroded by water and blown by wind. A few included areas contain soils that are less than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. In some areas soils that have a cobbly and gravelly surface layer are included. In a few areas, the surface layer is a sandy loam, loam, gravelly sandy loam, or gravelly loam.

This soil is used mainly for cultivated crops, hay, and pasture. In areas where land use is changing rapidly, houses are built on this soil because it generally has fewer limitations for building sites than other soils nearby. Gravel pits and Borrow pits are in a few areas.

Surface runoff is medium. The erosion hazard is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Soil blowing is a hazard in areas not vegetated. Trees and pasture plants that resist drought are better suited to this soil than row crops. Drought-resistant forage plants are better suited than other kinds of plants. This soil has limitations for many nonfarm uses, especially those for which

steepness is a consideration. (Capability unit IIIe-8; woodland suitability group 4o1)

Stetson gravelly fine sandy loam, 12 to 20 percent slopes (StC).—This soil occupies irregularly shaped areas that are 2 to 20 acres in size.

Included with this soil in mapping are small areas of Colton and Berkshire soils. Also included are areas eroded by water and blown by wind. A few areas contain soils that are less than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. In some areas there are included soils that have a cobbly and gravelly surface layer. A few mapped areas adjacent to soils formed in glacial till have a stony or very stony surface layer. In a few areas, the surface layer is sandy loam, loam, gravelly sandy loam, or gravelly loam.

This soil is used mainly for pasture and trees. A few areas are used for hay crops. Gravel pits and Borrow pits are in a few areas.

Surface runoff is rapid. The erosion hazard is severe where this soil is being prepared for seeding. Soil blowing is a hazard in areas not vegetated. Trees that resist drought are best suited to this soil. Drought-resistant forage plants are better suited than other kinds of plants. This soil has limitations for many nonfarm uses, especially those for which steepness is a consideration. (Capability unit IVE-6; woodland suitability group 4r1)

Stockbridge Series

The Stockbridge series consists of soils that are deep, stony and extremely stony, rocky, and well drained. These soils are loamy throughout their profile. They are gently sloping to steep. In most areas these soils occupy low, rounded hills and elongated hills in the eastern part of the Champlain Valley. They formed in glacial till that was derived from limestone, schist, phyllite, quartzite, and shale.

A representative profile of a cultivated Stockbridge soil has a dark-brown loam surface layer about 9 inches thick. The upper part of the subsoil is friable, yellowish-brown loam about 8 inches thick. The lower part of the subsoil is friable, yellowish-brown fine sandy loam about 13 inches thick. The substratum starts at a depth of about 30 inches and continues to more than 42 inches below the soil surface. It is firm, dark grayish-brown gravelly loam.

Stockbridge soils have a medium available moisture capacity and high natural fertility. Their permeability is moderate. The bright colors in the subsoil and lack of mottles throughout the soil indicates that these soils are well aerated most of the time. They are saturated with water during periods in spring, but this water disappears quickly after the rain stops. Since these soils dry out quickly, they are ready for planting earlier than most soils in the county. Because there is no restrictive layer, plants develop a good root system. Shrink-swell potential is low.

Where the stones have been removed, the Stockbridge soils are used mainly for hay, corn grown for silage, and improved pasture. These soils are mainly in trees

and pasture where the stones have not been removed. A small acreage is idle.

Stockbridge soils were not mapped separately in Chittenden County. They were mapped in areas that contain either or both Stockbridge and Nellis soils or in areas that contain both Farmington and Stockbridge soils. The Farmington-Stockbridge mapping units are discussed under the Farmington series.

Representative profile of a Stockbridge stony loam in a cultivated field in the town of Charlotte, one-fourth mile south of Prindle Corners, 1 mile north of Lewis Creek, and 100 yards west of gravel road:

- Ap—0 to 9 inches, dark-brown (10YR 4/3) loam; moderate, fine and medium, granular structure; friable; many grass roots; 10 percent coarse fragments of quartzite and phyllite; neutral; abrupt, smooth boundary.
- B21—9 to 17 inches, yellowish-brown (10YR 5/6) loam; weak, medium, subangular blocky structure; friable; common grass roots; 10 percent coarse fragments of quartz and phyllite; slightly acid; abrupt, smooth boundary.
- B22—17 to 30 inches, fine sandy loam that is yellowish brown (10YR 5/4) on ped faces and olive brown (2.5Y 4/4) in ped interiors; massive separating to weak, medium, subangular blocky structure; friable; few grass roots; 5 percent coarse fragments of quartz and phyllite; weathered limestone fragments; medium acid; abrupt, smooth boundary.
- C—30 to 42 inches, dark grayish-brown (2.5Y 4/2) gravelly loam; moderate, medium, platy structure; firm; few roots in the upper part, none in the lower; 20 percent coarse fragments of limestone, quartz, and phyllite; neutral.

The solum ranges from 22 to 30 inches in thickness. Its content of coarse fragments ranges from 5 to 35 percent. Weathered pebbles and cobbles of limestone in the solum have hues ranging from 5YR to 10YR.

The A horizon has a hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It ranges from medium acid to neutral.

The B horizon is 10YR or 2.5Y in hue, 4 or 5 in value, and 3 to 6 in chroma. The B21 horizon has a hue of 10YR, but the hue of the B22 horizon is either 10YR or 2.5Y. The B horizon is fine sandy loam, loam, and silt loam, or is gravelly or channery fine sandy loam, loam, and silt loam. It ranges from medium acid to neutral.

The C horizon has a hue of 2.5Y or 5Y, value of 3 or 4, and chroma of 2 or 3. It is fine sandy loam, loam, and silt loam, or is gravelly or channery fine sandy loam, loam, and silt loam. The C horizon is friable or firm and slightly acid or neutral.

Stockbridge soils are near the moderately well drained Georgia and Vergennes soils, the well drained Nellis soils, and the somewhat excessively drained Farmington soils. In the lower part of the subsoil, Stockbridge soils lack mottles that are present in the Georgia soils. Stockbridge soils are coarser textured than the Vergennes soils. The substratum of Stockbridge soils is not calcareous, but that of the Nellis soils is. Stockbridge soils have bedrock at a depth of more than 40 inches, but bedrock is less than 20 inches below the soil surface of Farmington soils.

Stockbridge and Nellis stony loams, 3 to 8 percent slopes (SuB).—An individual area of this mapping unit may consist of Stockbridge soils or Nellis soils, or soils of both series. These soils have convex slopes and occupy irregularly shaped areas that are 2 to 10 acres in size. Slopes range from 100 to 450 feet in length. Cobbles and stones have been cleared off the soil surface and piled along the edges of fields to form fences and walls. Where these soils border mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating these areas. The profile of the Nellis soil in this mapping

unit is the one described as representative for the Nellis series.

Included with these soils in mapping are small areas of Georgia, Massena, and Palatine soils. Georgia and Massena soils are in the more nearly level and slightly depressional areas or are in natural drainageways. In many places Palatine soils are on the higher mounds or slightly elongated rises. A few included areas contain soils that are more than 35 percent pebbles and cobbles from 10 to 40 inches below the soil surface. Soils that have slopes of less than 3 percent or of more than 8 percent are included in some areas. In a few included areas, the soils are underlain by calcareous sandy material. Also included are soils that are non-stony, very stony, or extremely stony. In a few areas of Stockbridge soils, the surface layer is silt loam, gravelly silt loam, channery silt loam, gravelly loam, or channery loam. In a few areas of Nellis soils, the surface layer is silt loam, gravelly loam, channery loam, gravelly silt loam, or channery silt loam.

These soils are used mainly for hay, pasture, and corn grown for silage. A few areas are in trees or are idle.

Surface runoff is medium. The hazard of water erosion is slight where these soils are being prepared for seeding or where cultivated crops are grown. The cobbles and stones are troublesome in tillage and harvesting operations, but they do not prohibit cultivation. These soils have slight limitations for many nonfarm uses, especially those for which steepness and stones on the soil surface are considerations. (Both soils, capability unit IIe-2; Stockbridge soil, woodland suitability group 3o2; Nellis soil, woodland suitability group 2o1)

Stockbridge and Nellis stony loams, 8 to 15 percent slopes (SuC).—These soils have smooth convex slopes and occupy irregularly shaped areas that are 2 to 20 acres in size. Slopes range from 100 to 550 feet in length. The cobbles and stones cleared off the soil surface have been piled along the edges of fields to form fences and walls. Where these soils border mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating these areas. The profile of the Stockbridge soil is the one described as typical for the Stockbridge series.

Included with these soils in mapping are small areas of Georgia, Massena, and Palatine soils. Georgia and Massena soils are in the more nearly level and slightly depressional areas or are in natural drainageways. In many places Palatine soils are on the higher mounds or slightly elongated rises. In a few included areas are soils that are more than 35 percent pebbles or cobbles from 10 to 40 inches below the soil surface. Soils that have slopes of less than 8 percent or of more than 15 percent are included in some areas. Also included are eroded soils that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. A few areas are underlain by calcareous sandy material. Also included are soils that are nonstony, very stony, and extremely stony. In a few included areas of Stockbridge soils, the surface layer is silt loam, gravelly silt loam, channery silt loam, gravelly loam, or channery loam. In a few areas of

Nellis soils, the surface layer is a silt loam, gravelly loam, channery loam, gravelly silt loam, or channery silt loam.

These soils are used mainly for hay, pasture, or corn grown for silage. A few areas are in trees and a small acreage is idle.

The hazard of water erosion is moderate where these soils are being prepared for seeding or where cultivated crops are grown. Cobblestones and stones are troublesome in tillage and harvesting operations, but they do not prohibit farming. These soils have limitations for many nonfarm uses, especially those for which steepness and stones on the soil surface are considerations. (Both soils, capability unit IIIe-2; Stockbridge soils, woodland suitability group 3o2; Nellis soils, woodland suitability group 2o1)

Stockbridge and Nellis stony loams, 15 to 25 percent slopes (SuD).—These soils have smooth convex slopes and occupy irregularly shaped areas that are 2 to 20 acres in size. Slopes range from 100 to 530 feet in length. The cobblestones and stones cleared off the soil surface have been piled along the edges of fields to form fences and walls. Where these soils border mapped areas of extremely stony soils, a straight stone fence or wall is on the boundary separating these areas.

Included with these soils in mapping are small areas of Georgia, Massena, and Palatine soils. Georgia and Palatine soils are in the more nearly level areas, in natural drainageways, or near springs. In most places the Palatine soils are on the higher mounds or slightly elongated rises. A few included areas contain soils that are more than 35 percent pebbles and cobblestones from 10 to 40 inches below the soil surface. Soils that have slopes of less than 15 percent or of more than 25 percent are included in some areas. In a few included areas, the soils are underlain by calcareous sandy material. Also included are soils that are nonstony, very stony, or extremely stony. Some included areas are of eroded soils that have not been vegetated or that have been in cultivated crops too frequently without conservation practices. In a few areas of the Stockbridge soils, the surface layer is silt loam, gravelly silt loam, channery silt loam, gravelly loam, or channery loam. In a few areas of the Nellis soils, the surface layer is silt loam, gravelly loam, channery loam, gravelly silt loam, or channery silt loam.

The soils in this mapping unit are used mainly for pasture and trees. A small acreage is idle.

Cobblestones and stones are troublesome in tillage and harvesting operations but do not prohibit tillage. Most areas of these soils have severe limitations to use for cultivated crops. The steep slopes make the use of modern farm machinery hazardous. Surface runoff is rapid, but it is reduced by small hummocks caused by tree windthrow. Woodland management of these soils is mainly for preventing forest fires, maintaining logging roads, controlling erosion in logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. The hazard of water erosion is slight where these soils are vegetated and is severe where they are not. These soils have limitations for

many nonfarm uses, especially those for which steepness and stoniness are considerations. (Both soils, capability unit IVe-2; Stockbridge soils, woodland suitability group 3r4; Nellis soils, wood and suitability group 2r1)

Stockbridge and Nellis extremely stony loams, 3 to 15 percent slopes (SxC).—These soils have convex slopes and occupy irregularly shaped areas that are 2 to 30 acres in size. Slopes range from 100 to 650 feet in length. Where these soils border mapped areas of stony soils, a straight stone fence or wall is on the boundary separating these areas.

The profiles of the Stockbridge and the Nellis soils are similar to those described for the respective series but, in most places, have a thinner surface layer.

Included with these soils in mapping are small areas of Georgia, Massena, and Palatine soils. Georgia and Massena soils are in the more nearly level and slightly depressional areas or in natural drainageways. In many places Palatine soils are on the higher mounds or slightly elongated rises. In a few included areas are soils that are more than 35 percent pebbles and cobblestones from 10 to 40 inches below soil surface. Soils that have slopes of less than 3 percent or of more than 15 percent are included in some areas. In a few included areas, the soils are underlain by calcareous sandy material. Soils that are stony and very stony are also included. In a few areas of Stockbridge soils, the surface layer is a silt loam, gravelly silt loam, channery silt loam, gravelly loam, or channery loam. In a few areas of Nellis soils, the surface layer is a silt loam, gravelly loam, channery loam, gravelly silt loam, or channery silt loam.

The soils in this mapping unit are used mainly for trees and unimproved pasture. A few areas are idle.

These soils are too stony for cultivation. Stones prohibit the use of ordinary tillage machinery and of mechanical equipment used for harvesting hay. The removal of stones ordinarily is not practical. Surface runoff is medium, but it is reduced by small hummocks caused by tree windthrow. Woodland management is mainly for preventing forest fires, maintaining logging roads, controlling erosion on logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. Erosion hazard is very slight where these soils are vegetated and is slight to moderate where they are not. These soils have limitations for many nonfarm uses, especially those for which steepness and stoniness are considerations. (Both soils, capability unit VIIs-2; Stockbridge soils, woodland suitability group 3x2, Nellis soils, woodland suitability group 2x1)

Stockbridge and Nellis extremely stony loams, 15 to 60 percent slopes (SxE).—These soils have convex slopes and occupy irregularly shaped areas that are 2 to 30 acres in size. Slopes range from 100 to 650 feet in length. Where these soils border mapped areas of stony soils, a straight stone fence or wall is on the boundary separating these areas.

The profiles of the Stockbridge and the Nellis soils are similar to those described for the respective series but, in most places, have a thinner surface layer.

Included with these soils in mapping are small areas of

Georgia and Palatine soils. Georgia soils are in slightly concave areas, in natural drainageways, or near springs. In many places Palatine soils are on the higher mounds or slightly elongated rises. In a few included areas are soils that are more than 35 percent pebbles and cobbles from 10 to 40 inches below the soil surface. Soils that have slopes of less than 15 percent are included in some areas. In a few areas, the soils are underlain by calcareous sandy material. Also included are soils that are stony and very stony. In a few areas of Stockbridge soils, the surface layer is a silt loam, gravelly silt loam, channery silt loam, gravelly loam, or channery loam. In a few areas of Nellis soils, the surface layer is a silt loam, gravelly loam, channery loam, gravelly silt loam, or channery silt loam.

The soils in this mapping unit are used mainly for trees. A few areas of the less sloping soils are used for unimproved pasture. A small acreage is idle.

These soils are too stony and, in many places, too steep for farming. Loose stones prohibit the use of ordinary tillage machinery and mechanical equipment for harvesting hay. The steep slopes make the use of modern farm machinery very hazardous. Surface runoff is rapid, but it is reduced by small hummocks caused by tree windthrow. Woodland management of these soils is mainly for preventing forest fires, maintaining logging roads, controlling erosion on logging roads, and using sound technical practices for harvesting trees. Trees can be planted in areas that are denuded by fire, are clear cut, or have been abandoned for farming and are in brush and weeds. The erosion hazard is slight where these soils are vegetated and, depending on slope, severe or very severe where they are not. These soils have severe limitations for many nonfarm uses, especially those for which steepness and stoniness are considerations. (Both soils, capability unit VIIIs-2; Stockbridge soils, woodland suitability group 3x4; Nellis soils, woodland suitability group 2x2)

Terrace Escarpments, Silty and Clayey

Terrace escarpments, silty and clayey (TeE) have slopes of 25 to 60 percent. The largest acreage of this mapping unit is in the towns of Colchester, Essex, Milton, and Westford. A smaller acreage is in most of the other towns in Chittenden County. The uppermost 40 inches of the soil material is silt loam or very fine sandy loam in some places. In other places a few inches or feet of loamy material overlies clayey material. Probably the most distinctive property of this unit is soil material having more than one texture within a vertical section. Because of this difference in texture, the soil material tends to slide when it is saturated with water.

This unit is in unimproved pasture or trees, or it is idle.

The steep slopes interfere with farming. Slopes are too steep for use of modern farm machinery. The main management need is maintaining a protective cover of plants. This vegetative cover is effective in slowing runoff and controlling erosion. (Capability unit and woodland suitability group not assigned)

Vergennes Series

The Vergennes series consists of soils that are deep and moderately well drained. These soils are clayey throughout their profile. They range from gently sloping to steep. Vergennes soils are widely distributed throughout the Champlain Valley. The largest acreage is between State Route 116 and Lake Champlain. These soils formed in estuarine and lacustrine deposits of clayey materials.

A representative profile of a Vergennes soil has a very dark grayish-brown and dark-brown clay surface layer about 6 inches thick (fig. 11). The subsoil is firm, dark-brown and dark grayish-brown clay about 19 inches thick. It is faintly mottled with dark yellowish brown in the lower part. The substratum starts at a depth of about 25 inches and continues to more than 41 inches below the soil surface. It is dark grayish-brown and dark-brown

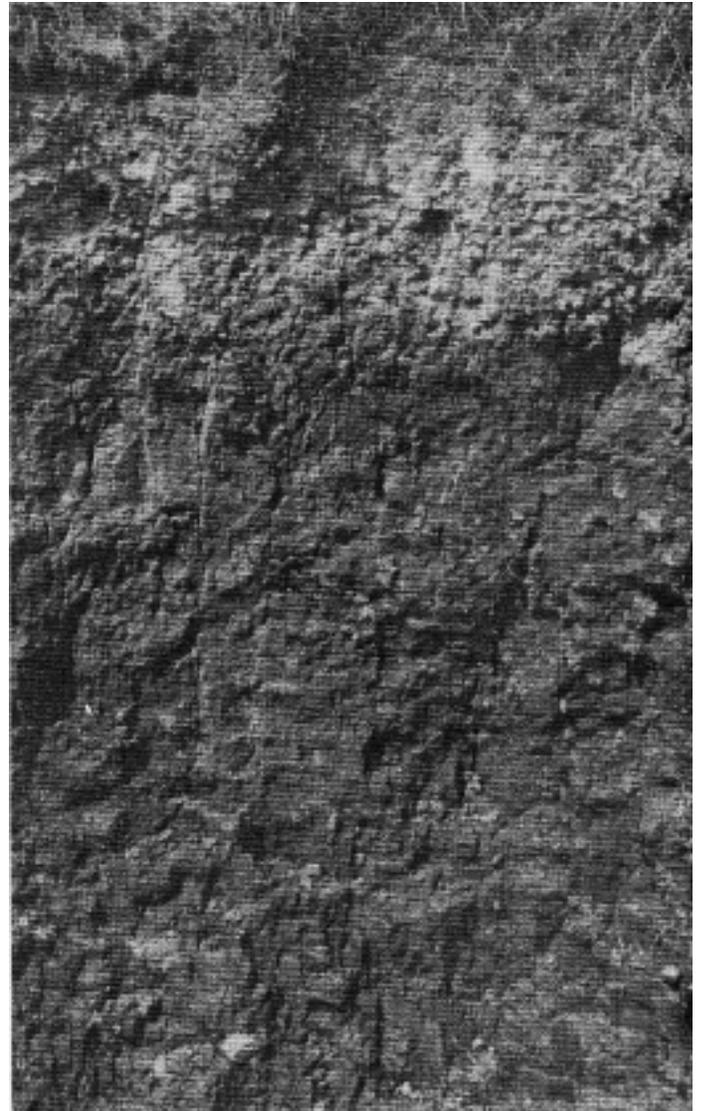


Figure 11.—Profile of a Vergennes clay showing a light-colored surface layer and a blocky, clayey subsoil and substratum. Profile extends to a depth of 3 feet.

clay mottled with yellowish brown and dark yellowish brown. The substratum contains thin layers of olive or olive-gray silt.

The Vergennes soils have very high natural fertility and a moderately high available moisture capacity. Their permeability is very slow. These soils have only faint mottles in the lower part of the subsoil, but mottles are more distinct as depth increases. This pattern of mottling indicates that the upper part of the subsoil is not frequently wet but that the lower part is saturated for significant periods. From late in fall to early in spring, water is less than 2 feet below the soil surface. It recedes to a depth of 2 feet or more during drier periods. These soils are farmed in many places, but in spring and following heavy rains, tillage is delayed because of wetness. Weed control is difficult because the narrow range of moisture content limits the length of time for good cultivation. These soils puddle if worked when wet, and they crust and become cloddy when they dry. The dry clods are very hard and are very difficult to crush. These soils are slow to warm in the spring. Artificial drainage may be needed for good growth of crops. Vergennes soils have a moderate or high shrink-swell potential.

These soils are used mainly for hay and pasture. A small acreage is used for corn grown for forage and for trees, and a small acreage is idle.

Representative profile of a Vergennes clay in a hayfield in South Burlington, 2½ miles northwest of Shelburne Pond and one-half mile north of the South Burlington-Shelburne town line:

- Ap—0 to 6 inches, mixed very dark grayish-brown (10YR 3/2) and dark-brown (7.5YR 4/2) clay; moderate, very fine and fine, subangular blocky structure; firm when moist, sticky and plastic when wet; many grass roots; less than 5 percent coarse fragments of limestone and shale; neutral; abrupt, wavy boundary.
- B21t—6 to 14 inches, dark-brown (7.5YR 4/4) clay; few, fine, faint mottles; strong, fine and medium, angular and subangular blocky structure; firm when moist, sticky and plastic when wet; common grass roots; clay films; less than 5 percent coarse fragments of limestone and shale; neutral; abrupt, wavy boundary.
- B22t—14 to 25 inches, clay that has dark grayish-brown (10YR 4/2) ped exteriors and dark yellowish-brown (10YR 3/4) ped interiors; few, fine, dark yellowish-brown (10YR 4/4) mottles; strong, very fine and fine, angular and subangular blocky structure; firm when moist, sticky and plastic when wet; common grass roots; clay films; less than 5 percent coarse fragments of limestone and shale; neutral; abrupt, smooth boundary.
- C1—25 to 35 inches, dark grayish-brown (10YR 4/2) and dark-brown (10YR 4/3) clay that has varves of olive (5Y 5/3) silt; few, fine, distinct, yellowish-brown mottles (10YR 5/6); moderate, fine and medium, angular and subangular blocky structure; firm when moist, sticky and plastic when wet; few grass roots; few clay films; few, fine, manganese patches; 5 percent coarse fragments of limestone and shale; mildly alkaline; slightly effervescent in cold, dilute hydrochloric acid; abrupt, smooth boundary.
- C2—35 to 41 inches +, dark grayish-brown (10YR 4/2) clay that has varves of olive-gray (5Y 5/2) silt; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, very fine and fine structure and massive; very firm when moist, sticky and plastic when wet; few clay films; 5 percent coarse fragments of limestone and shale; moderately alkaline; strongly effervescent in cold, dilute hydrochloric acid.

The solum ranges from 15 to 30 inches in thickness. The texture throughout the soil profile is clay.

The A horizon has a hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. It ranges from strongly acid to neutral. The B horizon is 7.5YR to 5Y in hue, 3 or 4 in value, and 1 to 4 in chroma. It ranges from medium acid to neutral. The C horizon has a hue of 10YR to 5Y, value of 3 or 4, and chroma of 1 to 3. It is mildly alkaline or moderately alkaline.

Vergennes soils are mostly near the somewhat excessively drained Farmington soils, the well drained Nellis soils, the moderately well drained Georgia soils, the poorly drained Covington soils, and the very poorly drained Livingston soils. Vergennes soils have more clay throughout the profile and are deeper to bedrock than the Farmington soils. The clay content is higher throughout the Vergennes soils than throughout the Nellis and Georgia soils. Vergennes soils lack the distinct and prominent mottles in the subsoil that are in the subsoil of the Covington and Livingston soils.

Vergennes clay, 2 to 6 percent slopes (VeB).—This soil occupies irregularly shaped areas that are 2 to 250 acres in size. Slopes range from 50 to 500 feet in length and are smooth and uniform. In most places where this soil is adjacent to the shore of Lake Champlain, the bank drops steeply to the edge of the water. In many places wave action is severely eroding this steep bank. The profile of this soil is the one described as representative for the Vergennes series.

Included in mapping are the Covington soils that are mainly in the more nearly level or depressional areas. Also included are small areas of soils that have bedrock at less than 40 inches below the soil surface. In a few included areas, the surface layer is silt loam, silty clay loam, or silty clay.

This soil is used mainly for hay. A small acreage is used for pasture and corn grown for silage.

Surface runoff is slow to medium. The erosion hazard is slight where this soil is being prepared for seeding or where cultivated crops are grown. Because this soil has more inclusions of wetter soils than the steeper Vergennes soils, tillage is delayed longer in the spring and following heavy rains. The addition of organic matter helps in maintaining good soil structure and in increasing infiltration. The clay surface layer makes it difficult to prepare a good seedbed. Long slopes should be protected with diversions. This soil has severe limitations for many non-farm uses, especially those for which texture of soil including the clay surface layer, very slow permeability, and wetness are considerations. (Capability unit IIe-1; woodland suitability group 4c1)

Vergennes clay, 6 to 12 percent slopes (VeC).—This soil occupies irregularly shaped areas that are 2 to 80 acres in size. It has smooth convex slopes. The topography is rolling and is dissected by small streams and shallow gullies that, in most places, are crossable with farm machinery. In most places where this soil is adjacent to the shore of Lake Champlain, it has a steep bank dropping to the edge of the water. In many places wave action is severely eroding this steep bank. The slopes of this soil range from 50 to 300 feet in length.

Included with this soil in mapping are the Covington soils that are mainly in the more nearly level or depressional spots. Also included are small areas of soils that have bedrock at less than 40 inches below the soil surface. In a few included areas, pebbles, cobblestones, or stones are on the soil surface. These areas occur near soils that

formed in glacial till. The surface layer is silt loam, silty clay loam, or silty clay in a few included areas.

This soil is used mainly for hay. A small acreage is in pasture, corn grown for silage, and trees, and a small acreage is idle.

Surface runoff is medium. The hazard of water erosion is moderate where this soil is being prepared for seeding or where cultivated crops are grown. Since this soil has fewer inclusions of wetter soils than the less sloping Vergennes soils, tillage is not delayed so long in the spring and following heavy rains. The addition of organic matter helps in maintaining good soil structure and in increasing infiltration. Long slopes should be protected with diversions. Although pebbles, cobblestones, and stones are on the soil surface in some areas, they do not hinder the operation of farm machinery. This soil has severe limitations for many nonfarm uses, especially those for which texture of the soil profile, including the clayey surface layer, very slow permeability, wetness, and steepness are considerations. (Capability unit IIIe-1; woodland suitability group 4c2)

Vergennes clay, 12 to 25 percent slopes (VeD).—This soil occupies irregularly shaped areas 2 to 40 acres in size. These areas are gullied in some places. Slopes range from 50 to 300 feet in length and are mostly smooth. The profile of this soil is similar to the one described as representative for the series but has a thinner surface layer.

Included with this soil in mapping are small areas of soils that have bedrock at less than 40 inches below the soil surface. In a few included areas are soils that have pebbles, cobblestones, and stones on the soil surface. These areas are near soils that formed in glacial till. The surface layer is silt loam, silty clay loam, or silty clay in a few included areas.

This soil is used mainly for hay in the less sloping areas. Pasture commonly is grown on all slopes. A small acreage is in trees or is idle.

Surface runoff is rapid. The hazard of water erosion is severe where this soil is being prepared for seeding. The steeper slopes make the use of modern farm machinery hazardous. Although pebbles, cobblestones, and stones are common, they do not prohibit the operation of farm machinery. This soil has severe limitations for many nonfarm uses, especially those for which the clayey surface layer, very slow permeability, and steepness are considerations. (Capability unit IVe-1; woodland suitability group 4c3)

Vergennes clay, 25 to 60 percent slopes (VeE).—This soil occupies irregularly shaped areas that are 2 to 30 acres in size. In most places these areas are on the walls of narrow valleys that have been cut by small streams. Slopes range from 50 to 300 feet in length. Some of the areas are gullied. The profile of this soil is similar to the one described as representative for the series but has a thinner surface layer.

Included with this soil in mapping are areas where the upper 3 feet of soil has been removed by landslides. These landslides range from about 0.1 acre to 2 acres in size. They occur in a very irregular pattern. The steep banks along Lake Champlain have been severely eroded by wave action. A few small areas of Vergennes soils that have slopes of less than 25 percent are included, as well as some soils that have bedrock at less than 3 feet below

the soil surface. In a few areas, the surface layer is silt loam, silty clay loam, or silty clay.

This soil is mainly in unimproved pasture or is idle. A small acreage is in trees.

The fertility is fair in the slightly eroded areas and poor in the severely eroded areas. Surface runoff is very rapid. The hazard of water erosion is very severe where this soil is not vegetated. Accelerated erosion can be controlled if this soil is continually vegetated. This soil has severe limitations to use for cultivated crops. The steep slopes make the use of modern farm machinery hazardous. This soil has severe limitations for many nonfarm uses, especially those for which steepness is a consideration. (Capability unit VIIe-2; woodland suitability group 4c3)

Whately Series

The Whately series consists of soils that formed in deep, moderately coarse textured material over moderately fine or fine textured materials. These soils are poorly drained. They are depressional to gently sloping. The Whately soils are mainly in the towns of Charlotte and Shelburne, but some small, scattered areas are throughout the Champlain Valley. These soils are easy to dig above the clayey layers, which are very sticky and plastic when wet and very hard when dry.

A representative profile of a Whately soil has a very dark grayish-brown fine sandy loam plow layer about 8 inches thick. The subsoil is friable, grayish-brown fine sandy loam mottled with dark yellowish brown. It is about 7 inches thick. The substratum is firm, dark grayish-brown silty clay loam mottled with yellowish brown.

The Whately soils have medium natural fertility and a medium available moisture capacity. Their permeability is moderately rapid in the moderately coarse textured materials and very slow in the moderately fine and fine-textured materials. A normally high water table keeps these soils wet from early in fall to late in spring. The mottles indicate that these soils have a fluctuating water table. The water table is less than 12 inches below the soil surface during the wettest part of the year and is below 24 inches during the driest part.

The very slowly permeable clayey layer restricts internal drainage. During the wettest part of the year and following heavy rains, water ponds for short periods in many places on the soil surface of the more nearly level areas and for extended periods in the depressional areas. Crops in the ponded areas are subject to drowning. The normally high water table restricts plant rooting depth. Tillage operations, weed control, and harvesting crops are hampered unless the water table is lowered. These soils are slow to warm in the spring.

Artificial drainage is needed for the good growth of most crops. Water moves through the moderately coarse textured materials readily, and it then flows downhill on top of the moderately fine and fine textured materials. This water creates seep spots at the base of the nearly level or gently sloping areas. These soils remain moist during most growing seasons. They receive runoff water from adjacent soils at higher elevations. Their shrink-swell potential is low in the moderately coarse textured

materials and high or moderate in the fine-textured materials.

The Whately soils are used mainly for pasture and hay. A few areas are in woodland, are idle, or are used for corn.

The Whately soils were not mapped separately in Chittenden County. They were mapped with Enosburg soils in undifferentiated groups. The undifferentiated groups are discussed under the Enosburg series.

Representative profile of a Whately fine sandy loam in a cultivated field in the town of Charlotte, 400 yards west of Rutland Railway tracks and 100 yards north of Thompson's Point Road:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, fine, granular structure; friable; common grass roots; neutral; abrupt, smooth boundary.

B2g—8 to 15 inches, grayish-brown (10YR 5/2) fine sandy loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, fine and medium, granular structure; friable; common grass roots; neutral; abrupt, irregular boundary.

IIC—15 to 42 inches +, dark grayish-brown (10YR 4/2) silty clay loam; many, coarse, distinct, yellowish-brown (10YR 5/8) mottles; massive; firm; neutral.

The solum ranges from 13 to 30 inches in thickness. Thickness of the moderately coarse textured materials ranges from 13 inches to less than 40 inches.

The A horizon has a hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 to 3. It ranges from medium acid to neutral.

The B horizon is 10YR to 5Y in hue, 4 or 5 in value, and 1 or 2 in chroma. Neutral colors have a value of 4 or 5. Mottles are distinct or prominent. This horizon is sandy loam or fine sandy loam and medium acid to neutral.

The C horizon, where present, and the IIC horizon have a hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. Neutral colors have a value of 4 or 5. Mottles are faint to prominent. The C horizon is sandy loam or fine sandy loam, and the IIC horizon is silty clay loam, silty clay, or clay. These horizons are slightly acid to neutral.

Whately soils in this county differ from the Whately soils mapped in other survey areas in being poorly drained instead of very poorly drained.

The Whately soils are mostly near the Eldridge and Covington soils. Whately soils have a generally duller color in the subsoil than the Eldridge soils and are finer textured throughout the profile. The solum of the Whately soils is sandier than that of the Covington soils. The Whately soils are finer textured throughout the solum than the Enosburg soils.

Windsor Series

These soils of the Windsor series are deep, loose, excessively drained, and sandy throughout their profile. They are on valley slopes and terraces. These soils formed in water-deposited sand that contains a large amount of quartz and schist. Windsor soils are nearly level to steep. The largest areas of the Windsor soils are at or near the mouths of the Winooski and Lamoille Rivers in the towns of Burlington, Colchester, Essex, and Milton, and the cities of Burlington and South Burlington. Smaller areas are in valleys of smaller streams and along the shores of Lake Champlain. These soils developed in sand that is more than 4 feet deep. In most places they are underlain by stratified sand and gravel, sandy loam or loam glacial till, clay, silt, or bedrock.

At the surface of a representative profile in a pine plantation is about 2 inches of pine needles, leaves, and material high in content of organic matter (fig. 12). This

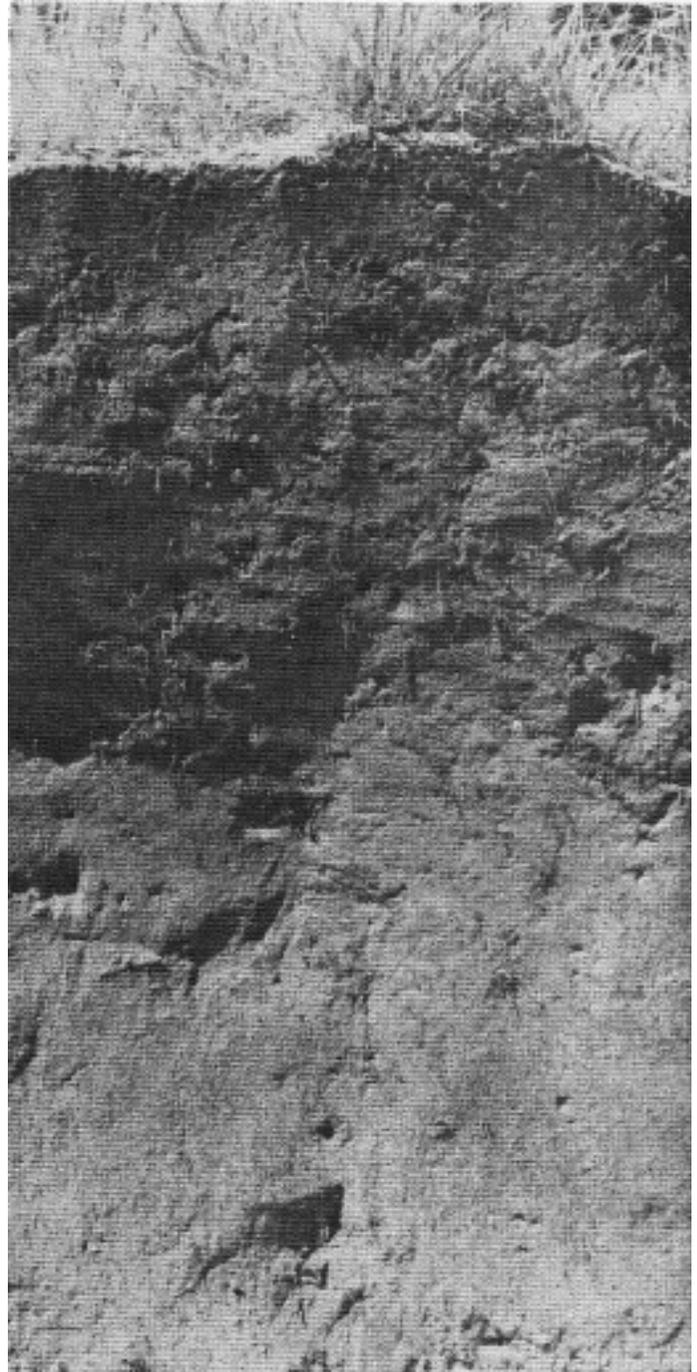


Figure 12.—Profile of a Windsor loamy sand showing moderately dark colored surface layer and the rooting depth of plants.

layer is underlain by a mineral surface layer of very dark grayish-brown loamy sand about 6 inches thick. The upper part of the subsoil is dark yellowish-brown loamy sand about 9 inches thick. The lower part of the subsoil is loose, olive-brown sand about 8 inches thick. The substratum is loose, pale-brown and black coarse sand to a depth of more than 60 inches.

The bright colors and lack of mottles in the Windsor

soils indicate that they are well aerated and porous. The Windsor soils are rapidly permeable. They have a moderately low available moisture capacity and very low natural fertility. These soils are filled to capacity with available moisture at the start of the growing season. As the growing season progresses, rain normally is not adequate to replenish the soil moisture used by plants. Crops, therefore, show signs of lack of moisture during the growing season. These soils warm faster in the spring than the more silty, more clayey, or wetter soils in the county. They are easily tilled and can be cultivated throughout a wide range of moisture content without puddling, crusting, or becoming cloddy. The Windsor soils can be worked earlier in the spring and sooner after rains than most soils in the county. These soils are susceptible to soil blowing in areas not vegetated. They have a low shrink-swell potential.

Windsor soils are used mainly for corn and hay on farms and for housing developments, industrial sites, truck crops, and roads near villages and cities. The acreage in trees and brush is considerable. These soils are in areas that are transitional from farm to nonfarm use. Near the city of Burlington, several large sand pits are in mapped areas of Windsor soils.

Windsor soils were not mapped separately in Chittenden County. They were mapped with Adams soils in undifferentiated groups. These undifferentiated groups are described under the Adams series.

Representative profile of a Windsor loamy sand in a Scotch pine plantation in the town of Essex, about 1 mile south-southeast of Essex Center and three-fourths of a mile east of Alder Brook:

- O1—2 inches to 1 inch, fresh litter of pine needles, twigs, and branches, and some hardwood leaves and twigs.
- O2—1 inch to 0, black (5YR 2/1) partly decomposed organic matter; many tree roots; very strongly acid; abrupt, smooth boundary.
- Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) loamy sand; very weak, fine, granular structure; very friable; many tree roots; very strongly acid; abrupt, smooth boundary.
- B21ir—6 to 15 inches, dark yellowish-brown (10YR 4/4) loamy sand; single grain; loose; many tree roots; strongly acid; clear, smooth boundary.
- B22—15 to 23 inches, olive-brown (2.5Y 4/4) sand; single grain; loose; common tree roots in upper part of horizon, few roots in lower part; strongly acid; clear, smooth boundary.
- C—23 to 60 inches, pale-brown (10YR 6/3) and black (10YR 2/1) coarse sand in a salt-and-pepper effect; single grain; loose; few tree roots; medium acid.

Each of the two organic layers of Windsor soils ranges from one-half to one inch in thickness. The solum is 20 to 30 inches thick. In most places it is free of coarse fragments, but the C horizon commonly contains up to 15 percent of coarse fragments by volume. All horizons are very friable or loose.

The Ap horizon and the A1 horizon, where present, have a hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. An A2 horizon occurs in some places. The Ap horizon ranges from very strongly acid to neutral, and the A1 and A2 horizons are very strongly acid or strongly acid.

The B21ir horizon is 7.5YR to 2.5Y in hue, 4 or 5 in value, and 3 to 6 in chroma. The B22 horizon has a hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4. The B horizon ranges from loamy fine sand to sand. It is strongly to slightly acid.

The C horizon is brown (10YR 6/3), black (10YR 2/1), and of colors that are 2.5Y in hue, 4 or 5 in value, and 2 to 4 in chroma. This horizon ranges from sand to very coarse sand. It ranges from strongly acid to slightly acid.

Windsor soils are near the Deerfield, Duane, and Agawam soils. They lack the mottles in the lower part of the subsoil that are characteristic in the Deerfield and Duane soils. The solum of Windsor soils is sandier than that of the Agawam soils. Windsor soils are similar to the Adams soils in the texture and natural drainage, but the Windsor soils are not so reddish brown in the upper part of the B horizon as are the Adams soils. Windsor soils have less than 10 percent pebbles and cobbles between the soil surface and a depth of 40 inches, but the Colton soils have more.

Winooski Series

The Winooski series consists of soils that are deep, moderately well drained, and loamy throughout their profile. These soils are level to nearly level and occur on the flood plains of streams. Winooski soils are near the Winooski, Lamoille, Browns, and La Platte Rivers and near the smaller streams that flow into them or into Lake Champlain. These soils formed in very fine sandy loam and silt loam material. The kind of sediments often is different in each flood. In most places the sediments have not been in place long enough for a distinct subsoil to form.

A representative profile of a Winooski soil has a very dark grayish-brown very fine sandy loam surface layer about 10 inches thick. The upper part of the subsoil is friable, olive silt loam about 5 inches thick. The lower part of the subsoil is friable, olive very fine sandy loam about 8 inches thick. The subsoil is mottled with olive brown and dark brown. The substratum starts at a depth of about 23 inches and continues to more than 40 inches below the soil surface. It is very friable, olive-brown very fine sandy loam mottled with dark brown.

Winooski soils have high natural fertility and a moderately high available moisture capacity. Their permeability is moderate. A few areas of the Winooski soils are low enough in relation to the level of the water in the streams that they are under water for periods of 1 or 2 weeks. This flooding occurs in spring and fall. Other areas are flooded for periods of only a few days. In a few places, flooding occurs only in some years. These soils have only faint mottles in the upper part, but the mottles are more distinct as depth increases. This pattern of mottling indicates that the upper part of the soils is not frequently wet but that the lower part is saturated for significant periods.

From late fall to early spring, a seasonal water table stands at less than 2 feet below the soil surface. It recedes to a depth of 2 feet or more during the drier period of the year. The erosion hazard is severe when floodwater flows swiftly across these soils. The deposition or removal of soil and nonsoil materials during flooding is a problem. Removal of stable manure spread on these soils is common. These soils commonly are farmed, but in spring farming operations are delayed because of wetness. Artificial drainage is necessary for optimum growth of crops. These soils are slow to warm in the spring. They remain moist below the surface layer during most of the growing season. Shrink-swell potential is low.

Winooski soils are used mainly for hay and pasture, but a small acreage is in corn grown for silage. In the Winooski River Valley, a few areas are harvested for corn grain.

Representative profile of pastured Winooski very fine

sandy loam, about 1.5 miles northwest of the bridge crossing the Winooski River between the cities of Winooski and Burlington:

- Ap—0 to 10 inches, very dark grayish-brown (2.5Y 3/2) very fine sandy loam, light brownish gray (2.5Y 6/2) when dry; moderate, medium, platy structure; friable; many roots; neutral; abrupt, smooth boundary.
- II B21—10 to 15 inches, olive (5Y 4/3) silt loam; few, fine, faint, olive-brown (2.5Y 4/4) mottles; weak, thin, platy structure; friable; many roots; neutral; abrupt, irregular boundary.
- II B22—15 to 23 inches, olive (5Y 4/3) very fine sandy loam; common, fine, distinct, dark-brown (10YR 3/3) mottles; weak, medium, platy structure; friable; common roots; neutral; abrupt, smooth boundary.
- II Cg—23 to 40 inches, olive-brown (2.5Y 4/4) very fine sandy loam; common, fine, distinct, dark-brown (7.5YR 3/2) mottles; massive; very friable; few roots; neutral.

The dominant texture to a depth of 40 inches is silt loam or very fine sandy loam, but very fine sand and loamy very fine sand are within the texture range. The reaction ranges from medium acid to neutral throughout the soil.

The A horizon, when moist, has a hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. The B and C horizons are 10YR to 5Y in hue, 3 to 5 in value, and 2 to 4 in chroma.

Winooski soils are near the well-drained Hadley soils and the poorly drained Limerick soils. The mottles in the uppermost 24 inches of the Winooski soils are lacking in the Hadley soils. Winooski soils do not have the gray colors that are mottled in the uppermost 20 inches of the soil profile, but the Limerick soils do.

Winooski very fine sandy loam (Wo).—This soil has slopes of 0 to 3 percent. It occupies irregularly shaped areas that are 2 to 80 acres in size.

Included with this soil in mapping are small areas of Limerick and Hadley soils. Limerick soils are mainly in the more level or slightly depressional spots. Hadley soils are on the higher mounds or slightly elongated rises. The more sloping areas of this Winooski soil have a higher proportion of naturally better drained soils included in mapping than have the less sloping Winooski areas. Also included are small areas of Winooski soils that are sandy loam and fine sandy loam in the subsoil and substratum. These Winooski soils are sandy at less than 40 inches below the soil surface. The sandy textures are most common in the smaller soil areas and in areas occupying the smaller stream valleys. A few areas contain inclusions of soils that have slope of more than 3 percent. In a few areas, the surface layer is silt loam or fine sandy loam.

This soil is used mainly for hay, corn grown for silage, and pasture. A small acreage is wooded or is idle. Roads and railroads occupy a considerable acreage of this soil in a few valleys.

Artificial drainage is necessary for optimum growth of crops. This soil can be farmed intensively without risk of damage if fertility and good structure are maintained. The addition of organic matter helps in maintaining good structure. Surface runoff is very slow, and the erosion hazard is very slight. Lime, manure, or commercial fertilizer spread on the soil surface or stockpiled is likely to be moved or damaged by floodwater. Floodwater also may damage or ruin farm equipment left on this soil. In most areas considerable time is needed to remove the debris left by the floodwater. This soil has limitations for many nonfarm uses, especially those for which wetness and flooding are considerations. (Capability unit IIw-1; woodland suitability group 3o1)

*Use and Management of the Soils*²

The first part of this section discusses management of tilled crops and tame pasture, gives estimates of yields, and briefly explains the system of capability classification used by the Soil Conservation Service. Those who wish to know the capability classification of a given soil can refer to the "Guide to Mapping Units" at the back of this survey. Those who want detailed information about management of the soil can refer to the section "Descriptions of the Soils."

The last part of this section discusses use of the soils as woodland, as wildlife habitat, in engineering works, and for community development and recreation.

Managing Soils for Tilled Crops and Tame Pasture

The main crops grown on the soils of Chittenden County are corn, oats, and forage crops. Apple orchards and vegetables are of minor importance in the county.

The dominant problems of use and management vary somewhat in different parts of the county. In the Green Mountains, their foothills, and the western hill section of the county, the dominant soils are loamy, extremely stony, very rocky, shallow to deep, and have a fragipan. The major limitations to use are stoniness, rockiness, and steep slopes. In managing the less stony and rocky soils, the farmer is concerned mainly with the improvement and maintenance of fertility and the control of erosion. The farms are used mainly for hay and pasture.

In the Champlain Valley, the loamy soils are dominantly stony, extremely rocky, and shallow to deep. The major limitations to use are rockiness and steep slopes. In managing the less rocky and stony soils, the farmer is concerned mainly with improving and maintaining fertility and in controlling erosion. The farms are used mainly for hay and pasture.

The dominant soils in the rest of the Champlain Valley are nonstony, nonrocky, sandy to clayey, and deep. The major concerns of management are excessive wetness, droughtiness, maintenance of fertility, and the control of erosion. The farms are used mainly for hay and pasture. Corn is grown for silage in a small acreage.

On the soils used for crops in this county, management is needed for controlling erosion, providing drainage, maintaining the supply of organic matter, improving or maintaining tilth, and increasing fertility.

Practices that help to control erosion in the county are growing a winter cover crop; stripcropping; growing grasses, legumes, or both in a long-term conservation cropping system that also provides tilled crops; constructing terraces; farming on the contour; grassing of waterways; planting trees and shrubs to act as windbreaks for Adams, Windsor, and other sandy soils that are subject to soil blowing; constructing diversions and ditches to intercept runoff from adjacent higher slopes; regulating grazing to maintain cover; using minimum tillage, particularly on short slopes where contour culti-

² JOHN E. GRIGGS, soil scientist, Soil Conservation Service, assisted in preparing this section.

vation is difficult; and applying lime and fertilizer as needed.

Many of the soils in the county need improved drainage for optimum crop growth. Wet soils are slower to warm up in spring than better drained soils. On wet soils tillage operations are delayed and farm machinery often bogs down. Drainage can be improved by constructing open ditches, smoothing the land, and installing tile. Land smoothing eliminates small elevated areas and fills small depressions. Tile may be used to remove excess water in drainageways, seeps, and depressions. Shallow waterways may also be used to remove surface water from depressions in the field.

In most of the soils, the content of organic matter is so low that practices are needed to improve and maintain tilth. Plowing under crop residues reduces crusting and evaporation, adds organic matter, increases the water absorbed, and makes the soil easier to till. The growing of a grass-legume crop to be plowed under as green manure improves tilth and soil structure and thus makes the soil more permeable. Soils that are tilled when wet lose their granular structure and become cloddy and hard when dry. Bare soils tend to develop a hard surface crust on drying after a heavy rain. This surface crust hinders the emergence of new seedlings and may result in sparse stands of plants. Clayey soils are difficult to plow and harrow. The Vergennes and similar soils that have a clayey surface layer normally are plowed in the fall. The alternate freezing and thawing during winter makes preparation of the seedbed easier in spring. Weed control is more difficult on clayey soils because the narrow moisture range for good tillage limits the length of time for optimum cultivation.

In recent years better plant varieties have been used, and fertilizer has been added. Most of the soils in Chittenden County are acid and low in natural fertility. The application of lime, livestock manure, and commercial fertilizer improves tilth and crop growth. Lime and fertilizers should be applied according to needs indicated by soil tests with consideration given to past use and potential of the soil.

Hay crops and tame pasture occupy a large acreage in Chittenden County. A grass-legume mixture most commonly used consists of alfalfa, ladino clover, bromegrass, and timothy. Also grown in the county are red clover, alsike clover, reedtop, reed canarygrass, orchardgrass, and birdsfoot trefoil. Alfalfa grows better on soils that are moderately well drained or well drained than on wet soils. In some years it is killed on soils that are flooded. Ladino clover is more tolerant of wet soils. At higher elevations on some soils, such as Georgia and Peru, ladino clover is substituted for alfalfa. Birdsfoot trefoil instead of alfalfa is commonly grown on the Vergennes soils. On some wet soils and in areas not adequately drained reed canarygrass and alsike clover are grown.

Fertilizer is generally needed for establishing a stand of perennial pasture plants. Soil deficiencies can be determined by soil tests. Then a fertilizer program can be used that is suited to the pasture plants and that gives the plant growth desired. Proper grazing and necessary brush and weed control insure good growth for a long period.

Estimated yields

The soils of Chittenden County vary considerably in productivity. Some soils consistently produce higher yields of cultivated crops, but others are better suited to less intensive uses because of soil limitations or erosion hazards.

The estimated average yields of the principal crops, per acre, for the soils of the county are given in table 2, for two levels of management—prevailing management and improved management. The estimated yield of a tall grass-legume pasture is given in cow-acre-days for the improved level of management only. Yields are not estimated for some soils and land types, because these soils are not suited to the crop, the land types are too variable to rate, or the crop is not commonly grown on the soil.

In columns A are the estimated yields for crops grown under prevailing management. For prevailing management, some legume-grass is grown in the crop rotations. Generally, little consideration is given to the suitability of the cropping system for the soil. Barnyard manure that is produced is returned to the soil. Lime is applied, though in many places in insufficient amounts and not according to soil test recommendations. Some fertilizer is applied. Drainage generally is inadequate, and often, because of excess water, only a partial crop is harvested from poorly drained areas. Erosion control and other soil management is not used to fullest advantage.

In columns B are the estimated yields for crops obtained under improved management. Improved management includes most of the following practices: The cropping system is adapted to the soil and has a proper proportion of row crops to legume-grass crops. The cropping system is supplemented by the necessary conservation measures that are needed to control soil blowing and water erosion. Such measures may include contour tillage, stripcropping, minimum tillage, and return of crop residues. The quantity of lime applied is determined by soil test. The fertilizer applied also is determined by soil test and is based on the amounts and kinds of plant nutrients needed by the crop. Where needed, an adequate system of artificial drainage is installed. Improved varieties of plants and high quality seeds are used. Weeds, disease, and insects are controlled. Suitable methods and proper timing of tillage and harvesting are used. Cover crops, crop residues, and manure are returned to improve soil structure, supply organic matter, and control erosion.

The crop yields listed are those that are expected over a period of several years under the two defined levels of management. The yields under improved management are not presumed to be the maximum obtainable. Potential yields per acre are somewhat higher, especially if the combination of soil, plant, and weather is favorable. Irrigation is not considered a part of improved management, since this practice is limited mainly to the production of truck and fruit crops.

These yields are estimates of relative productivity for the soils in Chittenden County. The actual yield figures, although they become out of date with time, are a guide to the relative rating of productivity of the soils.

TABLE 2.—*Estimated average acre yields of principal crops under two levels of management*

[All the land types in the county and soils that are steep and very steep; very rocky, and extremely rocky; extremely stony; and wet, are not in this table, because they are not suited to or generally used for the kinds of crops, hay, or pasture listed. Yields in columns A are those expected under ordinary management; those in columns B, under improved management. Absence of yield indicates the crop is not commonly grown on the soil or that yields were not estimated]

Mapping units	Alfalfa-grass hay		Clover-grass hay		Corn for silage ¹		Corn for grain		Oats for grain		Tall grass-legume pasture
	A	B	A	B	A	B	A	B	A	B	
	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.	Bu.	Bu.	Cow-acre-days ²
Adams and Windsor loamy sands, 0 to 5 percent slopes:											
Adams soil.....	2.0	3.0	1.0	2.5	7	12	33	60	33	60	170
Windsor soil.....	2.0	3.0	1.0	2.5	7	12	33	60	33	50	170
Adams and Windsor loamy sands, 5 to 12 percent slopes:											
Adams soil.....	1.5	2.5	1.0	2.0					25	55	170
Windsor soil.....											170
Adams and Windsor loamy sands, 12 to 30 percent slopes:											
Adams soil.....											145
Windsor soil.....											145
Agawam fine sandy loam, 0 to 5 percent slopes.....	2.5	4.5	1.5	4.0	16	24	77	120	38	70	255
Agawam fine sandy loam, 12 to 30 percent slopes.....	2.0	3.5	1.5	3.0							230
Au Gres fine sandy loam.....	1.5	3.0	1.5	2.6	11	16	54	80	34	50	170
Belgrade and Eldridge soils, 0 to 3 percent slopes:											
Belgrade soil.....	3.0	4.5	2.5	4.0	16	24	81	120	41	85	255
Eldridge soil.....	2.5	4.0	2.5	3.5	12	16	58	80	30	60	230
Belgrade and Eldridge soils, 3 to 8 percent slopes:											
Belgrade soil.....	3.0	4.5	2.5	4.0	16	24	58	120	41	85	255
Eldridge soil.....	2.5	4.0	2.5	3.5	12	16	58	80	30	60	230
Belgrade and Eldridge soils, 8 to 15 percent slopes:											
Belgrade soil.....	2.5	4.0	2.0	3.5	11	22	54	110	46	80	230
Eldridge soil.....	2.0	3.5	2.0	3.0	10	14	50	70	30	55	200
Belgrade and Eldridge soils, 15 to 25 percent slopes:											
Belgrade soil.....	2.5	3.5	2.0	3.0							200
Eldridge soil.....	2.0	3.0	1.5	2.5							180
Cabot stony silt loam, 0 to 3 percent slopes.....	2.5	4.0	1.5	3.5	10	14	47	70	41	60	200
Cabot stony silt loam, 3 to 15 percent slopes.....	2.5	4.0	2.0	4.0	10	15	51	75	36	54	230
Colton gravelly loamy sand, 0 to 5 percent slopes.....	1.5	2.5	1.0	2.0	7	12	33	60	33	50	145
Colton gravelly loamy sand, 5 to 12 percent slopes.....	1.5	2.5	1.0	2.0							145
Covington silty clay.....	1.5	3.0	2.0	3.0	10	15	48	78	38	55	170
Duane and Deerfield soils, 0 to 5 percent slopes:											
Duane soil.....	2.0	3.0	2.0	3.0	12	16	61	80	33	50	200
Deerfield soil.....	2.0	3.5	2.0	3.0	12	16	61	80	41	60	200
Duane and Deerfield soils, 5 to 12 percent slopes:											
Duane soil.....	2.0	3.0	1.0	2.5	9	14	47	68	27	45	180
Deerfield soil.....	2.0	3.0	1.0	2.5	9	14	47	68	38	55	180
Duane and Deerfield soils, 12 to 20 percent slopes:											
Duane soil.....	1.5	2.5	1.0	2.0	8	12	40	60	23	40	145
Deerfield soil.....	1.5	2.5	1.0	2.0	7	12	35	60	29	50	145
Enosburg and Whately soils, 0 to 3 percent slopes:											
Enosburg soil.....		4.0	1.5	3.0	9	14	45	70			
Whately soil.....		4.0	1.5	3.0	12	18	60	90			

See footnotes at end of table.

TABLE 2.—Estimated average acre yields of principal crops under two levels of management—Continued

Mapping units	Alfalfa-grass hay		Clover-grass hay		Corn for silage ¹		Corn for grain		Oats for grain		Tall grass-legume pasture
	A	B	A	B	A	B	A	B	A	B	
	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.	Bu.	Bu.	Cow-acre-days ²
Enosburg and Whately soils, 3 to 8 percent slopes:											
Enosburg soil.....		4.0	1.5	3.0	9	14	45	70			
Whately soil.....		4.0	1.5	3.0	12	18	60	90			
Farmington-Stockbridge rocky loams, 5 to 12 percent slopes.....	3.0	4.5	1.5	3.0	11	16	54	80	38	57	170
Farmington-Stockbridge rocky loams, 12 to 20 percent slopes.....	2.5	4.0	1.5	2.5	10	15	48	72	31	46	145
Georgia stony loam, 3 to 8 percent slopes.....	3.0	4.5	2.0	4.0	14	22	70	110	45	70	255
Georgia stony loam, 8 to 15 percent slopes.....	3.0	4.0	2.0	3.5	12	20	60	100	45	70	230
Groton gravelly fine sandy loam, 0 to 5 percent slopes.....	2.0	2.5	1.5	2.0	8	12	40	60			255
Groton gravelly fine sandy loam, 5 to 12 percent slopes.....	2.0	2.5	1.5	2.0	8	12	40	60			255
Groton gravelly fine sandy loam, 12 to 20 percent slopes.....	1.5	2.0	1.0	1.5							170
Hadley very fine sandy loam.....	3.5	5.0	2.5	4.5	17	28	84	136	54	80	285
Hadley very fine sandy loam, frequently flooded.....	3.0	5.0	2.5	4.5	17	28	84	136	54	80	200
Hartland very fine sandy loam, 2 to 6 percent slopes.....	3.5	5.0	2.5	4.5	19	28	89	137	51	85	285
Hartland very fine sandy loam, 6 to 12 percent slopes.....	3.0	4.5	2.5	4.0	16	26	78	127	45	80	255
Hartland very fine sandy loam, 12 to 25 percent slopes.....	2.5	4.0	2.0	3.5	14	22	67	102	38	75	230
Hinesburg fine sandy loam, 0 to 3 percent slopes.....	2.0	3.5	1.5	3.0	10	16	48	78	38	65	200
Hinesburg fine sandy loam, 3 to 8 percent slopes.....	2.0	3.5	1.5	3.0	9	16	44	80	38	65	200
Hinesburg fine sandy loam, 8 to 15 percent slopes.....	2.0	3.5	1.5	3.0	9	14	41	68	33	60	200
Hinesburg fine sandy loam, 15 to 25 percent slopes.....	1.5	3.0	1.0	2.5					28	55	170
Limerick silt loam.....				3.5	14	20	68	104			
Livingston clay.....											170
Livingston silty clay, occasionally flooded.....											170
Lyman-Marlow rocky loams, 5 to 12 percent slopes.....	2.5	4.0	1.5	3.0	10	15	52	78	37	56	170
Lyman-Marlow rocky loams, 12 to 20 percent slopes.....	1.5	3.0	1.0	2.5	9	14	46	68	28	42	145
Marlow stony loam, 5 to 12 percent slopes.....	3.0	4.0	2.5	4.0	12	18	61	90	45	67	230
Marlow stony loam, 12 to 20 percent slopes.....	2.5	3.5	2.0	3.5	10	16	53	80	37	56	200
Massena stony silt loam, 0 to 15 percent slopes.....	2.5	4.0	1.5	3.0	16	22	77	110			230
Munson and Belgrade silt loams, 12 to 25 percent slopes:											
Munson soil.....	2.0	3.0	2.0	3.0							170
Belgrade soil.....	2.5	3.5	2.0	3.0							170
Munson and Raynham silt loam, 2 to 6 percent slopes:											
Munson soil.....	2.0	3.5	2.0	3.5	14	22	67	108	38	57	200
Raynham soil.....	2.0	4.0	2.0	3.5	12	18	57	90			200

See footnotes at end of table.

TABLE 2.—Estimated average acre yields of principal crops under two levels of management—Continued

Mapping units	Alfalfa-grass hay		Clover-grass hay		Corn for silage ¹		Corn for grain		Oats for grain		Tall grass-legume pasture
	A	B	A	B	A	B	A	B	A	B	
	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.	Bu.	Bu.	Cow-acre-days ²
Munson and Raynham silt loams, 6 to 12 percent slopes:											
Munson soil.....	2.0	3.5	2.0	3.5	12	20	57	98	45	75	200
Raynham soil.....	2.0	3.5	2.0	3.5	12	16	57	80			200
Palatine silt loam, 3 to 8 percent slopes.....	3.0	4.5	2.0	4.0	15	22	78	110	58	90	240
Palatine silt loam, 8 to 15 percent slopes.....	2.0	4.0	1.5	3.5	14	21	68	105	53	85	240
Palatine silt loam, 15 to 25 percent slopes.....	2.0	3.5	1.5	3.5							200
Peacham stony silt loam.....											170
Peru stony loam, 0 to 5 percent slopes.....	2.5	4.0	2.5	4.0	14	20	58	97	33	50	230
Peru stony loam, 5 to 12 percent slopes.....	2.5	4.0	2.5	4.0	12	18	57	86	41	60	230
Peru stony loam, 12 to 20 percent slopes.....	2.0	3.5	2.0	3.5	10	16	46	77	32	48	200
Scantic silt loam, 0 to 2 percent slopes.....		3.0	1.5	3.0	10	16	51	80	41	60	
Scantic silt loam, 2 to 6 percent slopes.....		3.0	2.0	3.5	10	16	51	80	38	57	
Stetson gravelly fine sandy loam, 0 to 5 percent slopes.....	2.5	4.5	2.0	3.5	10	16	47	77	37	55	255
Stetson gravelly fine sandy loam, 5 to 12 percent slopes.....	2.0	4.0	1.5	3.0	9	14	43	67	33	50	255
Stetson gravelly fine sandy loam, 12 to 20 percent slopes.....	2.0	3.0	1.5	2.5							230
Stockbridge and Nellis stony loams, 3 to 8 percent slopes:											
Stockbridge soil.....	3.0	5.0	2.5	4.5	16	24	78	116	55	85	285
Nellis soil.....	3.0	5.0	2.5	4.5	16	24	78	116	55	85	285
Stockbridge and Nellis stony loams, 8 to 15 percent slopes:											
Stockbridge soil.....	3.0	5.0	2.5	4.5	13	22	66	107	50	80	285
Nellis soil.....	3.0	5.0	2.5	4.5	13	22	66	107	50	80	285
Stockbridge and Nellis stony loams, 15 to 25 percent slopes:											
Stockbridge soil.....	2.5	4.5	2.0	3.5							255
Nellis soil.....	2.5	4.5	2.0	3.5							255
Vergennes clay, 2 to 6 percent slopes.....	3.5	4.5	2.0	3.5	12	20	61	98			255
Vergennes clay, 6 to 12 percent slopes.....	3.5	4.5	2.0	3.5	11	18	57	86			255
Vergennes clay, 12 to 25 percent slopes.....	2.0	3.5	1.5	3.0							200
Winooski very fine sandy loam.....	3.0	4.5	2.5	4.0	18	26	88	127	47	70	255

¹ Green weight.² Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre, multiplied by the number of days the pasture can be grazed without damage during one season. An animal unit is one cow, steer, or horse; five hogs; or seven sheep or goats. An acre of pasture that provides 30 days of grazing for two cows has a carrying capacity of 60 cow-acre-days.

Capability classification

Some readers, particularly those who practice large-scale farming, may find it practical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification, a grouping that shows, in a general way, how suitable soils are used for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment when they are used for common field crops and pasture plants. The classification does not apply to most horticultural crops or to rice and other crops that have special requirements. The soils are classified according to degree and kind of permanent limitation but without consideration of major and generally expensive land-forming that would change the slope, depth, or other characteristics of the soils, and without consideration of possible but unlikely major reclamation projects.

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

The subclasses indicate major kinds of limitations within the classes. Within most of the classes, there can be as many as four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil 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 country, but not in Chittenden County, indicates that the chief limitation is climate that is too cold or too dry.

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

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. The capability unit is a convenient grouping of soils for making many statements about their management. Capability units generally are identified by numbers assigned locally, for example, IIe-4 and IIIe-8.

The eight classes in the capability system, and the subclasses and units in Chittenden County, are described in the list that follows. The unit designation for each soil in the county can be found in the "Guide to Mapping

Units." The capability classification of a soil is also listed at the end of each mapping unit in the section "Description of the Soils." Capability units are not consecutive in Chittenden County, because a statewide system is used in Vermont, and some of the units in the State are not used in this county.

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

Unit I-1. Deep, well-drained, nearly level, loamy soils on flood plains infrequently flooded.

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

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

Unit IIe-1. Deep, moderately well drained, gently sloping, clayey soils formed in estuarine and lacustrine deposits on terraces.

Unit IIe-2. Deep and moderately deep, well-drained and somewhat excessively drained, gently sloping loamy soils formed in glacial till on uplands.

Unit IIe-4. Deep, well-drained, gently sloping, loamy soils formed in glacial lacustrine materials on terraces.

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

Unit IIw-1. Deep, well drained and moderately well drained, nearly level, loamy soils on flood plains that are subject to flooding in spring.

Unit IIw-2. Deep, moderately well drained, nearly level and gently sloping, loamy soils that formed in glacial till on uplands.

Unit IIw-3. Deep, moderately well drained and somewhat poorly drained, nearly level and gently sloping, loamy soils that formed in glaciolacustrine materials on lake plains and terraces.

Unit IIw-4. Deep, moderately well drained, nearly level and gently sloping, loamy soils that formed in stratified outwash materials on terraces.

Subclass IIs. Soils that have moderate limitations of moisture-holding capacity.

Unit IIs-2. Deep, well-drained and somewhat excessively drained, nearly level and gently sloping, loamy and gravelly soils that formed in waterlaid materials on terraces.

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

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

Unit IIIe-1. Deep, moderately well drained and somewhat poorly drained, sloping, clayey and loamy soils that formed in glaciolacustrine materials on terraces.

Unit IIIe-2. Deep and moderately deep, well-drained and somewhat excessively drained,

- sloping, loamy soils that formed in glacial till on uplands.
- Unit IIIe-3. Deep and shallow, well-drained and somewhat excessively drained, sloping, loamy soils that formed in glacial till having outcrops of bedrock on uplands.
- Unit IIIe-4. Deep, well drained and moderately well drained, sloping, loamy soils that formed in glaciolacustrine deposits on terraces.
- Unit IIIe-5. Deep, moderately well drained, sloping, loamy soils that formed in glacial till on uplands.
- Unit IIIe-6. Deep, somewhat poorly drained and poorly drained, gently sloping and sloping, loamy soils that have a fragipan and formed in glacial till on uplands.
- Unit IIIe-7. Deep, moderately well drained, sloping, loamy soils that formed in stratified outwash materials on terraces.
- Unit IIIe-8. Deep, well-drained and somewhat excessively drained, sloping, loamy and gravelly soils that formed in water-laid materials on terraces.
- Subclass IIIw. Soils that have severe limitations because of excess water.
- Unit IIIw-1. Deep, somewhat poorly drained, gently sloping, loamy soils that formed in glaciolacustrine materials on lake plains and terraces.
- Unit IIIw-2. Deep, poorly drained, level, loamy soils on flood plains subject to flooding in spring and fall.
- Unit IIIw-3. Deep, moderately well drained and poorly drained, depressional to gently sloping, loamy soils that formed in stratified water-laid deposits on terraces.
- Unit IIIw-4. Deep, somewhat poorly and poorly drained, nearly level to sloping, loamy soils that formed in glacial till on uplands.
- Subclass IIIs. Soils that have severe limitations of available moisture capacity.
- Unit IIIs-1. Deep, excessively drained, level to gently sloping, sandy and gravelly soils that formed in water-laid materials on terraces.
- Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.
- Unit IVe-1. Deep, moderately well drained and somewhat poorly drained, moderately steep, loamy and clayey soils that formed in glaciolacustrine materials on terraces.
- Unit IVe-2. Deep and moderately deep, well-drained and somewhat excessively drained, moderately steep, loamy soils that formed in water-laid materials on terraces and soils formed in glacial till on uplands.
- Unit IVe-3. Deep and shallow, well drained and somewhat excessively drained, moderately steep, loamy soils formed in glacial till with outcrops of bedrock on uplands.
- Unit IVe-5. Deep, moderately well drained, moderately steep, loamy soils with a fragipan, formed in glacial till on uplands.
- Unit IVe-6. Deep, moderately well drained to somewhat excessively drained, moderately steep, loamy and gravelly soils that formed in water-laid materials on terraces.
- Subclass IVw. Soils that have very severe limitations because of excess water.
- Unit IVw-3. Deep, poorly drained, level and gently sloping, clayey and loamy soils that formed in lacustrine deposits in old glacial lakes.
- Unit IVw-4. Deep, very poorly drained, level and depressional, clayey soils that formed in lacustrine deposits in old glacial lakes.
- Unit IVw-5. Deep, somewhat poorly and poorly drained, loamy soils that formed in water-laid materials on terraces.
- Subclass IVs. Soils that have very severe limitations because of low available moisture capacity.
- Unit IVs-1. Deep, excessively drained, sloping, sandy and gravelly soils that formed in water-laid materials on terraces.
- Class V. Soils that are not likely to erode but have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture, woodland, or wildlife food and cover.
- Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.
- Unit Vw-1. Deep, very poorly drained, depressional to level, loamy soils that formed in glacial till on uplands and soils formed in glaciofluvial deposits on terraces.
- Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and limit their use mainly to pasture, woodland, or wildlife food and cover.
- Subclass VIe. Soils severely limited, chiefly by risk of erosion, if protective cover is not maintained.
- Unit VIe-1. Deep, somewhat excessively drained, moderately steep, gravelly soils that formed in water-laid deposits on terraces.
- Unit VIe-2. Deep, well-drained and moderately well drained, moderately steep, loamy soils that have a fragipan, formed in glacial till on uplands.
- Subclass VIs. Soils generally unsuitable for cultivation and limited for other uses by low available moisture capacity, by stones or other features.
- Unit VIs-1. Deep, excessively drained, sandy and gravelly soils that formed in water-laid materials on terraces, and shallow to deep, well-drained to somewhat excessively drained, sloping to moderately steep, very rocky soils that formed in glacial till on uplands.
- Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife.
- Subclass VIIe. Soils very severely limited, chiefly by risk of erosion, if protective cover is not maintained.

Unit VIIe-2. Deep, moderately well drained to somewhat excessively drained, loamy to clayey and gravelly soils that formed in water-laid materials on terraces, and shallow to deep, well drained to somewhat excessively drained, steep, loamy soils that formed in glacial till on uplands.

Subclass VIIw. Soils very severely limited by excess water.

Unit VIIw-1. Deep, poorly drained and very poorly drained, depressional to level, loamy to clayey, very wet mineral soils and organic soils that are subject to flooding.

Subclass VIIs. Soils very severely limited by rocks, stones, or low available moisture capacity.

Unit VIIs-2. Deep, excessively drained, moderately steep to steep, sandy and gravelly soils, and shallow to deep, poorly drained to somewhat excessively drained, nearly level to steep, extremely stony and extremely rocky soils.

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

Subclass VIIIw. Extremely wet or marshy land.

Unit VIIIw-1. Fresh water marsh under water most of the year.

Subclass VIIIs. Rock or soil materials that have little potential for production of vegetation.

Unit VIIIs-2. Barren beaches, Blown-out land, Quarries, and Rock land.

Woodland ^a

The forest survey made in 1966 by the Forest Service, United States Department of Agriculture, reports that there were about 196,000 acres of commercial woodland in Chittenden County. This is 58 percent of the county. The Vermont Department of Forests and Parks reports that in 1968 the timber used in the county amounted to 6.5 million board feet. About 4.0 million of this was cut in the county. The pulpwood, boltwood, and posts cut are not considered timber and are not included. The general condition of the woodland indicates that an annual harvest of 4.0 million board feet can be maintained and even increased if management of woodland is good. Because of the competition of other land use, however, wood-using industries in the county may have to depend more on wood harvested outside of the county.

The woodlands in the county have been grouped into three geographical areas—the Champlain Valley, the foothills between this valley and the Green Mountains, and the Green Mountains.

The Champlain Valley has major tree associations consisting of hickory, oak, basswood, elm, ash, soft maple, sugar maple, white pine, hemlock, northern white cedar,

and red cedar. This area contains most of the operating farms, and the woodland normally is in small woodlots. Farming is important in this area and management of the woodlots is extremely good or extremely poor. This variation in management is a result of poor sites or changes in ownership. The Champlain Valley makes up 40 percent of the county.

The foothills between the main range of the Green Mountains and the Champlain Valley have major tree associations consisting of soft maple, sugar maple, white birch, yellow birch, beech, black birch, ash, basswood, elm, white pine, red spruce, and hemlock. This area is transitional between the farm woodlots in the Champlain Valley and the larger tracts in the Green Mountains. In this area many abandoned farms have been purchased by speculators, lumber companies, and people interested in recreation. In general, forest management in the foothills is better than in the Champlain Valley. The foothills make up about 45 percent of the county.

The main mountains in the Green Mountain range are in the eastern part of the county. They have major tree associations consisting of yellow birch, beech, sugar maple, red maple, ash, basswood, white birch, hemlock, red spruce, and balsam fir. This area contains much steep, rough land. All except a few farms have been abandoned. Much of the large privately owned woodland occurs here. The Green Mountains make up about 15 percent of the county.

Woodland suitability groups

The soils of the county have been grouped according to their suitability as woodland. Table 3 gives woodland interpretations by woodland suitability groups.

The soils in each group are similar, within defined ranges, in their potential productivity for trees, in the major hazards and limitations that affect use of the soils as woodland, and in the problems in management of trees that are caused by soil characteristics. The woodland suitability groups of soils have been placed in a national system of woodland suitability classes and subclasses.

Site index is a common measure of potential productivity. It is the average height of the dominant and codominant trees in a fully stocked stand at the age of 50 years. The range of site index within a suitability class is defined by the Soil Conservation Service on a regional basis within the United States. In the Northeast Region, which includes Vermont, seven woodland suitability classes are established.

Woodland suitability classes are designated by Arabic numerals 1 through 7. These numbers are the first part of a three-part symbol. Class 1, potentially the highest in productivity, is followed by classes 2, 3, 4, and so on, to include the entire site-index range of each species or forest type. Only classes 2 through 5 occur in Chittenden County. In this county, the potential productivity of these classes is expressed as good, fair, or poor as shown in table 3. The following list shows the site index range for each of these ratings for red spruce, white pine, and northern hardwoods and indicates the total volume in board feet that can be expected.

^a ROBERT A. FARRINGTON, senior forester, Vermont Department of Forests and Parks, and WILLIAM P. HALL, Chittenden County forester, assisted in the preparation of this section.

Tree species or forest types and their productivity Ratings	Range of site index	Average total yield in board feet per acre
Red spruce:		
Good.....	50+	11, 700
Fair.....	40-49	9, 900
Poor.....	30-39	5, 000
White pine:		
Good.....	70+	50, 000
Fair.....	60-69	36, 000
Poor.....	50-59	24, 000
Northern hardwoods:		
Good.....	59+	3, 000
Fair.....	53-58	2, 300
Poor.....	45-53	900

All site indexes and yields in the foregoing list are for trees in unmanaged stands. For red spruce and northern hardwoods, the listing is from unpublished data developed by the Soil Conservation Service and the Vermont Department of Forests and Parks, and the ratings are for all trees that have a 12-inch, or larger, diameter at breast height and a top of up to 8 inches. For white pine, the data are from the United States Department of Agriculture Bulletin 13, and the ratings are for all trees having a 7-inch, or larger, diameter at breast height and a top of up to 6 inches.

Woodland suitability subclasses are used for grouping soils within woodland suitability classes. Subclasses are based on selected soil properties associated with moderate to severe hazards or limitations in woodland use or management. The subclasses are designated by adding a lower case Arabic letter *x*, *w*, *t*, *d*, *c*, *s*, *f*, *r*, or *o* to the class numeral, for example, 2*x*. The letter *x* indicates that the soils have restrictions or limitations because of stoniness or rockiness; *w* indicates excessive wetness; *t* indicates toxic substances; *d* indicates restricted rooting depth; *c* indicates restrictions or limitations that result from the kind or amount of clay in the upper part of the soil profile; *s* indicates dry, unstable, abrasive sandy soils; *f* indicates limitations because of large amounts of coarse fragments in the soil profile; *r* indicates limitations that result from steepness; and *o* indicates soils that have no significant restrictions or limitations for woodland use and management. Some kinds of soil may have more than one set of subclass characteristics. Priority in placing each kind of soil into a subclass is in the order that the subclass characteristics are listed above. None of the soils in Chittenden County have been assigned to subclasses *f* or *t*.

Woodland suitability groups are derived by grouping soils within suitability subclasses so that the ratings given to each group apply to all the soils in the group. A woodland suitability group, therefore, is made up of soils that can produce similar kinds of woodcrops, that need similar management to produce these crops where the existing vegetation is similar, and that have about the same potential productivity.

Woodland suitability groups are numbered consecutively with Arabic numerals from 1 to as many as are needed. These numbers represent the third part of a symbol that shows the complete placement of each kind of soil into the woodland suitability classification system. Examples are 2*x*1 and 2*x*2.

Severe and wasteful cutting of woodlands generally is changing to more conservative and scientific cutting.

Change in land use and ownership contributes to better management, fewer owners, and slightly larger ownerships. Future trends forecast by the Forest Service and the Vermont Department of Forests and Parks indicate a continued and even larger need for wood in one form or another. The pattern of ownership and size of tracts probably will continue to change. A more diversified use of woodlands, such as for recreation, water control, rural residences, and community development, is expected to continue.

Trees, like any crop that depends on soil capabilities and fertility, grow best on the best soils. Since only 58 percent of this county is commercial woodland, less than half of the land is used for other uses, particularly farming, recreation, and rural nonfarm houses. Because these uses also require the best soils, it is assumed that only a small part of the acreage in the most productive woodland suitability classes is available for wood production.

In addition to the 318,900 acres of soils in subclasses suited to trees, 4,980 acres of soils are too variable to rate, 19,070 acres are not suited to commercial timber, and 3,530 acres are in the military test-firing area.

For each woodland suitability group, table 3 rates for important trees the potential productivity of commercial timber. These ratings were derived from site index data, but studies were not made on all soils in the county. For those soils on which studies were not made, site index data are based on studies of similar soils in Vermont, Maine, and New Hampshire. Site index for a given soil is the average total height, in feet, attained by dominant and codominant trees in a specified period of time. In Vermont this time normally is 50 years. The class of soils represents a grouping of site indexes within a defined range for a tree species or combination of species.

Potential productivity ratings are designated as *good*, *fair*, and *poor* in table 3. Soils are rated *good* if they can produce high yields of good-quality forest crops. Intensive management is justified on these soils. Soils are rated *fair* if they have an average potential for woodland use. Growth of adapted species is slower than on good sites. Management, though justified on these soils, should not be so intensive as on the soils rated *good*. Soils rated *poor* have less than average potential for woodland. Good timber can be produced on these soils, but tree growth is slow.

The information given for the capability of the various soils to produce trees is based on soil-forest site studies made by the Soil Conservation Service, the Maine Forest Service, the New Hampshire Extension Service, and the Vermont Department of Forests and Parks.

Rated in table 3 are erosion hazard, equipment limitations, seedling mortality, plant competition, and wind-throw hazard. These are defined in the following paragraphs.

Erosion hazard indicates the degree of potential erosion on the soil under common woodland management. The ratings are *slight* if there are no special problems, *moderate* if some care is needed in locating roads and skid trails, and *severe* if extreme care is needed in locating roads, skid trails, loading areas, and other

TABLE 3.—Woodland interpretations by woodland suitability groups¹

Woodland group	Potential productivity for commercial timber ²	Factors affecting management—						Windthrow hazard
		Erosion hazard	Equipment limitations	Seedling mortality	Plant competition			
					Northern hardwoods	Conifers		
Group 2o1: Moderately deep and deep, well-drained and somewhat excessively drained, loamy soils that are nonstony and stony and are gently sloping and sloping.	Good	Slight	Slight	Slight	Moderate	Severe	Slight.	
Group 2r1: Moderately deep and deep, well-drained, loamy soils that are nonstony and stony and are moderately steep.	Good	Slight	Moderate	Slight	Moderate	Severe	Slight.	
Group 2r2: Moderately deep, somewhat excessively drained, loamy soils that are nonstony and steep.	Good	Moderate	Moderate	Slight	Moderate	Severe	Slight.	
Group 2x1: Deep, well-drained, loamy soils that are extremely stony and are gently sloping to sloping.	Good	Slight	Moderate	Slight	Moderate	Severe	Slight.	
Group 2x2: Deep, well-drained, loamy soils that are extremely stony and are moderately steep and steep.	Good	Moderate	Moderate to severe.	Slight	Moderate	Severe	Slight.	
Group 3o1: Deep, moderately well drained, loamy soils that are nonstony and stony and are level to sloping.	Good	Slight	Slight	Slight ³	Slight	Moderate	Slight.	
Group 3o2: Deep, well-drained, loamy soils that are nonstony and stony and are level to sloping.	Good	Slight	Slight	Slight	Slight	Moderate	Slight.	
Group 3r1: Deep, moderately well drained, loamy soils that are stony and moderately steep.	Good	Slight	Moderate	Slight	Slight	Moderate	Slight.	
Group 3r2: Deep, moderately well drained and well drained, loamy soils that are sloping.	Good	Moderate	Slight	Slight ⁴	Slight	Moderate	Slight.	
Group 3r4: Deep, well-drained, loamy soils that are stony and moderately steep.	Good	Slight	Moderate	Slight	Slight	Moderate	Slight.	
Group 3r5: Deep, moderately well drained and well drained, loamy soils that are moderately steep.	Good	Severe	Moderate	Slight ⁴	Slight	Moderate	Slight.	
Group 3r6: Deep, well-drained, loamy soils that are steep.	Good	Severe	Severe	Slight	Slight	Moderate	Slight.	
Group 3x1: Deep, moderately well drained, loamy soils that are extremely stony and are nearly level to moderately steep.	Good	Slight	Moderate	Slight	Slight	Moderate	Slight.	

Group 3x2: Deep, well-drained, loamy soils that are extremely stony and are gently sloping to moderately steep.	Good	Slight	Moderate	Slight	Slight	Moderate	Slight
Group 3x3: Deep, moderately well drained, loamy soils that are extremely stony and are moderately steep and steep.	Good	Slight to moderate	Moderate to severe	Slight	Slight	Moderate	Slight
Group 3x4: Deep, well-drained, loamy soils that are extremely stony and are moderately steep and steep.	Good	Slight to moderate	Moderate to severe	Slight	Slight	Moderate	Slight
Group 4c1: Deep, moderately well drained, clayey soils that are gently sloping.	Fair	Slight	Moderate	Severe	Slight	Moderate	Slight
Group 4c2: Deep, moderately well drained, clayey soils that are sloping.	Fair	Moderate	Moderate	Severe	Slight	Moderate	Slight
Group 4c3: Deep, moderately well drained, clayey soils that are moderately steep and steep.	Fair	Severe	Severe	Severe	Slight	Moderate	Slight
Group 4d1: Shallow and deep, well-drained and somewhat excessively drained, loamy soils that are rocky and sloping.	Fair	Slight	Slight	Moderate	Slight	Slight	Moderate
Group 4d2: Shallow and deep, well-drained and somewhat excessively drained, loamy soils that are rocky and are moderately steep.	Fair	Slight	Moderate	Moderate	Slight	Slight	Moderate
Group 4d3: Shallow and deep, well-drained and somewhat excessively drained, loamy soils that are rocky and steep.	Fair	Moderate	Severe	Moderate	Slight	Slight	Moderate
Group 4o1: Deep, well-drained and somewhat excessively drained, loamy over sandy soils that are nearly level to sloping.	Fair	Slight	Slight	Slight	Slight	Slight	Slight
Group 4o3: Deep, moderately well drained, sandy soils that are level to sloping.	Fair	Slight	Slight	Slight	Slight	Moderate	Slight
Group 4o4: Deep, moderately well drained, sandy over loamy soils that are nearly level to sloping.	Fair	Slight	Slight	Slight	Slight	Moderate	Slight
Group 4r1: Deep, well-drained and somewhat excessively drained, loamy over sandy soils that are moderately steep.	Fair	Slight	Moderate	Slight	Slight	Slight	Slight
Group 4r2: Deep, well-drained and somewhat excessively drained, loamy over sandy soils that are steep.	Fair	Moderate	Severe	Slight	Slight	Slight	Slight
Group 4r5: Deep, moderately well drained, sandy or sandy over loamy soils that are moderately steep.	Fair	Slight	Moderate	Slight	Slight	Moderate	Slight

See footnotes at end of table.

TABLE 3.—Woodland interpretations by woodland suitability groups¹—Continued

Woodland group	Potential productivity for commercial timber ²	Factors affecting management—						Windthrow hazard
		Erosion hazard	Equipment limitations	Seedling mortality	Plant competition			
					Northern hardwoods	Conifers		
Group 4s1: Deep, excessively drained, sandy soils that are level to sloping.	Fair	Slight	Slight	Moderate	Slight	Slight	Slight	Slight.
Group 4s2: Deep, excessively drained, sandy soils that are moderately steep.	Fair	Slight	Moderate	Moderate	Slight	Slight	Slight	Slight.
Group 4s3: Deep, excessively drained, sandy soils that are steep.	Fair	Moderate	Severe	Moderate	Slight	Slight	Slight	Slight.
Group 4s4: Deep, well-drained, sandy over loamy soils that are nearly level to sloping.	Fair	Slight	Slight	Moderate	Slight	Moderate	Moderate	Slight.
Group 4s5: Deep, well-drained, sandy over loamy soils that are moderately steep and steep.	Fair	Moderate	Moderate to severe.	Moderate	Slight	Moderate	Moderate	Slight.
Group 4w1: Deep, somewhat poorly drained and poorly drained, sandy or sandy over loamy soils that are depressional to gently sloping.	Fair	Slight	Severe	Severe	Moderate	Moderate	Moderate	Moderate.
Group 4w2: Deep, somewhat poorly drained and poorly drained, loamy soils that are stony and are nearly level to sloping.	Fair	Slight	Severe	Severe	Moderate	Moderate	Moderate	Severe.
Group 4w3: Deep, poorly drained, loamy soils that are level.	Fair	Slight	Severe	Severe	Severe	Severe	Severe	Severe.
Group 4w4: Deep, somewhat, poorly drained and poorly drained, loamy soils that are stony and are nearly level to sloping.	Fair	Slight	Moderate	Moderate	Moderate	Severe	Severe	Moderate.
Group 4w5: Deep, somewhat poorly drained, loamy or loamy over clayey soils that are gently sloping or sloping.	Fair	Slight to moderate.	Moderate	Moderate	Moderate	Severe	Severe	Moderate.
Group 4w6: Deep, somewhat poorly drained, loamy over clayey soils that are moderately steep.	Fair	Severe	Moderate	Moderate	Moderate	Severe	Severe	Moderate.

Group 4x1: Deep, somewhat poorly drained and poorly drained, loamy soils that are extremely stony and are level to moderately steep.	Fair	Slight	Severe	Severe	Moderate	Moderate	Severe
Group 4x2: Deep, somewhat poorly drained and poorly drained, loamy soils that are extremely stony and are level to sloping.	Fair	Slight	Moderate	Moderate	Moderate	Severe	Moderate
Group 4x3: Shallow and deep, well-drained and somewhat excessively drained, loamy soils that are very rocky and are sloping to moderately steep.	Fair	Slight	Moderate	Moderate	Slight	Slight	Moderate
Group 4x4: Shallow and deep, well-drained and somewhat excessively drained, loamy soils that are very rocky and steep.	Fair	Moderate	Severe	Moderate	Slight	Slight	Moderate
Group 5s1: Deep, excessively drained, sandy or loamy over sandy soils that are level to sloping.	Poor	Slight	Slight	Severe	Slight	Slight	Slight
Group 5s2: Deep, excessively drained, sandy or loamy over sandy soils that are moderately steep.	Poor	Slight	Moderate	Severe	Slight	Slight	Slight
Group 5s3: Deep, excessively drained, sandy or loamy over sandy soils that are steep.	Poor	Moderate	Severe	Severe	Slight	Slight	Slight
Group 5w1: Deep, poorly drained, clayey or loamy over clayey soils that are level or gently sloping.	Poor	Slight	Severe	Severe	Severe	Severe	Severe
Group 5w3: Deep, poorly drained and very poorly drained, sandy or sandy over loam or clayey soils that are depressional or gently sloping.	Poor	Slight	Severe	Severe	Moderate	Moderate	Severe
Group 5x1: Shallow, somewhat excessively drained, loamy soils that are extremely rocky and are sloping to moderately steep.	Poor	Slight	Severe	Severe	Slight	Slight	Moderate
Group 5x2: Shallow, somewhat excessively drained, loamy soils that are extremely rocky and steep.	Poor	Moderate	Severe	Severe	Slight	Slight	Moderate

¹ The soils and land types not placed in woodland suitability groups and, therefore, not rated in this table are Alluvial land, Beaches, Blown-out land, Borrow pits, Fill land, Fresh water marsh, Limerick silt loam, very wet, Livingston clay, Livingston silty clay, occasionally flooded, Muck and peat, Peacham stony silt loam, Quarries, Rock land, and Terrace escarpments, silty and clayey. These soils and land types are not suited to commercial timber or are too variable to rate.

² See text for the timber production that can be expected from red spruce, white pine, and northern hardwoods.

³ Frost heaving may occur on Belgrade and Winooski soils.

⁴ Frost heaving may occur on Belgrade soil.

areas of operation, and in the use of methods that minimize soil erosion.

Equipment limitations depend on soil characteristics and topographic features that restrict or prohibit the use of conventional equipment for planting and harvesting wood crops, for constructing roads, for controlling unwanted vegetation, and for controlling fires. The limitation is *slight* if there is little or no restriction on the type of equipment that can be used or the time of the year that the equipment can be used. The limitation is *moderate* if the use of equipment is moderately restricted by one or more unfavorable soil characteristics. The limitation is *severe* if special equipment is needed, or if the use of such equipment is severely restricted by one or more unfavorable soil characteristics.

Seedling mortality refers to the expected loss of seedlings as a result of unfavorable soil characteristics or topographic features, or as a result of plant competition. Even if healthy plants are correctly planted or occur naturally in adequate numbers, some do not survive if conditions are unfavorable. Mortality is *slight* if the loss of seedlings is less than 25 percent; *moderate* if between 25 and 50 percent; and *severe* if more than 50 percent.

Plant competition refers to the rate of invasion by unwanted trees, shrubs, and vines when openings are made in the canopy. Competition is *slight* if it does not prevent adequate establishment of a desirable stand of trees. Competition is *moderate* if it delays the establishment and slows the growth of seedlings, either naturally occurring or planted, but does not prevent the eventual development of a fully stocked, normal stand. Competition is *severe* if it prevents adequate restocking, either natural or artificial, without intensive preparation of the site and special maintenance practices.

Windthrow hazard ratings are based on an evaluation of soil characteristics that control the development of tree roots and thus affect the capability of the trees to stand against the wind. A rating of *slight* indicates that trees are not expected to be blown down in commonly occurring winds. A rating of *moderate* indicates that root development is adequate except during periods of excessive wetness and high winds, when some trees are expected to blow down. A rating of *severe* indicates that root depth does not give adequate stability and that many trees are expected to blow down during periods of soil wetness and moderate or high winds.

For specific information on what trees to plant or how to manage woodlands, landowners should consult their county forester of the Vermont Department of Forests and Parks at Essex Junction. For educational information concerning forestry, they should consult the forester of the Agricultural Extension Service.

Wildlife⁴

Fish and wildlife are important natural resources in Chittenden County. The dominant mammals and birds are waterfowl, white-tailed deer, ruffed grouse, squirrel, and snowshoe hare, but cottontail rabbit and pheasant also occur in smaller numbers.

The welfare of any wildlife species depends on the

⁴ ROBERT W. FULLER, assistant professor of wildlife management, University of Vermont, assisted in preparing this section.

amount, quality, and adequate distribution of food, shelter, and water. Where any one of these is missing, inadequate, or inaccessible, the species is absent or scarce. The kinds and numbers of wildlife that live in a given area are closely related to land use, to the resulting kind, amount, and pattern of vegetation, and to the supply and distribution of water. These, in turn, are generally related to the kinds of soil.

Most habitats managed for wildlife are created or improved by planting suitable vegetation, by properly managing the existing vegetation, by inducing desirable plants to reseed naturally, or by combining some of these measures. Suitable plants for different kinds of habitat are listed elsewhere in this subsection.

Limitations of the soils for wildlife habitat

In table 4 the limitation of the soils of Chittenden County are rated for seven elements of wildlife habitat and for three kinds of wildlife. In the following paragraphs, these ratings and their use are explained and the habitat elements and classes of wildlife are discussed. An additional wildlife habitat element, not rated in table 4, is dug-out ponds. This element is discussed after the discussion of the seven elements that are rated. Soil features affecting dug-out ponds are listed in table 6, in the subsection "Engineering Uses of Soils." For more detailed explanation of the rating system, refer to the publication by Allan, Garland, and Dugan (1).

Ratings of the limitation of each soil for the wildlife habitat elements and classes of wildlife are given in table 4. A rating of *slight* indicates that the soils have few or no limitations that restrict their use for the habitat elements and the kind of wildlife specified. Good results are well assured. A rating of *Moderate* indicates that the soil has limitations that are moderately easy to overcome for the elements and the kind of wildlife specified. More intensive management is needed than on soils rated *slight*, and good results are less well assured. If the rating is *severe*, the limitations are serious and overcoming them is difficult for the elements and the kind of wildlife specified. Management of the wildlife habitat may be difficult and expensive. Good results are not assured or are doubtful.

These limitation ratings can be used as an aid in—

1. Planning broad uses of land for parks, wildlife refuges, and areas developed for wildlife and used for recreation and nature study.
2. Determining the limitations of areas to be purchased for wildlife use.
3. Selecting appropriate sites that have potential to meet habitat needs for specified wildlife.
4. Determining the intensity of management needed to maintain each habitat element.
5. Avoiding sites that are difficult or are not feasible to manage for specific kinds of wildlife.

Wildlife habitat elements

The seven kinds of habitat elements listed in table 4 are defined as follows:

Planted small grains and corn include such seed-producing annuals as corn, sorghum, wheat, barley, oats, millet, buckwheat, and sunflower. Soils that have slight limitations are deep, nearly level, moderately coarse textured and medium textured, well drained, and free

or nearly free of stones and rock outcrops. They have a medium to very high available moisture capacity and are not subject to flooding. These soils can be safely planted to these crops each year, but an increase in limitation rating shows that more intensive management and a narrower selection of crops are required.

Planted grasses and legumes are domestic grasses and legumes that are established by planting. They include bluegrass, switchgrass, fescue, brome grass, red top, timothy, orchardgrass, reed canarygrass, clover, trefoil, and alfalfa. On soils that have slight limitations, many kinds of plants that are adapted to the climate can be easily maintained in adequate stands for at least 10 years. These soils are level to sloping, are well drained or moderately well drained, and have a medium to very high available moisture capacity. Occasional flooding and stoniness are not serious concerns, for the soils are seldom tilled.

Wild herbaceous upland plants are perennial grasses and rushes and many kinds of weeds that occur naturally and have wildlife value. These plants include low-lying plantain, strawberry, and dandelion; taller blue-stem and quackgrass, fern, chicory, pigweed, scouring rush, and sorrel; and still taller needlerush, goldenrod, wild carrot, briars, nightshade, and burdock. Soils that have slight limitations for these plants are deep or moderately deep, nonstony to very stony, somewhat poorly drained to well drained, moderately coarse or medium textured, and medium to very high in available moisture capacity. Occasional flooding is not a serious concern. Slopes are not a limiting soil property.

Hardwood trees and shrubs provide valuable wildlife food in the form of nuts, fruits, buds, catkins, twigs, or foliage. Some of these trees and shrubs are oak, beech, hickory, butternut, and locust; apple, hawthorn, dogwood, viburnum, wild rose, grape, bittersweet, elderberry, black alder, and staghorn sumac; and maple, birch, poplar, hophornbeam, shadbush, and witchhazel. These plants generally are established naturally, but they can be planted. Soils that have slight limitations for these plants are deep or moderately deep, moderately coarse to fine textured, and very poorly drained to well drained. Slope and surface stoniness are of little significance.

Also in this group are several kinds of fruiting shrubs that are grown commercially for planting. Plants that generally are available and can be planted on soils that have slight limitations are autumn-olive, Amur honeysuckle, Tartarian honeysuckle, crab apple, high bush cranberry, and silky cornel dogwood. In addition, high-bush cranberry, silky dogwood, and other shrubs that have similar site requirements can be planted on soils that have moderate limitations. Hardwoods that are not available commercially can commonly be transplanted successfully.

Conifers consist of cone-bearing evergreen trees and shrubs that are used by wildlife primarily as cover, though they also provide browse and seeds. Among them are Norway spruce, white pine, white-cedar, hemlock, yew, and juniper. Generally the plants are established naturally in areas where the cover of weeds and sod is thin. The soils that have a slight limitation for coniferous wildlife habitat are those that cause plants

to grow slowly and delay closure of the canopy. Survival of planted trees on these soils is low. Delayed closure of the canopy is important so that live branches will be maintained close to the ground for a long period of time. These low branches provide food and cover that are readily available to pheasant, rabbit, and other small animals. If the trees quickly form a dense canopy that shuts out the light, the lower branches die.

On soils having a severe rating for coniferous wildlife habitat, a wide variety of species can be planted and good survival expected. Plants must be widely spaced, however, to retain their value for wildlife as long as possible because growth of conifers on these soils is fairly rapid. In most places the maintenance of pure stands of conifers is difficult because these soils are well suited to the competing hardwoods. Unless the stand is carefully managed, hardwoods invade and commonly overtop the conifers.

Wetland plants for food and cover are wild annuals and perennials that grow on moist to wet soils. These plants include smartweed, wild millet, rush, spiked rush, sedges, rice cutgrass, mannagrass, red-osier dogwood, willow, sweetflag, iris, water lilies, buttonbush, and cattails. Soils having slight limitations for these plants are depressional to nearly level, poorly drained or very poorly drained, and moderately coarse to moderately fine textured. Soils having moderate limitations are nearly level and somewhat poorly drained or frequently flooded. Depth and stoniness of the soils are of little concern.

Shallow water areas are made in soils suitable for construction of low dikes to impound shallow water. Marsh, which has only runoff as a source of water, is the most common type of shallow water development. A similar impoundment can be developed for ducks on tillable land if a supply of water is nearby. In these impoundments, domestic grains generally are grown to be flooded in fall by water from a nearby pond or stream. This water is supplied to the impoundment by gravity or pump. Ponds that are small and shallow are also developed as wildlife watering places.

Soils that have slight limitations for this use are level (0 to 1 percent slopes), more than 40 inches deep to bedrock, and poorly drained or very poorly drained. Soils rated moderate are nearly level (1 to 2 percent slopes), 20 to 40 inches deep to bedrock, and somewhat poorly drained.

Dug-out ponds may be considered a wildlife habitat element since they provide water for wildlife and may be used for producing fish. Information on soils for dug-out ponds is given in table 7 in the subsection "Engineering Uses of the Soils." Other similar elements are level ditches, shallow excavations, and potholes that are created to improve the wetland wildlife habitat, particularly that for waterfowl. Success of these impoundments depends primarily on a high water table as a source of water, but the impoundments may also receive surface runoff. Onsite investigation is needed to determine the suitability of the soils and location for dug-out ponds. The suitability for fish depends on the depth, temperature, and other qualities of the water. The surface area of a pond suitable for fish should be at least one-tenth acre, and the average depth should be 6 feet in at least one-fourth of the area.

TABLE 4.—*Limitation of the soils for*
[Alluvial land (An), Borrow pits (Br), Fill land (Fu), and

Soil series and map symbols	Habitat elements			
	Planted small grains and corn	Planted grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs
Adams and Windsor: AdA, AdB.....	Severe: sandy texture; droughtiness.	Severe: droughtiness.	Severe: droughtiness.	Severe: droughtiness.
AdD.....	Severe: slopes; sandy texture; droughtiness.	Severe: slopes; droughtiness.	Severe: droughtiness.	Severe: droughtiness.
AdE.....	Severe: slopes; sandy texture; droughtiness.	Severe: slopes; sandy texture; droughtiness.	Severe: droughtiness.	Severe: droughtiness.
Agawam: AgA.....	Moderate: slopes.....	Slight.....	Slight.....	Slight.....
AgD.....	Severe: slopes.....	Moderate: slopes.....	Slight.....	Slight.....
AgE.....	Severe: slopes.....	Severe: slopes.....	Slight.....	Slight.....
Au Gres: Au.....	Severe: wetness.....	Moderate: wetness.....	Moderate: wetness.....	Slight.....
Beaches: Be.....	Severe: sandy texture; droughtiness.	Severe: sandy texture; droughtiness.	Severe: sandy texture; droughtiness.	Severe: droughtiness.
Belgrade: BIA.....	Moderate: wetness.....	Slight.....	Slight.....	Slight.....
BIB, BIC.....	Moderate: slopes wetness.	Slight.....	Slight.....	Slight.....
BID..... For limitations of Eldridge parts of BIA, BIB, BIC, and BID, see Eldridge series.	Severe: slopes.....	Moderate: slopes.....	Slight.....	Slight.....
Blown-out land: Bo.....	Severe: sandy texture; droughtiness.	Severe: sandy texture; droughtiness.	Severe: sandy texture; droughtiness.	Severe: droughtiness.
Cabot: CaA.....	Severe: wetness.....	Moderate: wetness.....	Moderate: wetness.....	Slight.....
CaC.....	Severe: wetness.....	Moderate: wetness.....	Moderate: wetness.....	Slight.....
CbA.....	Severe: stoniness; wetness.	Severe: stoniness.....	Moderate: wetness.....	Slight.....
CbD.....	Severe: stoniness; slopes; wetness.	Severe: stoniness.....	Moderate: wetness.....	Slight.....

wildlife habitat and kinds of wildlife

Quarries (Qd) are so variable that they were not rated]

Habitat elements—Continued			Kinds of wildlife		
Conifers	Wetland plants for food and cover	Shallow water areas	Openland	Woodland	Wetland
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Severe.....	Severe.
Moderate: medium growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Slight.....	Moderate.....	Severe.
Moderate: medium growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Moderate.....	Moderate.....	Severe.
Moderate: medium growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Severe.....	Moderate.....	Severe.
Moderate: medium growth.	Slight to severe: slopes.	Slight to severe: slopes.	Moderate.....	Moderate.....	Slight to severe.
Slight.....	Severe: drainage unfavorable.	Severe: drainage unfavorable.	Severe.....	Severe.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Slight.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Slight.....	Slight.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Severe.....	Severe.....	Severe.
Moderate: medium growth.	Slight.....	Slight to severe: slopes.	Moderate.....	Moderate.....	Slight.
Moderate: medium growth.	Severe: slopes.....	Severe: slopes.....	Moderate.....	Moderate.....	Severe.
Moderate: medium growth.	Slight.....	Moderate to severe: stoniness, slopes.	Severe.....	Moderate.....	Slight.
Moderate: medium growth.	Severe: slopes.....	Severe: slopes.....	Severe.....	Moderate.....	Severe.

TABLE 4.—*Limitation of the soils for*

Soil series and map symbols	Habitat elements			
	Planted small grains and corn	Planted grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs
Colton: Co A, Co B.....	Severe: sandy texture.	Severe: droughtiness.	Severe: droughtiness.	Severe: droughtiness.
Co C.....	Severe: slopes; sandy texture.	Severe: droughtiness.	Severe: droughtiness.	Severe: droughtiness.
Cs D, Cs E..... For limitations of Stetson soils in mapping units Cs D and Cs E, see Stetson series.	Severe: slopes; sandy texture.	Severe: slopes; droughtiness.	Severe: droughtiness.	Severe: droughtiness.
Covington: Cv.....	Severe: wetness.....	Moderate: clayey texture; wetness.	Moderate: clayey texture; wetness.	Slight.....
Duane and Deerfield: Dd A, Dd B.....	Severe: sandy to loamy texture.	Moderate: sandy to loamy texture.	Moderate: sandy to loamy texture.	Severe: droughtiness.
Dd C.....	Severe: slopes; sandy to loamy texture.	Moderate: slopes; sandy to loamy texture.	Moderate: sandy to loamy texture.	Severe: droughtiness.
Eldridge parts of: B1 A.....	Severe: sandy texture.	Moderate: sandy texture.	Moderate: sandy texture; droughtiness.	Severe: droughtiness.
B1 B, B1 C.....	Severe: sandy texture.	Moderate: sandy texture; slopes.	Moderate: sandy texture; droughtiness.	Severe: droughtiness.
B1 D.....	Severe: slopes; sandy texture.	Moderate: slopes; sandy texture.	Moderate: sandy texture; droughtiness.	Severe: droughtiness.
Enosburg: Ew A.....	Severe: wetness.....	Moderate: wetness.....	Moderate: wetness.....	Moderate: droughtiness.
Ew B..... For limitations of Whately parts of Ew A and Ew B, see Whately series.	Severe: wetness.....	Moderate: wetness.....	Moderate: wetness.....	Moderate: droughtiness.
Farmington: Fa C, Fa E.....	Severe: slopes; shallow to bedrock.	Severe: shallow to bedrock.	Moderate: shallow to bedrock; droughtiness.	Severe: shallow to bedrock; droughtiness.
Fs B.....	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Moderate: shallow to bedrock; droughtiness.	Moderate: shallow to bedrock; droughtiness.
Fs C.....	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock.	Moderate: shallow to bedrock; droughtiness.	Moderate: shallow to bedrock; droughtiness.
Fs E..... For limitations of Stockbridge soils in Fs B, Fs C, and Fs E, see Stockbridge series.	Severe: shallow to bedrock; slopes.	Severe: slopes; shallow to bedrock.	Moderate: shallow to bedrock; droughtiness.	Moderate: shallow to bedrock; droughtiness.
Fresh water marsh: Fw.....	Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness.....	Severe: wetness.....

wildlife habitat and kinds of wildlife—Continued

Habitat elements—Continued			Kinds of wildlife		
Conifers	Wetland plants for food and cover	Shallow water areas	Openland	Woodland	Wetland
Slight.....	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Severe.....	Severe.....	Severe.
Moderate: medium growth.	Slight.....	Slight to moderate: slopes.	Moderate.....	Moderate.....	Slight.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Moderate.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Moderate.....	Severe.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Moderate.....	Severe.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable; slopes.	Moderate.....	Severe.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable.	Severe: drainage unfavorable; slopes.	Moderate.....	Severe.....	Severe.
Moderate: medium growth.	Moderate: sandy texture.	Slight.....	Moderate.....	Moderate.....	Slight.
Moderate: medium growth.	Severe: slopes.....	Severe: slopes.....	Moderate.....	Moderate.....	Severe.
Slight.....	Severe: slopes; drainage unfavorable.	Severe: slopes; shallow to bed-rock; drainage unfavorable.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; shallow to bed-rock; drainage unfavorable.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; shallow to bed-rock; drainage unfavorable.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; shallow to bed-rock; drainage unfavorable.	Severe.....	Severe.....	Severe.
Severe: rapid growth.	Slight.....	Slight.....	Severe.....	Severe.....	Slight.

TABLE 4.—*Limitation of the soils for*

Soil series and map symbols	Habitat elements			
	Planted small grains and corn	Planted grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs
Georgia: GeB, GeC.....	Severe: stoniness...	Moderate: stoniness.	Slight.....	Slight.....
GgC.....	Severe: stoniness...	Severe: stoniness...	Slight.....	Slight.....
GgE.....	Severe: slopes; stoniness.	Severe: slopes; stoniness.	Slight.....	Slight.....
Groton: GrA, GrB, GrC, GrD.....	Severe: droughtiness; slopes.	Moderate: droughtiness.	Moderate: droughtiness.	Severe: droughtiness.
GrE.....	Severe: droughtiness; slopes.	Severe: slopes.....	Moderate: droughtiness.	Severe: droughtiness.
Hadley: Hf.....	Moderate: flooding.	Slight.....	Slight.....	Slight.....
Hh.....	Severe: flooding.....	Moderate: flooding.	Moderate: flooding.	Slight.....
Hartland: HIB, HIC.....	Moderate: slopes.....	Slight.....	Slight.....	Slight.....
HID.....	Severe: slopes.....	Moderate: slopes.....	Slight.....	Slight.....
HIE.....	Severe: slopes.....	Moderate: slopes.....	Slight.....	Slight.....
Hinesburg: HnA.....	Severe: sandy to loamy texture; droughtiness.	Moderate: sandy to loamy texture; droughtiness.	Moderate: sandy to loamy texture; droughtiness.	Severe: droughtiness.
HnB, HnC.....	Severe: sandy to loamy texture; droughtiness.	Moderate: sandy to loamy texture; droughtiness.	Moderate: sandy to loamy texture; droughtiness.	Severe: droughtiness.
HnD, HnE.....	Severe: sandy to loamy texture; droughtiness; slopes.	Moderate: sandy to loamy texture; droughtiness.	Moderate: sandy to loamy texture; droughtiness.	Severe: droughtiness.
Limerick: Le.....	Severe: wetness; flooding.	Moderate: wetness; flooding.	Moderate: wetness; flooding.	Slight.....
Lf.....	Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Slight.....
Livingston: Lh.....	Severe: wetness.....	Severe: wetness.....	Severe: wetness.....	Slight.....
Lk.....	Severe: flooding; wetness.	Severe: wetness.....	Severe: wetness.....	Slight.....

wildlife habitat and kinds of wildlife—Continued

Habitat elements—Continued			Kinds of wildlife		
Conifers	Wetland plants for food and cover	Shallow water areas	Openland	Woodland	Wetland
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Severe.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable.	Severe: drainage unfavorable.	Slight.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable.	Severe: drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Slight.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Slight.....	Severe: drainage unfavorable.	Severe: drainage unfavorable; slopes.	Moderate.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Severe.....	Severe.
Moderate: medium growth.	Slight.....	Moderate to severe: flooding; slopes.	Moderate.....	Moderate.....	Moderate.
Slight.....	Slight.....	Moderate: flooding.	Severe.....	Moderate.....	Moderate.
Slight.....	Slight.....	Slight to moderate: slopes.	Severe.....	Moderate.....	Slight.
Slight.....	Slight.....	Slight.....	Severe.....	Moderate.....	Moderate.

TABLE 4. *Limitation of the soils for*

Soil series and map symbols	Habitat elements			
	Planted small grains and corn	Planted grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs
Lyman: LmB-----	Severe: shallow to bedrock; droughtiness.	Severe: shallow to bedrock.	Moderate: shallow to bedrock.	Severe: droughtiness.
LmC-----	Severe: shallow to bedrock; droughtiness; slopes.	Severe: shallow to bedrock.	Moderate: shallow to bedrock.	Severe: droughtiness.
LyD-----	Severe: shallow to bedrock; droughtiness; slopes.	Severe: shallow to bedrock.	Moderate: shallow to bedrock.	Severe: droughtiness.
LyE----- For limitations of Marlow soils in LmB, LmC, LyD, and LyE, see Marlow series.	Severe: shallow to bedrock; droughtiness; slopes.	Severe: shallow to bedrock.	Moderate: shallow to bedrock.	Severe: droughtiness.
Marlow: MaB-----	Severe: slopes; stoniness.	Moderate: stoniness.	Slight-----	Slight-----
MaC, MaD-----	Severe: slopes; stoniness.	Moderate: slopes; stoniness.	Slight-----	Slight-----
MeC-----	Severe: slopes; stoniness.	Severe: stoniness---	Slight-----	Slight-----
MeE-----	Severe: slopes; stoniness.	Severe: slopes; stoniness.	Slight-----	Slight-----
LmB-----	Moderate: slopes; rockiness.	Slight-----	Slight-----	Slight-----
LmC-----	Severe: slopes-----	Moderate: slopes---	Slight-----	Slight-----
LyD-----	Severe: slopes; rockiness; stoniness.	Severe: stoniness---	Slight-----	Moderate: rockiness.
LyE----- For limitations of Lyman soils in mapping units LmB, LmC, LyD, and LyE, see Lyman series.	Severe: slopes; rockiness; stoniness.	Severe: slopes; rockiness; stoniness.	Slight-----	Moderate: rockiness.
Massena: MnC-----	Severe: wetness---	Moderate: wetness--	Moderate: wetness--	Slight-----
MoC-----	Severe: stoniness; wetness.	Severe: stoniness---	Moderate: wetness--	Slight-----
Muck: Mp----- For limitations of Peat in Mp, see Peat.	Severe: wetness---	Severe: wetness---	Severe: wetness---	Severe: wetness---

wildlife habitat and kinds of wildlife—Continued

Habitat elements—Continued			Kinds of wildlife		
Conifers	Wetland plants for food and cover	Shallow water areas	Openland	Woodland	Wetland
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; shallow to bed-rock.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; shallow to bed-rock.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; shallow to bed-rock.	Severe.....	Severe.....	Severe.
Slight.....	Severe: drainage unfavorable; slopes.	Severe: slopes; shallow to bed-rock.	Severe.....	Severe.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Slight.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Severe.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Severe.....	Severe.
Moderate: medium growth.	Slight to severe: slopes.	Slight to severe: slopes.	Moderate.....	Moderate.....	Slight to severe.
Moderate: medium growth.	Slight to severe: slopes.	Moderate to severe: stoniness; slopes.	Severe.....	Moderate.....	Slight.
Severe: rapid growth.	Moderate: texture..	Slight.....	Severe.....	Severe.....	Slight.

TABLE 4. *Limitation of the soils for*

Soil series and map symbols	Habitat elements			
	Planted small grains and corn	Planted grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs
Munson: MuD.....	Severe: slopes.....	Moderate: slopes; wetness.	Slight.....	Slight.....
MyB, MyC..... For limitations of Belgrade soils in MuD, see Belgrade series; for limitations of Raynham soils in MyB and MyC, see Raynham series.	Moderate: slopes; wetness.	Moderate: wetness	Slight.....	Slight.....
Nellis: SuB, SuC.....	Severe: stoniness.....	Moderate: stoniness.	Slight.....	Slight.....
SuD.....	Severe: slopes; stoniness.	Moderate: slopes; stoniness.	Slight.....	Slight.....
SxC.....	Severe: stoniness.....	Severe: stoniness.....	Slight.....	Slight.....
SxE..... For limitations of Stockbridge soils in mapping units SuB, SuC, SuD, SxC, and SxE, see Stockbridge series.	Severe: stoniness; slopes.	Severe: slopes; stoniness.	Slight.....	Slight.....
Palatine: PaB, PaC.....	Moderate: slopes; moderately deep to bedrock; droughtiness. shaly and very shaly.	Moderate: shaly and very shaly; droughtiness.	Moderate: shaly and very shaly; droughtiness.	Moderate: droughtiness.
PaD.....	Severe: slopes.....	Moderate: slopes.....	Moderate: shaly and very shaly; droughtiness.	Moderate: droughtiness.
PaE.....	Severe: slopes.....	Severe: slopes.....	Moderate: shaly and very shaly; droughtiness.	Moderate: droughtiness.
Peachan: Pc.....	Severe: wetness.....	Severe: wetness.....	Severe: wetness.....	Slight.....
Peat..... Mapped only with Muck.	Severe: wetness; texture.	Severe: wetness; texture.	Severe: wetness.....	Severe: wetness.....
Peru: PeA, PeB.....	Severe: stoniness.....	Moderate: stoniness.	Slight.....	Slight.....
PeC, PeD.....	Severe: slopes; stoniness.	Moderate: slopes; stoniness.	Slight.....	Slight.....
PsC.....	Severe: slopes; stoniness.	Severe: stoniness.....	Slight.....	Slight.....
PsE.....	Severe: slopes; stoniness.	Severe: stoniness; slopes.	Slight.....	Slight.....

wildlife habitat and kinds of wildlife—Continued

Habitat elements—Continued			Kinds of wildlife		
Conifers	Wetland plants for food and cover	Shallow water areas	Openland	Woodland	Wetland
Severe: rapid growth.	Severe: slopes.....	Severe: slopes.....	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: slopes.....	Severe: slopes.....	Slight.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Moderate: medium growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable; moderately deep to bedrock.	Moderate.....	Moderate.....	Severe.
Moderate: medium growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable; moderately deep to bedrock.	Moderate.....	Moderate.....	Severe.
Severe: medium growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable; moderately deep to bedrock.	Severe.....	Moderate.....	Severe.
Slight.....	Slight.....	Slight.....	Severe.....	Moderate.....	Slight.
Severe: rapid growth.	Moderate: texture..	Slight.....	Severe.....	Severe.....	Slight.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.

TABLE 4. *Limitation of the soils for*

Soil series and map symbols	Habitat elements			
	Planted small grains and corn	Planted grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs
Rock land: Rk-----	Severe: bedrock---	Severe: bedrock---	Severe: bedrock---	Severe: bedrock---
Raynham Mapped only with Munson soils.	Moderate: wetness; slopes.	Moderate: wetness.	Slight-----	Slight-----
Scantic: ScA-----	Severe: wetness---	Moderate: wetness.	Moderate: wetness.	Slight-----
ScB-----	Severe: wetness---	Moderate: wetness.	Moderate: wetness.	Slight-----
Scarboro: Sd-----	Severe: wetness---	Severe: wetness---	Severe: wetness---	Slight-----
Stetson: StA, StB-----	Severe: droughtiness.	Moderate: droughtiness.	Moderate: droughtiness.	Severe: droughtiness.
CsD, StC-----	Severe: slopes; droughtiness.	Moderate: droughtiness.	Moderate: droughtiness.	Severe: droughtiness.
CsE----- For limitations of Colton soils in CsD and CsE, see Colton series.	Severe: slopes; droughtiness.	Severe: slopes; droughtiness.	Moderate: droughtiness.	Severe: droughtiness.
Stockbridge: FsB-----	Moderate: slopes; rockiness.	Slight-----	Slight-----	Slight-----
FsC-----	Severe: slopes; rockiness.	Moderate: slopes---	Slight-----	Slight-----
FsE----- For limitations of Farmington soils in FsB, FsC, and FsE, see Farmington series.	Severe: slopes; rockiness.	Severe: slopes---	Slight-----	Slight-----
SuB, SuC-----	Severe: stoniness---	Moderate: stoniness.	Slight-----	Slight-----
SuD-----	Severe: slopes; stoniness.	Moderate: slopes; stoniness.	Slight-----	Slight-----
SxC-----	Severe: stoniness---	Severe: stoniness---	Slight-----	Slight-----
SxE----- For limitations of Nellis soils in mapping units SuB, SuC, SuD, SxC, and SxE, see Nellis series.	Severe: slopes; stoniness.	Severe: slopes; stoniness.	Slight-----	Slight-----
Terrace escarpments, silty and clayey: TeE.	Severe: slopes---	Severe: slopes---	Slight-----	Slight-----

TABLE 4.—*Limitation of the soils for*

Soil series and map symbols	Habitat elements			
	Planted small grains and corn	Planted grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs
Vergennes: Ve B, Ve C-----	Moderate: slopes; clayey texture; wetness.	Moderate: clayey texture.	Moderate: clayey texture.	Slight-----
Ve D-----	Severe: slopes-----	Moderate: slopes; clayey texture.	Moderate: clayey texture.	Slight-----
Ve E-----	Severe: slopes-----	Severe: slopes-----	Moderate: clayey texture.	Slight-----
Whately:----- Mapped only with Enosburg soils.	Severe: wetness-----	Moderate: wetness-----	Moderate: wetness-----	Slight-----
Winooski: Wo-----	Severe: flooding-----	Moderate: flooding-----	Moderate: flooding-----	Slight-----

Level, poorly drained, and very poorly drained soils that are more than 72 inches deep and have a high or fairly stable water table are suitable for dug-out impoundments provided they are not flooded frequently and have few or no limitations for construction. As the slope of the dugout increases, the difficulty in constructing the impoundment increases.

Kinds of wildlife are grouped, according to their habitat requirements, as openland, woodland, and wetland wildlife. The kinds of wildlife are defined as follows:

Openland wildlife consists of birds and mammals that normally frequent areas of cropland, pasture, meadow and lawns, and areas overgrown with grasses, herbs, and shrubs. Examples are pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck.

Woodland wildlife consists of birds and mammals that prefer woodland. Examples are ruffed grouse, snowshoe hare, woodcock, thrush, vireo, scarlet tanager, gray squirrel, red squirrel, gray fox, white-tailed deer, and raccoon. They obtain food and cover in stands of hardwoods, coniferous trees, and shrubs, or a mixture of these plants.

Wetland wildlife consists of birds and mammals that normally frequent ponds, marshes, swamps, and other wet areas. Examples are ducks, geese, rails, herons, shore birds, mink, muskrat, and beaver.

In table 4, each rating under the heading "Kinds of Wildlife" is based on ratings listed for selected essential habitat elements from the first part of the table. For openland wildlife, the ratings are based on the limitations shown for planted small grains and corn, planted grasses and legumes, wild herbaceous upland plants, and hardwood trees and shrubs. The ratings for woodland wildlife are based on the limitations listed for planted small grains and corn, wild herbaceous upland plants, hardwood trees and shrubs, and conifers.

For wetland wildlife, the ratings are based on the limitations shown for wetland plants for food and cover and shallow water areas.

Engineering Uses of the Soils⁵

This section contains information about the use of soils as material in construction. Most of the information is presented in table 5, "Estimated soil properties significant in engineering," table 6, "Engineering interpretations," and table 7, "Engineering test data."

These tables, with the soil map and information given elsewhere in this survey, can be used by engineers to—

1. Make soil and land-use studies that will aid in selecting and developing business, residential, recreational, and light industrial sites.
2. Plan the construction of drainage and irrigation systems, farm ponds, diversions, and other soil and water conservation structures.
3. Make preliminary evaluations of soil conditions that will aid in selecting locations for highways, airports, pipelines, cables, and buildings, and in planning detailed soil surveys at the selected locations. (fig. 13).
4. Locate sources of sand, gravel, topsoil, and other construction materials.
5. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining such structures.
6. Supplement information from other sources and make engineering maps and reports.
7. Develop other preliminary estimates for construction purposes pertinent to a specific area.

⁵ By L. J. DONDERO, soil scientist, and K. P. WILSON, State conservation engineer, Soil Conservation Service.

wildlife habitat and kinds of wildlife—Continued

Habitat elements—Continued			Kinds of wildlife		
Conifers	Wetland plants for food and cover	Shallow water areas	Openland	Woodland	Wetland
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Moderate.....	Moderate.....	Severe.
Sever: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: slopes; drainage unfavorable.	Severe.....	Moderate.....	Severe.
Moderate: medium growth.	Slight.....	Slight to severe: slopes.	Moderate.....	Moderate.....	Slight to severe for EwA; severe for EwB.
Severe: rapid growth.	Severe: drainage unfavorable; slopes.	Severe: drainage unfavorable.	Moderate.....	Moderate.....	Severe.

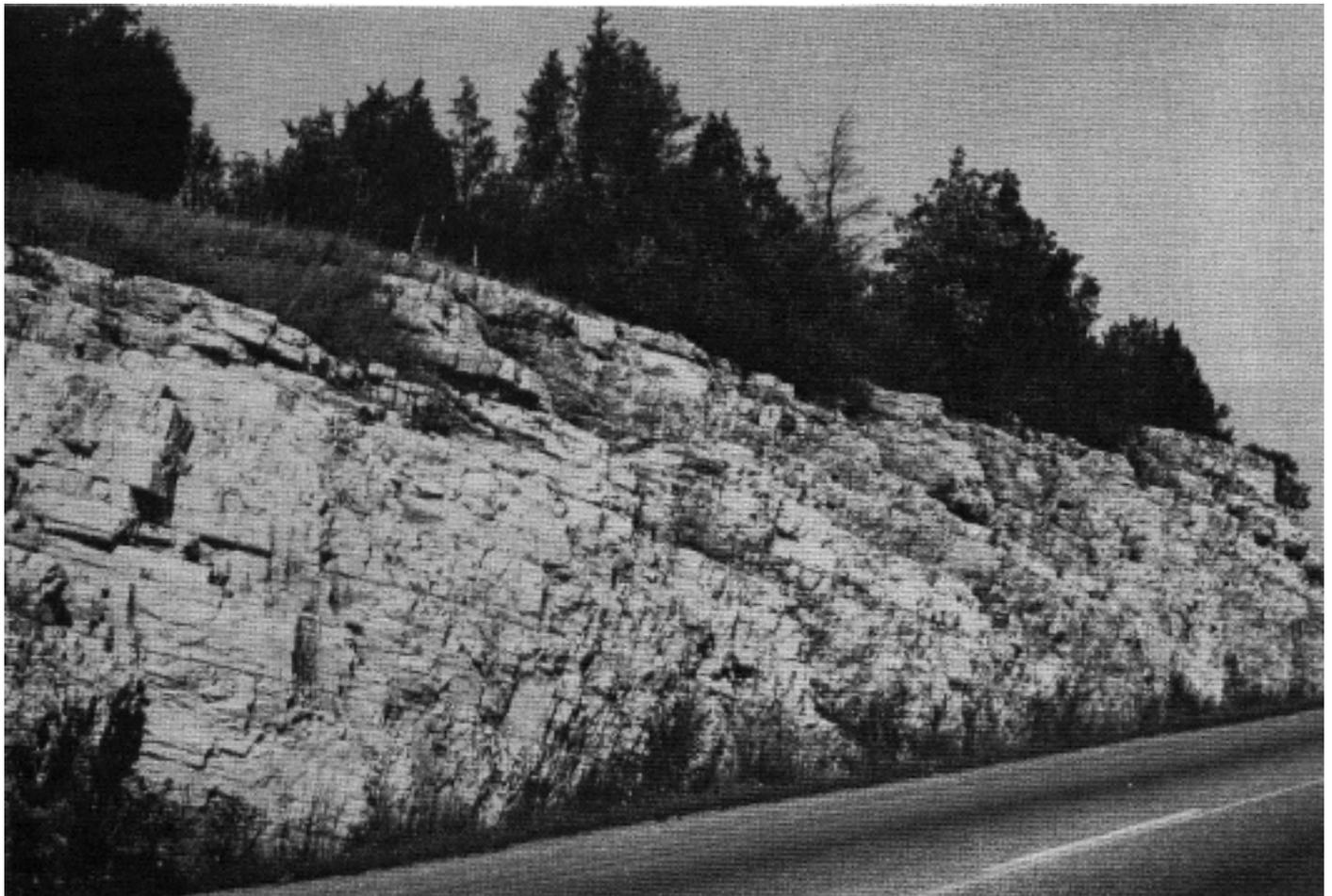


Figure 13.—Bedrock excavated on Farmington soils when constructing a highway.

TABLE 5.—*Estimated soil properties*

[Not listed in table 5 are the land types Alluvial land (An), Beaches (Be), Blown-out land (Bo), Borrow pits (Br), Fill land (Fu), more than, and < means less than. An asterisk in the first column indicates that at least one mapping unit in this series is made it is necessary to follow carefully the instructions for referring

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification ¹	
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified
*Adams: AdA, AdB, AdD, AdE For Windsor part of AdA, AdB, AdD, and AdE, see Windsor series.	Feet 5+	Feet 4+	Inches 0-9 9-45	Loamy fine sand Loamy fine sand	SM SP-SM or SM
Agawam: AgA, AgD, AgE	5+	4+	0-18 18-40	Fine sandy loam Loamy sand or gravelly loamy fine sand.	SM or ML SM, SP, or SP-SM
Au Gres: Au	5+	½-1	0-8 8-12 12-40	Fine sandy loam Loamy sand Sand or coarse sand	SM SM SM or SP
*Belgrade: BIA, BIB, BIC, BID For Eldridge part of BIA, BIB, BIC, and BID, see Eldridge series.	5+	1-2	0-7 7-35 35-60	Very fine sandy loam Very fine sandy loam Very fine sandy loam	ML ML ML
Cabot: CaA, CaC, CbA, CbD	5+	0-1	0-7 7-12 12-48	Silt loam Silt loam Gravelly sandy loam or loam	ML ML SM or ML
*Colton: CoA, CoB, CoC, CsD, CsE For Stetson part of CsD and CsE, see Stetson series.	4+	4+	0-4 4-27 27-40	Gravelly loamy sand Gravelly loamy sand Gravelly coarse sand	SM or SP-SM SM, GM or SP-SM SP, SM, GP, or GM.
Covington: Cv	5+	½-1	0-8 8-78	Silty clay Clay	MH or CL MH, CH, or MH-CH.
Deerfield Mapped only in undifferentiated groups with Duane soils.	4+	1-2	0-6 6-30 30-43	Fine sandy loam Loamy sand or sand Fine sand or sand	SM SM or SP-SM SM or SP-SM
*Duane: DdA, DdB, DdC For Deerfield part of DdA, DdB, and DdC, see Deerfield series.	5+	1-2	0-7 7-48	Fine sandy loam Gravelly loamy fine sand, very gravelly sand, and gravelly loamy sand.	SM SP or SM
Eldridge Mapped only in undifferentiated groups with Belgrade soils.	5+	1-2	0-9 9-16 16-60	Loamy fine sand Loamy fine sand Silt loam or very fine sandy loam.	SM SM ML
*Enosburg: EwA, EwB For Whately part of EwA and EwB, see Whately series.	5+	½-1	0-8 8-32 32-60	Loamy sand Sand or coarse sand or silt Silt loam, or very fine sandy loam.	SP-SM or SM SP-SM, SW, or SM ML, ML-CL
*Farmington: FaC, FaE, FsB, FsC, FsE For Stockbridge part of FsB, FsC, and FsE, see Stockbridge series.	1-1½	4+	0-7 7-17 17	Loam Silt loam or loam Bedrock.	SM, ML, or GM GM, SM, or ML
Georgia: GeB, GeC, GgC, GgE	5+	1-2	0-8 8-26 26-48	Loam Loam Loam	ML or SM CL, SC-SM, ML, or SM SC-SM, ML, or SM

See footnotes at end of table.

significant in engineering

Fresh water marsh (Fw), Quarries (Qd), Rock land (Rk), and Terrace escarpments, silty and clayey (TeE). The symbol > means up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason to other series that appear in the first column of this table]

Classification ¹ — Continued	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permea- bility	Available moisture capacity	Reaction	Shrink- swell potential
		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
A-2	0	95-100	95-100	45-75	15-35	6.3-20.0	0.06-0.09	4.5-5.5	Low.
A-2	0	95-100	95-100	45-75	5-30	6.3-20.0	0.04-0.08	5.1-6.0	Low.
A-4	0	100	85-100	70-85	35-55	2.0-6.3	0.12-0.16	5.1-7.3	Low.
A-2 or A-3	0	75-100	50-100	30-75	0-20	6.3-20.0	0.02-0.04	6.1-7.3	Low.
A-4	0	100	100	80-90	40-50	2.0-6.3	0.10-0.17	5.1-6.5	Low.
A-2	0	100	100	80-90	15-30	6.3-20.0	0.04-0.10	5.6-7.3	Low.
A-1 or A-3	0	85-100	75-95	40-65	0-15	6.3-20.0	0.02-0.08	5.6-7.3	Low.
A-4	0	100	100	95-100	55-75	0.63-2.0	0.18-0.25	5.6-7.5	Low.
A-4	0	100	100	95-100	55-75	0.63-2.0	0.15-0.20	5.6-7.3	Low.
A-4	0	100	100	95-100	55-65	0.20-0.63	0.18-0.20	5.6-7.3	Low.
A-4	0-15	85-100	80-95	65-85	60-80	0.63-2.0	0.16-0.25	5.6-7.3	Low.
A-4	0-15	85-100	80-95	70-85	55-75	0.63-2.0	0.12-0.16	6.1-7.3	Low.
A-2 or A-4	0-15	70-100	65-95	30-75	20-55	<0.20	0.10-0.14	6.1-7.3	Low.
A-1 or A-2	0-5	70-85	60-80	35-50	10-25	>6.3	0.06-0.08	4.5-7.3	Low.
A-1 or A-2	0-5	55-85	50-60	30-40	10-25	>6.3	0.04-0.08	4.5-6.0	Low.
A-1	5-10	45-75	40-60	10-35	0-15	>6.3	0.01-0.04	5.1-6.5	Low.
A-7	0	100	100	95-100	90-95	0.06-0.20	0.16-0.19	5.6-7.3	Moderate.
A-7	0	100	100	95-100	85-95	<0.06	0.15-0.18	5.6-8.2	High or mod- erate.
A-4 or A-2	0	95-100	90-100	70-85	30-45	2.0-6.3	0.02-0.13	5.1-7.3	Low.
A-2 or A-3	0	95-100	90-100	45-60	10-25	>6.3	0.02-0.08	5.0-6.5	Low.
A-2, A-1, or A-3.	0	80-100	70-100	45-60	10-25	>6.3	0.02-0.08	5.0-6.5	Low.
A-2	0-10	75-90	70-100	50-70	15-35	6.30-20.0	0.10-0.14	>5.5	Low.
A-1, A-3, or A-2.	0-10	65-80	40-75	20-65	0-20	6.30-20.0	0.02-0.04	5.1-6.5	Low.
A-4 or A-2	0	100	95-100	70-90	15-50	2.0-20.0	0.08-0.12	5.5-7.3	Low.
A-2	0	100	95-100	60-85	15-35	2.0-20.0	0.06-0.10	5.5-7.3	Low.
A-4	0	100	95-100	90-95	55-90	0.20-0.63	0.16-0.20	6.6-7.3	Low.
A-1 or A-2	0	95-100	90-100	45-75	5-30	2.0-20.0	0.08-0.12	5.1-7.3	Low.
A-1, A-3, or A-2.	0	95-100	85-100	30-70	0-20	2.0-20.0	0.04-0.10	5.1-7.3	Low.
A-4	0	100	100	95-100	65-95	0.20-0.63	0.16-0.20	6.1-7.3	Low.
A-4	0-15	60-85	55-80	45-60	40-55	0.63-2.0	0.12-0.18	5.6-7.3	Low.
A-4	0-20	60-85	55-80	45-70	40-60	0.63-2.0	0.10-0.14	5.6-7.3	Low.
A-4	0-10	85-100	70-100	50-90	35-70	0.63-2.0	0.14-0.17	5.6-7.3	Low.
A-4 or A-6	10-20	85-100	70-100	50-90	35-70	0.63-2.0	0.12-0.15	5.6-7.3	Low.
A-4	5-10	85-100	70-100	50-90	35-70	0.06-0.63	0.10-0.14	6.1-7.3	Low.

TABLE 5.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification ¹	
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified
Groton: GrA, GrB, GrC, GrD, GrE.....	Feet 4+	Feet 4+	Inches 0-15 15-24 24-41	Gravelly fine sandy loam, gravelly sandy loam. Gravelly loamy coarse sand..... Very gravelly coarse sand.....	SM or GM SP-SM, SM, GM, or GW-GM GP or GW
Hadley: Hf, Hh.....	5+	² 0-3	0-27 27-41	Very fine sandy loam..... Silt loam.....	ML ML
Hartland: H1B, H1C, H1D, H1E.....	5+	3+	0-23 23-26 26-41	Very fine sandy loam..... Silt loam..... Very fine sandy loam.....	ML ML ML
Hinesburg: HnA, HnB, HnC, HnD, HnE.....	5+	3-4+	0-11 11-29 28-48	Fine sandy loam and loamy fine sand. Loamy fine sand and fine sand..... Very fine sandy loam and fine sandy loam.	SM SM or SP-SM ML or SM
Limerick: Le, Lf.....	5+	² 0-½	0-18 18-72	Silt loam..... Silt loam and very fine sandy loam.	ML ML or SM
Livingston: Lh, Lk.....	5+	² 0	0-9 9-27 27-40	Clay..... Clay..... Silty clay.....	OH or MH CH CH
*Lyman: LmB, LmC, LyD, LyE..... For Marlow part of LmB, LmC, LyD, and LyE, see Marlow series.	1-1½	4+	0-6 6-19 19	Channery loam..... Channery loam..... Mica Schist bedrock.	SM SM or GM
Marlow: MaB, MaC, MaD, MeC, MeE.....	5+	³ 1-1½	0-8 8-24 24-66	Loam..... Fine sandy loam..... Gravelly fine sandy loam (fragipan).	SM SM SM or GM
Massena: MnC, MoC.....	5+	½-1	0-9 9-25 25-40	Silt loam..... Silt loam..... Very fine sandy loam.....	ML ML or SM ML or SM
Muck and peat: Mp.....	5+	0-½			
*Munson: MuD, MyB, MyC..... For Belgrade part of MuD; for Raynham part of MyB and MyC, see Belgrade and Raynham series, respectively.	5+	½-1	0-15 15-56	Silt loam..... Silty clay loam and silty clay..	ML or MH CH or CL
Nellis..... Mapped only in undifferentiated groups with Stockbridge soils.	5+	4+	0-9 9-21 21-40	Loam..... Silt loam..... Channery loam.....	ML ML SM or ML
Palatine: PaB, PaC, PaD, PaE.....	1½-3½	4+	0-5 5-25 25	Silt loam..... Shaly silt loam..... Calcareous shale.	GM, SM or ML GM, SM or ML
Peacham: Pc.....	5+	0-½	0-14 14-34 34-40	Silt loam..... Loam (fragipan)..... Silt loam (fragipan).....	ML ML ML

See footnotes at end of table.

significant in engineering—Continued

Classification ¹ — Continued	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permea- bility	Available moisture capacity	Reaction	Shrink- swell potential
		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
A-2 or A-4	Percent 0-5	60-95	55-90	45-75	25-45	Inches per hour 2.0-6.3	Inches per inch of soil 0.05-0.14	pH value 5.6-7.3	Low.
A-1 or A-2	0-5	55-95	45-90	25-50	5-25	>6.3	0.04-0.08	5.6-7.3	Low.
A-1	5-15	20-40	15-35	10-20	0-5	>20.0	0.01-0.04	7.4-8.0	Low.
A-4	0	100	100	95-100	65-85	0.63-2.0	0.18-0.25	6.1-7.3	Low.
A-4	0	100	100	95-100	70-90	0.63-2.0	0.16-0.20	6.1-7.3	Low.
A-4	0	100	100	95-100	65-85	0.63-2.0	0.18-0.22	4.5-7.3	Low.
A-4	0	100	100	95-100	70-90	0.20-0.63	0.16-0.20	5.1-7.3	Low.
A-4	0	100	100	95-100	65-85	0.20-0.63	0.16-0.20	5.1-7.3	Low.
A-4 or A-2	0	100	95-100	60-80	20-45	0.63-6.3	0.03-0.15	5-6.7.3	Low.
A-2	0	100	95-100	60-80	10-30	6.3-20.0	0.06-0.10	5.6-7.3	Low.
A-4	0	100	100	90-100	40-90	0.20-0.63	0.13-0.20	6.1-7.3	Low.
A-4 or A-5	0	100	100	90-100	70-85	0.63-2.0	0.18-0.25	5.1-7.3	Low.
A-4	0	100	100	95-100	45-100	0.20-0.63	0.16-0.22	5.1-7.3	Low.
A-7	0	100	100	85-100	70-90	<0.20	0.16-0.20	5.6-7.3	High or mod- erate.
A-7	0	100	100	95-100	85-95	<0.06	0.16-0.20	5.6-7.8	High or mod- erate.
A-7	0	100	100	95-100	85-95	<0.06	0.16-0.20	6.6-8.0	High or mod- erate.
A-4	5-20	70-90	60-85	50-70	40-50	0.63-6.3	0.14-0.18	4.5-6.0	Low.
A-2 or A-4	15-30	60-85	55-85	40-60	30-40	0.63-2.0	0.10-0.14	4.5-6.0	Low.
A-2 or A-4	5-35	75-95	70-85	50-75	30-50	0.63-2.0	0.16-0.18	5.1-7.3	Low.
A-2 or A-4	5-35	75-90	65-80	45-70	30-50	0.63-2.0	0.14-0.18	5.1-7.3	Low.
A-2 or A-4	5-35	65-90	60-80	45-70	20-40	0.06-0.20	0.10-0.14	5.1-7.3	Low.
A-4	0-35	90-100	85-100	70-90	55-80	0.63-2.0	0.18-0.22	5.6-7.3	Low.
A-4 or A-2	0-35	80-95	75-95	60-90	25-75	0.63-2.0	0.12-0.20	5.6-7.3	Low.
A-4 or A-2	0-35	80-95	75-95	60-75	25-75	0.06-0.63	0.12-0.14	6.6-8.0	Low.
A-4 or A-5	0	100	95-100	90-100	80-90	0.20-2.0	0.18-0.22	5.6-7.3	Low.
A-7 or A-6	0	100	95-100	90-100	80-100	<0.20	0.14-0.18	5.6-7.3	Moderate.
A-4 or A-6	5-20	80-95	70-95	65-90	55-70	0.63-2.0	0.18-0.20	6.0-7.3	Low.
A-4 or A-6	5-20	80-95	70-95	65-90	55-70	0.63-2.0	0.16-0.20	6.0-7.3	Low.
A-4	5-25	80-85	70-75	50-60	45-55	0.63-2.0	0.12-0.16	7.3-8.0	Low.
A-4	5-15	65-90	60-85	55-75	45-65	0.63-2.0	0.16-0.22	6.1-7.8	Low.
A-4	0.20	45-65	45-85	40-75	35-65	0.63-2.0	0.14-0.20	6.6-8.0	Low.
A-4	0-5	90-100	85-95	75-90	65-85	0.63-2.0	0.18-0.22	6.1-7.3	Low.
A-4	0-15	85-100	80-95	70-90	55-75	<0.20	0.10-0.18	6.1-7.3	Low.
A-4	0-15	85-100	80-95	70-90	65-85	<0.20	0.08-0.18	6.1-7.3	Low.

TABLE 5.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification ¹	
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified
Peru: PeA, PeB, PeC, PeD, PsC, PsE.....	Feet 5+	Feet ³ 1-2	Inches 0-9 9-22 22-40	Loam and gravelly loam..... Gravelly or channery fine sandy loam. Gravelly fine sandy loam (fragipan).	SM or ML SM, GM SM, GM
Raynham..... Mapped only in undifferentiated groups with Munson soils.	5+	0-1	0-6 6-22 22-60	Silt loam..... Silt loam..... Silt loam.....	ML ML ML
Seantic: ScA, ScB.....	5+	0-1	0-13 13-18 18-40	Silt loam..... Silty clay loam..... Silty clay.....	ML or ML-CL ML or CL CL or MH
Scarboro: Sd.....	5+	0-½	0-10 10-15 15-42	Loam..... Loamy fine sand..... Fine sand or sand.....	OL or ML SM SM or SP
Stetson: StA, StB, StC.....	4+	4+	0-8 8-25 25-72	Gravelly fine sandy loam..... Gravelly fine sandy loam and very gravelly loamy coarse sand. Very gravelly coarse sand.....	SM SM, GM, SP-SM, or GP-GM GP, SP, SP-SM, or GP, GM
*Stockbridge: SuB, SuC, SuD, SxC, SxE..... For Nellis part of SuB, SuC, SuD, SxC, and SxE, see Nellis series.	5+	3-4	0-9 9-30 30-42	Loam..... Loam or fine sandy loam..... Gravelly loam.....	ML ML or SM SM or ML
Vergennes: VeB, VeC, VeD, VeE.....	5+	½-2	0-41	Clay.....	MH, CH, or MH-CH
Whately..... Mapped only in undifferentiated groups with Enosburg soils.	5+	0-1	0-15 15-42	Fine sandy loam..... Silty clay loam.....	SM CL, CH or MH-CH
Windsor..... Mapped only in undifferentiated groups with Adams soils.	5+	4+	0-15 15-23 23-36	Loamy sand..... Sand..... Coarse sand.....	SP-SM or SM SM or SP-SM SP or SP-SM
Winooski: Wo.....	5+	1½-2	0-40	Very fine sandy loam or silt loam.	ML

¹ Engineering classification and percent passing sieves are based on 100 percent passing the 3-inch sieve.

² Flooded, at least at times.

³ Perched water table.

significant in engineering—Continued

Classification ¹ — Continued	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permea- bility	Available moisture capacity	Reaction	Shrink- swell potential
		No. 4 (4.7 mm.)	No. 10 (2.0 mm)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
A-4	<i>Percent</i> 5-15	85-95	75-90	60-70	40-55	0.63-2.0	<i>Inches per inch of soil</i> 0.15-0.18	<i>pH value</i> 4.5-6.5	Low.
A-2 or A-4	5-25	65-80	60-75	50-60	25-45	0.63-2.0	0.10-0.15	5.1-7.3	Low.
A-2 or A-4	5-20	65-85	60-75	50-60	25-45	0.06-0.20	0.08-0.14	5.1-7.3	Low.
A-4	0	100	100	95-100	80-90	0.20-2.0	0.18-0.20	5.6-7.3	Low.
A-4	0	100	100	95-100	85-90	0.20-2.0	0.16-0.20	5.6-7.3	Low.
A-4	0	100	100	95-100	85-90	0.06-0.20	0.16-0.20	5.6-7.3	Low.
A-4 or A-6	0	100	100	95-100	80-90	0.20-2.0	0.18-0.20	5.6-7.3	Low.
A-6	0	100	100	95-100	85-95	0.06-0.63	0.16-0.18	5.6-7.3	Moderate.
A-6 or A-7	0	100	100	95-100	90-95	0.06-0.63	0.12-0.14	5.6-7.3	Moderate.
A-4	0	100	95-100	65-75	55-65	0.63-6.3	0.18-0.24	5.6-6.5	Low.
A-2	0	100	95-100	75-85	15-30	6.3-20.0	0.04-0.10	6.1-7.3	Low.
A-2 or A-3	0	100	95-100	70-80	0-25	6.3-20.0	0.02-0.06	6.1-7.3	Low.
A-2 or A-4	0-10	85-90	75-85	55-65	30-50	2.0-6.3	0.10-0.15	5.6-7.3	Low.
A-2 or A-1	5-10	40-80	35-85	20-50	10-30	>6.3	0.05-0.10	5.6-7.3	Low.
A-1	5-20	35-75	30-85	10-20	0-10	>20.0	<0.04	5.1-7.3	Low.
A-4	0-5	90-100	85-100	75-90	60-80	0.63-2.0	0.14-0.18	5.6-7.3	Low.
A-4	0-5	85-100	75-100	60-85	40-75	0.63-2.0	0.13-0.16	5.6-7.3	Low.
A-4	0-15	75-90	70-85	60-75	40-55	0.63-2.0	0.10-0.14	6.1-7.3	Low.
A-7	0	100	100	95-100	90-95	<0.06	0.10-0.14	5.1-8.2	High or moderate.
A-4	0	95-100	95-100	75-85	40-50	2.0-6.3	0.12-0.13	5.6-7.3	Low.
A-7	0	100	100	95-100	90-95	<0.06	0.10-0.14	6.1-7.3	Moderate.
A-2	0	100	95-100	80-90	10-30	>6.3	0.05-0.08	5.1-7.3	Low.
A-2 or A-3	0	100	95-100	60-70	5-15	>6.3	<0.05	5.1-6.5	Low.
A-2 or A-1	0	95-100	90-100	40-50	0-10	>6.3	<0.05	5.1-6.5	Low.
A-4	0	100	95-100	90-100	55-95	0.63-2.0	0.18-0.25	5.6-7.3	Low.

TABLE 6.—*Engineering*

[Because their properties are too variable for interpretation, Alluvial land (An), Beaches (BE), Borrow pits (Br), Fill land (Fu), Fresh water table. 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. The instructions for referring to other series that

Soil and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil ¹	Road fill	Highway location
*Adams: AdA, AdB, AdD, AdE..... For Windsor part, see Windsor series.	Fair: very low fertility; loamy sand.	Fair: contains little binder.	Loose sand; erosion on exposed embankments; difficult to vegetate.
Agawam: AgA, AgD, AgE.....	Fair to good to a depth of 8 to 12 inches; poor deeper: low fertility.	Fair: contains little binder	Loose sand; erosion on exposed embankments.
Au Gres: Au.....	Poor: wet; loamy or sandy; low fertility.	Fair to poor: wet; sandy..	High water table.....
*Belgrade: BIA, BIB, BIC, BID..... For Eldridge part, see Eldridge series.	Fair to depth of 6 to 10 inches; poor deeper: wet in spring.	Fair to poor: silt or very fine sand; wet in spring.	Seasonal high water table; subject to frost heave.
Blown-out land: Bo.....	Poor: sandy.....	Fair: contains little binder.	Loose sand; difficult to vegetate.
Cabot: CaA, CaC, CbA, CbD.....	Fair to depth of 6 to 12 inches; poor deeper: wet; stones in soil.	Poor: wet; cobblestones and stones throughout soil.	Seasonal high water table; subject to frost heave.
*Colton: CoA, CoB, CoC, CsD, CsE..... For Stetson part of CsD and CsE, see Stetson series.	Fair to poor to depth of 6 to 10 inches; poor deeper: gravelly and sandy; very low fertility.	Good: gravel, sand, and some binder.	Good drainage and bearing value. ²
Covington: Cv.....	Poor: clayey; excessively wet.	Poor: clayey; poor stability; moderate or high shrink-swell potential; wet.	Clayey; poor capacity to support loads; high water table.
Deerfield..... Mapped only in undifferentiated groups with Duane soils.	Fair to good to depth of 6 to 10 inches: very low fertility; poor deeper: loamy or sandy; wet in spring.	Good: sand with binder; wet in spring.	Temporary seasonal high water table; subject to frost heave.
*Duane: DdA, DdB, DdC..... For Deerfield part, see Deerfield series.	Fair to depth of 8 to 10 inches: gravel in soil; wet in spring; poor deeper: very low fertility.	Fair to good: gravel and sand with binder; wet in spring.	Temporary seasonal high water table.
Eldridge..... Mapped only in undifferentiated groups with Belgrade soils.	Fair: sandy; wet in spring; low fertility.	Fair: fair stability; wet in spring.	Silty substratum; subject to frost heave.
*Enosburg: EwA, EwB..... For Whately part, see Whately series.	Fair to depth of 8 to 12 inches: wet in spring; poor deeper: sandy; low fertility.	Fair: fair stability; wet..	High water table; subject to frost heave.
*Farmington: FaC, FaE, FsB, FsC, FsE..... For Stockbridge part of FsB, FsC, and FsE, see Stockbridge series.	Poor: shallow to bedrock..	Poor: stony; shallow to bedrock.	Shallow to bedrock.....

See footnotes at end of table.

interpretations

marsh (Fw), Muck and peat (Mp), Quarries (Qd), Rock land (Rk), and Terrace escarpments, silty and clayey (TeE) are not listed in this soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the in-appear in the first column of this table]

Soil features affecting—Continued			
Farm ponds			Agricultural drainage
Dug-out ponds	Reservoir areas	Embankments	
Rapid permeability; deep water table.	Rapid permeability-----	Poor stability; permeable; susceptible to piping where compacted.	Not needed.
Rapid permeability; deep water table.	Rapid permeability-----	Poor stability; permeable; susceptible to piping where compacted.	Not needed.
High water table; rapid permeability.	Rapid permeability-----	Moderate to rapid permeability; poor stability; susceptible to piping.	High water table; pervious material; seepage; needs outlet.
Moderately slow permeability; seasonal high water table.	Moderately slow permeability---	Very poor stability; susceptible to piping.	Unstable ditchbanks; moderately slow permeability.
Rapid permeability-----	Rapid permeability-----	Poor stability and permeability; susceptible to piping where compacted.	Not needed.
Slow permeability in compact layer; normally high water table.	Slow permeability in compact layer.	Fair to poor stability and slow permeability; stones and cobblestones throughout soil.	High water table; slow permeability in compact layer.
Very rapid permeability; deep water table.	Very rapid permeability; sandy and gravelly.	Very rapid permeability where compacted; fair to good drain fill.	Not needed.
Very slow permeability; high water table.	Very slow permeability-----	Good core material; low shear strength; very slow permeability when compacted; shrinks and swells.	Very slow permeability; high water table.
Rapid permeability; temporary seasonal high water table.	Rapid permeability-----	Rapid permeability when compacted.	Temporary seasonal high water table; rapid permeability.
Rapid permeability; temporary seasonal high water table.	Rapid permeability-----	Rapid permeability when compacted.	Temporary seasonal high water table.
Moderately slow permeability---	Moderately slow permeability---	Poor stability when wet-----	Not needed.
Moderately slow permeability; high water table.	Moderately slow permeability---	Poor stability when wet-----	Moderately slow permeability.
Shallow to bedrock-----	Shallow to bedrock; solution channels.	Shallow to bedrock-----	Not needed.

TABLE 6.—*Engineering*

Soil and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil ¹	Road fill	Highway location
Georgia: GeB, GeC, GgC, GgE.....	Good to depth of 8 to 12 inches; poor deeper: wet in spring; stones in some areas.	Fair: wet in spring; cobblestones and stones throughout soil.	Seep areas: subject to frost heave; temporary seasonal high water table.
Groton: GrA, GrB, GrC, GrD, GrE.....	Fair to poor to depth of 6 to 10 inches; poor deeper: gravelly.	Good: gravel and sand with binder.	Good drainage and bearing value.
Hadley: Hf, Hh.....	Good to depth of 18 to 36 inches; fair to poor deeper.	Fair to poor: high in organic matter; erodible; silty.	Subject to flooding and frost heave.
Hartland: HIB, HIC, HID, HIE.....	Good to depth of 8 to 12 inches; poor deeper.	Poor: very fine sand and silt; erodible; poor stability.	Poor stability on slopes; erodible.
Hinesburg: HnA, HnB, HnC, HnD, HnE....	Fair to depth of 4 to 6 inches; low fertility; poor deeper: sandy.	Fair to depth of 18 to 40 inches: erodible; poor deeper: silty.	Silt layer at depth of 18 to 40 inches; subject to frost heave.
Limerick: Le, Lf.....	Poor: excessively wet.....	Poor: excessively wet; very fine sand and silt.	Subject to frost heave; flooding; high water table.
Livingston: Lh, Lk.....	Poor: clayey; excessively wet.	Poor: clayey; moderate or high shrink-swell potential; excessively wet.	Very poorly drained clay....
*Lyman: LmB, LmC, LyD, LyE..... For Marlow part, see Marlow series.	Poor: shallow to bedrock..	Not suitable: rock within 20 inches of the soil surface.	Shallow to hard bedrock....
Marlow: MaB, MaC, MaD, MeC, MeE.....	Good to depth of 6 to 8 inches; some stones; poor deeper.	Good: stones and cobblestones throughout soil.	Seep areas and seepage along compact layer on cuts.
Massena: MnC, MoC.....	Fair to depth of 6 to 10 inches: wet; poor deeper: some stones.	Fair below 18 to 24 inches: fine materials; stones throughout soil; wet.	High water table; subject to frost heave.
*Munson: MuD, MyB, MyC..... For Belgrade part of MuD; for Raynham part of MyB and MyC, see their respective series.	Poor: silty; wet in spring..	Poor: silt and clay; wet in spring.	Subject to frost heave; poor stability on slopes; erodible.
Nellis..... Mapped only in undifferentiated groups with Stockbridge soils.	Good to depth of 6 to 10 inches; poor deeper: stones.	Good: contains considerable fines and cobblestones and boulders.	Stones throughout soil; seepage on steep cuts.
Palatine: PaB, PaC, PaD, PaE.....	Fair to poor: moderately deep to bedrock.	Poor: moderately deep to bedrock; poor bedrock for crushing.	Moderately deep to bedrock.
Peacham: Pc.....	Poor: excessively wet; stones.	Poor: excessively wet; fine material.	High water table; subject to frost heave.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued			
Farm ponds			Agricultural drainage
Dug-out ponds	Reservoir areas	Embankments	
Moderately slow to slow permeability; high lime; temporary seasonal high water table.	Moderately slow to slow permeability; high lime content.	Fair stability; moderately slow permeability when compacted; contains stones and cobblestones.	Seep spots; firm in compact layers.
Very rapid permeability; deep water table.	Very rapid permeability-----	Very rapid permeability when compacted; good drain fill material.	Not needed.
Subject to flooding; deep water table.	Moderate permeability; subject to flooding.	Poor stability; pipeable-----	Not needed.
Moderately slow permeability----	Moderately slow permeability----	Pipeable; moderately slow permeability when compacted; poor stability.	Not needed.
Moderately slow permeability; deep water table.	Moderately slow permeability----	Poor stability; pipeable-----	Seep spots.
High water table; moderately slow permeability.	Moderately slow permeability----	Moderately slow permeability when compacted; poor stability; pipeable.	High water table; flooding; moderately slow permeability.
Very slow permeability; high water table.	Very slow permeability; high lime content.	High or moderate shrink-swell potential; poor to fair shear strength; very slow permeability.	High water table; very slow permeability; erodible; outlets may be difficult to locate.
Shallow to bedrock-----	Shallow to bedrock-----	Shallow to bedrock-----	Not needed.
Slow permeability in compact layer; deep water table.	Slow permeability in compact layer.	Fair to good stability; slow permeability when compacted; contains stones and cobblestones.	Seep spots; slow permeability in compact layers.
High water table; moderately slow to slow permeability.	Moderately slow to slow permeability.	Pipeable; poor to fair stability, moderately slow to slow permeability when compacted; stones and cobblestones throughout soil.	High water table.
Slow to very slow permeability; temporary seasonal high water table.	Slow to very slow permeability--	Slow to very slow permeability; poor stability; poor bearing strength.	Slow to very slow permeability; temporary seasonal high water table.
Moderate permeability-----	Moderate permeability-----	Slow to moderate permeability when compacted; stones and cobblestones throughout soil; pipeable.	Not needed.
Moderately deep to bedrock----	Moderately deep to bedrock----	Moderately deep to bedrock----	Not needed.
High water table; slow to very slow permeability.	Slow to very slow permeability--	Pipeable; poor to fair stability; slow seepage potential; contains stones and cobblestones.	High water table; needs outlets; slow to very slow permeability.

TABLE 6.—*Engineering*

Soil and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil ¹	Road fill	Highway location
Peru: PeA, PeB, PeC, PeD, PsC, PsE-----	Fair to good to depth of 8 to 12 inches: stones; poor deeper: wet in spring.	Good to fair: wet in spring; stones and cobblestones throughout soil.	Subject to frost heave; seepage in cuts along compact layer.
Raynham----- Mapped only in undifferentiated groups with Munson soils.	Good: silty; wet in spring.	Poor: poor stability; wet in spring.	Poor capacity to support loads; subject to frost heave.
Seantic: ScA, ScB-----	Good: silty; wet-----	Poor: wet; poor stability--	Wet in spring; silt; subject to frost heave.
Scarboro: Sd-----	Fair to depth of 8 to 12 inches: wet; poor deeper: low fertility; loamy or sandy.	Poor: wet; fine sand-----	High water table-----
Stetson: StA, StB, StC-----	Fair to depth of 6 to 8 inches: gravelly; low fertility.	Good: gravel and sand with some binder.	Steep cuts are hard to vegetate.
*Stockbridge: SuB, SuC, SuD, SxC, SxE--- For Nellis part, see Nellis series.	Good to depth of 8 to 12 inches; poor deeper: stones.	Fair to good: may contain considerable fines; cobblestones and stones throughout soil.	Seepage in deep cuts; subject to frost heave.
Vergennes: VeB, VeC, VeD, VeE-----	Poor: clayey; wet in spring.	Poor: clayey; wet in spring; moderate or high shrink-swell potential.	Frost heaves: poor bearing value; poor stability.
Whately----- Mapped only in undifferentiated groups with Enosburg soils.	Fair: excessively wet-----	Fair to depth of 15 to 30 inches: excessively wet fine sands; poor deeper: silt and clay.	Frost heaves: silt and clay at depth of 13 to 30 inches; high water table.
Windsor----- Mapped only in undifferentiated groups with Adams soils.	Fair to depth of 6 to 8 inches: very low fertility; sand; poor deeper.	Fair: sand containing little binder.	Loose sand: erosion on exposed embankments.
Winooski: Wo-----	Good to depth of 12 to 36 inches: wet in spring; poor deeper.	Poor: silt and very fine sand; wet in spring.	Temporary seasonal high water table; subject to flooding and frost heave.

¹ All very stony and very rocky soils have severe limitations for topsoil.

² Bearing values have general ratings; for example, good, fair, and poor. Specific ratings or measurements, such as pounds per square feet, are not given.

interpretations—Continued

Soil features affecting—Continued			Agricultural drainage
Farm ponds		Embankments	
Dug-out ponds	Reservoir areas		
Slow permeability in compact layer; temporary seasonal water table.	Slow permeability in compact layer.	Slow permeability when compacted; stones and cobblestones throughout soil.	Seepage on top of compact layer; stones throughout soil.
Slow permeability-----	Slow permeability-----	Slow permeability; poor stability; pipeable.	Slow permeability; erodible.
Moderately slow to slow permeability.	Moderately slow to slow permeability.	Moderately slow to poor stability; slow permeability; pipeable.	Moderately slow to slow permeability; erodible, outlets may be difficult to locate.
Rapid permeability; high water table.	Rapid permeability-----	Moderately rapid permeability when compacted; very pipeable; poor stability.	Rapid permeability, high water table.
Very rapid permeability; deep water table.	Very rapid permeability-----	Very rapid permeability when compacted.	Not needed.
Moderate permeability-----	Moderate permeability-----	Moderate permeability when compacted; stones and cobblestones throughout soil.	Not needed; may have wet seep areas.
Very slow permeability; temporary water table.	Very slow permeability-----	Poor stability when wet; very slow permeability.	Very slow permeability; erodible.
High water table; very slow permeability in clay at depths below 13 to 30 inches.	Very slow permeability in material at depths of 13 to 30 inches.	Poor stability; low shear strength; pipeable; very slow permeability of clayey layer.	High water table.
Rapid permeability; deep water table.	Rapid permeability-----	Rapid permeability; poor stability; pipeable.	Drainage not needed; well drained sands.
Flooding; temporary seasonal water table.	Moderate permeability; subject to flooding.	Slow permeability when compacted; pipeable.	Flooding; temporary seasonal high water table.

TABLE 7.—Engineering

[Tests performed by the Vermont Highway Department in accordance with standard

Soil name and location	Depth	Moisture density data ¹			Mechanical analysis ²		
		Maximum dry density	Optimum moisture	Coarse fraction larger than 3 in.	Percentage passing sieve—		
					3 in.	1½ in.	¾ in.
	<i>Inches</i>	<i>Lb. per cu. ft.</i>	<i>Percent</i>	<i>Percent</i>			
Enosburg loamy sand: 4,000 feet directly east of Lamoille River Bridge where U.S. Highway No. 2 crosses the bridge in a north-south direction.	0-8	(⁶)	(⁶)	-----	-----	-----	100
	8-16	(⁶)	(⁶)	-----	-----	-----	100
	16-32	117	14	-----	-----	-----	100
	32-60	104	18	-----	-----	-----	-----
Georgia stony loam: 1.89 miles north-northeast of North Ferrisburg.....	0-8	(⁶)	(⁶)	1	-----	-----	-----
	12-21	(⁶)	(⁶)	1	-----	-----	100
	26-36	(⁶)	(⁶)	1	-----	-----	-----
	36-48	(⁷)	(⁶)	1	-----	-----	-----
Hinesburg fine sandy loam: 1.5 miles south-southeast of Chimney Corner on U.S. Highway No. 7.	0-8	(⁶)	(⁶)	-----	-----	-----	-----
	11-20	(⁶)	(⁶)	-----	-----	-----	-----
	20-26	(⁶)	(⁶)	-----	-----	-----	-----
	32-48	(⁶)	(⁶)	-----	-----	-----	-----
Limerick silt loam: 2.2 miles northeast of city of Winooski.....	0-3	83	28	-----	-----	-----	-----
	18-28	104	16	-----	-----	-----	-----
	65-72	97	23	-----	-----	-----	-----
Marlow stony loam: 1.2 miles east-southeast of Underhill Center. (Modal).....	0-8	97	20	5	100	98	98
	24-35	117	11	5	100	92	88
	54-66	124	11	5	100	80	76
1.8 miles southeast of village of Westford. (Thicker solum than in modal profile.)	0-9	100	19	-----	100	94	92
	19-29	90	13	-----	100	96	89
	34-41	118	12	-----	-----	100	94
Munson silt loam: About 2.0 miles northeast of Essex Center, as the crow flies.....	0-8	(⁶)	(⁶)	-----	-----	-----	-----
	15-19	(⁶)	(⁶)	-----	-----	-----	-----
	24-38	(⁶)	(⁶)	-----	-----	-----	-----
	38-56	(⁶)	(⁶)	-----	-----	-----	-----
Winooski very fine sandy loam: 1.8 miles east of village of Williston. (More poorly drained than modal profile.)	0-8	93	24	-----	-----	-----	-----
	22-35	99	21	-----	-----	-----	-----
	54-69	104	16	-----	-----	-----	-----
40 feet east of Winooski River, 450 ft. south of Mill Brook, town of Jericho. (More clayey lower substratum than in modal profile.)	0-8	72	22	-----	-----	-----	-----
	15-27	98	21	-----	-----	-----	-----
	38-43	93	22	-----	-----	-----	-----

¹ Based on the Moisture-Density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop, AASHO Designation T 99, Method.² Mechanical analyses according to the AASHO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.³ Classifications based on material smaller than 3 inches.

test data

procedures of the American Association of State Highway Officials (AASHO) (2)]

Mechanical analysis ² —Continued									Liquid limit	Plasticity index	Classification ³	
Percentage passing sieve—Continued					Percentage smaller than—							
¾ in.	No. 4 (4.75 mm.)	No. 10 (2.0 mm.)	No. 40 (0.425 mm.)	No. 200 (0.75 mm.)	0.075 mm.	0.075 mm.	0.075 mm.	0.075 mm.				
99	96	93	66	27	(6)	(6)	(6)	(6)	Percent 29 18 8 NV 28	7 NP NP NP 5	A-2-4(0) A-2-4(0) A-1-b(0) A-4	SM SM 9 SW ML-CL
96	93	87	60	15	(6)	(6)	(6)					
100	93	87	30	1	(6)	(6)	(6)					
		100	95	90	(6)	(6)	(6)	(6)				
100	99	96	90	62	61	53	27	15	35	NP	A-4	ML
99	95	93	83	57	54	43	28	18	32	15	A-6	CL
100	99	96	74	47	45	23	17	11	22	7	A-4	SC-SM
100	96	92	80	50	44	29	14	7	19	4	A-4	SC-SM
	100	99	93	25	21	16	7	4	21	NP	A-2-4	SM
		100	99	21	16	18	6	4	17	NP	A-2-4	SM
		100	98	14	10	4	2	2	NV	NP	A-2-4	SM
		100	99	43	35	24	18	15	19	NP	A-4	SM
		100	94	71	64	32	8	6	48	NP	A-5(9)	ML (OL)
		100	99	49	38	12	6	4	22	NP	A-4(3)	SM
			100	98	98	71	25	12	31	NP	A-4(8)	ML
95	90	85	72	35	32	25	11	6	32	NP	A-2-4(0)	SM
85	81	76	67	28	26	11	4	3	NV	NP	A-2-4(0)	SM
72	69	65	54	26	22	10	6	3	NV	NP	A-2-4(0)	SM
88	82	72	61	35	31	12	6	4	37	NP	A-2-4(0)	SM
83	75	68	56	32	29	14	5	3	19	NP	A-2-4(0)	SM
89	85	79	67	33	27	12	5	3	17	NP	A-2-4(0)	SM
	100	99	95	87	80	43	23	12	51	8	A-5	MH
	100	99	94	82	79	68	44	32	38	16	A-6	ML-CL
			100	98	95	89	64	43	41	18	A-7-6	CL
				100	93	70	59	42	46	21	A-7-6	ML-CL
		100	99	91	80	16	7	5	17	NP	A-4(8)	ML
		100	99	83	78	35	11	7	26	NP	A-4(8)	ML
		100	99	20	18	9	6	5	NV	NP	A-2-4(0)	SM
		100	99	72	64	38	16	11	33	NP	A-4(7)	ML (OL)
		100	99	91	85	56	28	12	34	NP	A-4(8)	ML
		100	98	94	90	76	39	37	29	NP	A-4(8)	ML

⁴ Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145-49.

⁵ Based on the Unified Soil Classification System for Roads, Airfields, Embankments, and Foundations (11).

⁶ Data not available.

⁷ Nonplastic.

⁸ No value.

⁹ The Soil Conservation Service (SCS) and the Bureau of Public Roads (BPR) have agreed to consider all soils having plasticity indexes within 2 points of A-line as having a borderline classification. An example of a borderline classification is ML-CL.

With the use of the soil map for identification, the engineering estimates and interpretations reported here can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loams or excavations deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used in this survey have special meanings in soil science that do not correspond with the meanings of the same terms in engineering. These terms are defined in the Glossary at the back of this survey. For additional information about the soils, engineers may want to refer to "Descriptions of the Soils," "Formation and Classification of Soils," and other sections of this survey.

Soil classification systems

The texture of the soils has been classified in table 5 according to the systems used by the U.S. Department of Agriculture (10), the American Association of State Highway Officials (AASHTO) (2), and the Department of Defense (11). The latter two systems are described in the "PCA Soil Primer" (4).

Under the U.S. Department of Agriculture system, soils are classified according to texture, structure, color, and other morphological characteristics. The textural classification is in some ways comparable to the systems used by engineers.

Most highway engineers use the AASHTO system, in which there are seven basic groups of soils ranging from group A-1 to A-7. Soils in group A-1 contain predominantly sand and gravel and generally have a high load-carrying capacity. Soils in group A-7 are composed predominantly of clay and have a low load-carrying capacity when wet.

Many engineers use the Unified Soil Classification System in which soils are divided into three classes: (1) coarse grained, (2) fine grained, and (3) highly organic. The coarse-grained soils are divided into eight groups, ranging from well-graded clean gravel (GW) to clayey sand (SC). The fine-grained soils are divided into six groups, ranging from silty soil with a low liquid limit (ML) to organic silt and clay with a high liquid limit (OH). Highly organic soil is classified as Pt. The Unified Soil Classification System is used by the Soil Conservation Service in engineering work.

Estimated engineering properties

Table 5 provides estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, available physical and chemical tests of representative samples, available test data from comparable soils in adjacent areas, and detailed experience in working with the individual kinds of soil in the survey area.

More information useful to engineers can be found in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

The soil horizons for any soil series vary in thickness from place to place. The thicknesses and USDA soil tex-

tures given in table 5 are for the representative profiles described in the section, "Description of the Soils." The USDA soil texture is determined by relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some other terms used in the USDA textural classification are defined in the glossary of this soil survey. The other estimates in table 5 can be expected for the soil horizons even though the horizons vary from place to place in thickness and texture.

Depth to seasonal high water table is important as it may limit use of sites for highways, buildings, septic tank effluent disposal systems, and other engineering uses. It is important in choosing sites for dug-out ponds.

Depth to bedrock is important because it may greatly affect the cost of any excavation and is important in foundation design.

Similar soil layers important to engineering are grouped and their grain-size fraction and the AASHTO and Unified engineering classification are given. The uppermost soil layer—the surface layer—is not, in most places, suitable for most engineering structures but it generally is used for topsoil.

Permeability, as used in table 5, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water capacity is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. In table 5 it is expressed as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH values and relative terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material as its moisture content changes. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials.

Engineering interpretations

Table 6 contains selected information useful to engineers and others who plan to use soil material in the construction of highways and soil and water conservation measures. Detrimental or undesirable features are emphasized, but very important desirable features also may be listed. The ratings and other interpretations in this table are based on estimated engineering properties of the soils in table 5, on available test data, including those in table 7, and on field experience. Although the engineering information is shown to apply to soil depths given in table 5, this same information is reasonably reliable to depths of about 4 feet for most soils and several more feet for some soils.

Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, used as a top-

dressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such use.

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

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features, favorable as well as unfavorable, are the principal ones that may affect geographic location of highways.

A farm dug-out pond is an excavation generally made in depressional or nearly level soils. Depth to water table, permeability, depth to bedrock, and flooding hazard are features affecting the feasibility of a dug-out pond.

Farm pond reservoir areas may be affected by loss of water through seepage, and the soil features described are those that influence such seepage.

Farm pond embankments serve as dams. The soil features, of both subsoil and substratum, are those important to the use of soils for constructing embankments.

Agricultural drainage is affected by soil properties. A feasible outlet, which is not a soil property, must be available before agricultural drainage is possible.

Engineering test data

Samples that represent six soil series were taken from eight locations in Chittenden County and tested by the Vermont Highway Department according to standard procedures of the American Association of State Highway Officials (AASHO) (2). The data obtained from these tests are given in table 7.

Table 7 also gives two systems of engineering classification for each sample, the AASHO system and the Unified System (11). The classifications are based on data obtained by mechanical analyses and by tests made to determine the liquid limit and the plastic limit (4).

The tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semi-solid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which a soil passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition. Some silty and sandy soils are nonplastic; that is, they do not become plastic at any moisture content.

Engineering test data for the Covington, Livingston, and Vergennes soils are given in the soil survey of Addison County, Vermont.

Community Development and Recreational Uses of Soils

This section is to aid planners, developers, and others who are interested in community development and recreational uses of soils. It indicates the limitation of each soil in the county for specific community developments

and recreational uses. An estimate of the degree and kind of limitation for each soil is given in table 8. The geographical location, accessibility, water supply, esthetic value, and other features also need to be considered.

The ratings in table 8 are based on the main features that affect community development and recreational uses. The ratings are *slight*, *moderate*, and *severe*. These ratings are relative, however, and do not preclude the use of any soil for the uses listed in the table, provided that it is economically feasible to overcome the limitation or hazard. Also, the ratings do not eliminate the need for investigation for a specified use at the site of the proposed works. If the limitation in table 8 is rated severe or moderate, one or more limitations for the use specified are listed. A rating of *slight* indicates that the soil has few or no limitations. A rating of *moderate* indicates that the soil has limitations that are moderately easy to overcome. If the rating is *severe*, the limitations are serious and difficult to overcome.

The main soil features that affect community development and recreational uses of soils are flooding, high water table, seasonal water table, permeability, rockiness, shallowness to bedrock, depth to bedrock, slope, stoniness, soil texture (subsoil or substratum), and surface soil texture (surface layer). Some community development and recreational uses are affected little by any one of these features, and other uses are affected by several. The ratings in table 8 are based on features that produce the strongest effect for a specified use.

In the following paragraphs, the features that affect community development and recreational uses of soils are listed and their effect on specified uses is described.

Flooding.—Soils subject to flooding have severe limitations for use as sites for septic tank effluent disposal, low buildings, streets and parking lots, camp areas, and sanitary land fill. If these soils cannot be protected by dikes, levees, or other flood prevention structures, they should not be used for these purposes. Soils used for picnic areas, golf fairways, lawns, and playground sites may be slightly or moderately affected by infrequent flooding.

High water table and seasonal water table.—These affect the use of many soils in Chittenden County. The Au Gres, Cabot, Covington, Enosburg, Livingston, Massena, Muck and peat, Peacham, Scantic, Scarborough, and Whately soils have a high water table. They are wet most of the year and have severe limitations for all community developments and recreational uses. These soils generally range from depressional to gently sloping, but sloping and moderately steep soils are not uncommon. Although most of the steeper soil areas are small, they are scattered throughout the county. Many soils that are wet part of the year have a seasonal water table above a restricting layer or a water table that rises and falls without reaching the soil surface. These wet soils are not readily recognized. They include the moderately well drained Belgrade, Deerfield, Duane, Eldridge, Georgia, Peru, and Vergennes soils, and the somewhat poorly drained Munson and Raynham soils. These soils have moderate or severe limitations for many community and recreational uses.

TABLE 8.—*Soil interpretations for community*

[Because their properties are too variable for interpretation, Alluvial land (An), Beaches (Be), Blown-

Soil series and map symbols	Estimated degree and dominant kind of limitation			
	Low buildings		Septic tank disposal fields	Streets and parking lots
	With basements	Without basements		
Adams and Windsor: AdA.....	Slight.....	Slight.....	Slight ¹	Slight to moderate.....
AdB.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes ¹	Moderate to severe: slopes.
AdD, AdE.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes ¹	Severe: slopes.....
Agawam: AgA.....	Slight.....	Slight.....	Slight ²	Slight to moderate: slopes; loamy subsoil or substratum.
AgD, AgE.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes ²	Severe: slopes.....
Au Gres: Au.....	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Belgrade: BIA, BIB.....	Moderate: seasonal water table.	Moderate: seasonal water table; subject to frost heave.	Severe: moderately slow permeability.	Moderate: seasonal water table; loamy subsoil or substratum.
BIC.....	Moderate: seasonal water table; slopes.	Moderate: slopes.....	Severe: slopes; moderately slow permeability.	Severe: slopes.....
BID..... For limitations of Eldridge soils, see Eldridge series.	Severe: slopes.....	Severe: slopes.....	Severe: slopes; moderately slow permeability.	Severe: slopes.....
Cabot: CaA.....	Severe: high water table.	Severe: high water table.	Severe: high water table; slow permeability.	Severe: high water table.
CaC.....	Severe: high water table.	Severe: high water table; slopes.	Severe: high water table; slow permeability; slopes.	Severe: slopes; high water table.
CbA.....	Severe: high water table; stones.	Severe: stones; high water table.	Severe: high water table; slow permeability.	Severe: high water table.
CbD.....	Severe: high water table; stones.	Severe: stones; high water table.	Severe: high water table; slopes; slow permeability.	Severe: slopes; high water table.
Colton: CoA.....	Slight.....	Slight.....	Slight ¹	Slight to moderate: slopes.
CoB.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes ¹	Severe: slopes.....
CoC, CsD, CsE..... For limitations of Stetson soils in CsD and CsE, see StC under the Stetson series.	Severe: slopes.....	Severe: slopes.....	Severe: slopes ¹	Severe: slopes.....

See footnotes at end of table.

development and recreational uses

out land (Bo), Borrow pits (Br), Fill land (Fu), Quarries (Qd), and Rockland (Rk), are not listed in this table]

Estimated degree and dominant kind of limitation—Continued				
Sanitary land fill	Picnic areas	Camp areas	Golf fairways and lawns	Playgrounds
Slight ² -----	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Severe: sandy surface layer.	Moderate: sandy surface layer.
Moderate: slopes ² -----	Moderate: slopes; sandy surface layer.	Moderate: slopes; sandy surface layer.	Severe: sandy surface layer.	Moderate: sandy surface layer.
Severe: slopes-----	Severe: slopes-----	Severe: slopes-----	Severe: slopes; sandy surface layer.	Severe: slopes.
Slight ² -----	Slight-----	Slight-----	Slight-----	Slight to moderate: slopes.
Severe ² -----	Severe: slopes-----	Severe: slopes-----	Severe: slopes-----	Severe: slopes.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: seasonal water table.	Slight-----	Moderate: seasonal water table.	Slight-----	Moderate: seasonal water table; moderately slow permeability.
Severe: slopes; seasonal water table.	Moderate: slopes-----	Moderate: slopes; seasonal water table.	Moderate: slopes-----	Severe: slopes.
Severe: slopes; seasonal water table.	Severe: slopes-----	Severe: slopes-----	Severe: slopes-----	Severe: slopes.
Severe: high water table; slow permeability.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table; slow permeability.	Severe: high water table.	Severe: slopes; high water table.	Severe: slopes; high water table.	Severe: high water table; slopes.
Severe: stoniness; high water table; slow permeability.	Severe: high water table.	Severe: stoniness; high water table.	Severe: stoniness; high water table.	Severe: high water table; stoniness.
Severe: stoniness; slopes; high water table; slow permeability.	Severe: high water table; slopes.	Severe: slopes; high water table; stoniness.	Severe: slopes; stoniness; high water table.	Severe: high water table; slopes; stoniness.
Slight ² -----	Moderate: gravelly and sandy surface layer.	Moderate: gravelly and sandy surface layer.	Severe: gravelly and sandy surface layer.	Severe: gravelly and sandy surface layer.
Moderate: slopes ² -----	Moderate: slopes; gravelly and sandy surface layer.	Moderate: slopes; gravelly and sandy surface layer.	Severe: gravelly and sandy surface layer.	Severe: slopes; gravelly and sandy surface layer.
Severe: slopes ² -----	Severe: slopes-----	Severe: slopes-----	Severe: slopes; gravelly and sandy surface layer.	Severe: slopes; gravelly and sandy surface layer.

TABLE 8.—*Soil interpretations for community*

Soil series and map symbols	Estimated degree and dominant kind of limitation			
	Low buildings		Septic tank disposal fields	Streets and parking lots
	With basements	Without basements		
Covington: Cv.....	Severe: high water table; clayey surface layer.	Severe: high water table; clayey surface layer.	Severe: high water table; very slow permeability.	Severe: high water table; clayey surface layer.
Duane and Deerfield: DdA.....	Moderate: seasonal water table.	Slight.....	Moderate: seasonal water table.	Moderate: seasonal water table; slopes.
DdB.....	Moderate: seasonal water table; slopes.	Moderate: slopes.....	Moderate: seasonal water table; slopes.	Severe: slopes.....
DdC.....	Severe: seasonal water table; slopes.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....
Eldridge: Eldridge part of BIA.....	Moderate: seasonal water table.	Slight.....	Severe: seasonal water table; moderately slow permeability.	Moderate: seasonal water table; sandy surface layer.
Eldridge part of BIB.....	Moderate: seasonal water table.	Slight.....	Severe: seasonal water table; moderately slow permeability.	Moderate: seasonal water table; sandy surface layer; slopes.
Eldridge part of BIC.....	Moderate: slopes; seasonal water table.	Moderate: slopes.....	Severe: slopes; seasonal water table; moderately slow permeability.	Severe: slopes.....
Eldridge part of BID.....	Severe: slopes; seasonal water table.	Severe: slopes.....	Severe: slopes; moderately slow permeability.	Severe: slopes.....
Enosburg: EwA, EwB..... For limitations of Whately soils, see Whately series.	Severe: high water table.	Severe: high water table.	Severe: high water table; moderately slow permeability.	Severe: high water table.
Farmington: FaC, FaE.....	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: rockiness; slopes.
FsB.....	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: slopes; shallow to bedrock.
FsC, FsE..... For limitations of Stockbridge soils in FsB, FsC, and FsE, see Stockbridge series.	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: slopes; shallow to bedrock.
Fresh water marsh: Fw.....	Severe: flooding.....	Severe: flooding.....	Severe: flooding.....	Severe: flooding.....

development and recreational uses—Continued

Estimated degree and dominant kind of limitation—Continued				
Sanitary land fill	Picnic areas	Camp areas	Golf fairways and lawns	Playgrounds
Severe: high water table; very slow permeability.	Severe: high water table; clayey surface layer.	Severe: high water table; clayey surface layer; very slow permeability.	Severe: high water table; clayey surface layer.	Severe: high water table; clayey surface layer; very slow permeability.
Severe: seasonal water table.	Moderate: sandy to loamy surface layer.	Moderate: seasonal water table; sandy to loamy surface layer.	Severe: sandy to loamy surface layer.	Moderate: seasonal water table; slopes; sandy to loamy surface layer.
Severe: slopes; seasonal water table.	Moderate: slopes; sandy to loamy surface layer.	Moderate: slopes; seasonal water table; sandy to loamy surface layer.	Severe: sandy to loamy surface layer.	Severe: slopes.
Severe: slopes; seasonal water table.	Severe: slopes-----	Severe: slopes-----	Severe: slopes; sandy to loamy surface layer.	Severe: slopes.
Severe: seasonal water table.	Moderate: sandy surface layer.	Moderate: seasonal water table; sandy surface layer.	Moderate: sandy surface layer.	Moderate: seasonal water table; sandy surface layer; moderately slow permeability.
Severe: seasonal water table.	Moderate: sandy surface layer; seasonal water table.	Moderate: seasonal water table; sandy surface layer.	Moderate: sandy surface layer.	Moderate: seasonal water table; sandy surface layer; slopes; moderately slow permeability.
Severe: slopes; seasonal water table.	Moderate: slopes; sandy surface layer.	Moderate: seasonal water table; slopes; sandy surface layer.	Moderate: slopes; sandy surface layer.	Severe: slopes.
Severe: slopes; seasonal water table.	Severe: slopes-----	Severe: slopes-----	Severe: slopes-----	Severe: slopes.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: shallow to bedrock; slopes.	Severe: rockiness; slopes.	Severe: rockiness; slopes.	Severe: rockiness; slopes.	Severe: shallow to bedrock; slopes; rockiness.
Severe: shallow to bedrock.	Moderate: slopes-----	Moderate: slopes; rockiness.	Moderate: rockiness; slopes.	Severe: slopes; rockiness.
Severe: slopes; shallow to bedrock.	Severe: slopes-----	Severe: slopes-----	Severe: slopes-----	Severe: slopes; rockiness.
Severe: flooding-----	Severe: flooding; high water table.	Severe: high water table; flooding.	Severe: flooding; high water table.	Severe: flooding; high water table.

TABLE 8.—*Soil interpretations for community*

Soil series and map symbols	Estimated degree and dominant kind of limitation			
	Low buildings		Septic tank disposal fields	Streets and parking lots
	With basements	Without basements		
Georgia: GeB.....	Moderate: seasonal water table.	Slight.....	Severe: moderately slow to slow permeability.	Moderate: seasonal water table; slopes; loamy subsoil or substratum.
GeC.....	Moderate: seasonal water table.	Moderate: slopes.....	Severe: moderately slow to slow permeability.	Severe: slopes; loamy subsoil or substratum.
GgC.....	Severe: stones.....	Severe: stones.....	Severe: moderately slow to slow permeability; slopes.	Severe: slopes; seasonal water table; loamy subsoil or substratum.
GgE.....	Severe: slopes.....	Severe: slopes.....	Severe: moderately slow to slow permeability.	Severe: slopes.....
Groton: GrA.....	Slight.....	Slight.....	Slight ²	Slight to moderate: slopes.
GrB.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes ²	Moderate to severe: slopes.
GrC, GrD, GrE.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes ²	Severe: slopes.....
Hadley: Hf.....	Severe: flooding.....	Severe: flooding.....	Severe: flooding.....	Moderate: loamy subsoil or substratum.
Hh.....	Severe: flooding.....	Severe: flooding.....	Severe: flooding.....	Severe: flooding.....
Hartland: HIB.....	Slight.....	Moderate: subject to frost heave.	Severe: moderately slow permeability.	Moderate: slopes; loamy subsoil or substratum.
HIC.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes.....	Severe: slopes; loamy subsoil or substratum.
HID, HIE.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes; moderately slow permeability.	Severe: slopes.....
Hinesburg: HnA.....	Slight.....	Slight.....	Severe: moderately slow permeability.	Moderate: loamy subsoil or substratum.
HnB.....	Slight.....	Slight.....	Severe: moderately slow permeability; slopes.	Moderate: slopes; loamy subsoil or substratum.
HnC.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes; moderately slow permeability.	Severe: slopes.....

See footnotes at end of table.

development and recreational uses—Continued

Estimated degree and dominant kind of limitation—Continued				
Sanitary land fill	Picnic areas	Camp areas	Golf fairways and lawns	Playgrounds
Severe: seasonal water table; moderately slow to slow permeability.	Slight.....	Moderate: seasonal water table; moderately slow to slow permeability.	Slight.....	Moderate: seasonal water table; slopes; stoniness; moderately slow to slow permeability.
Severe: seasonal water table; moderately slow to slow permeability.	Moderate: slopes.....	Moderate: seasonal water table; moderately slow to slow permeability.	Moderate: slopes.....	Severe: slopes.
Severe: stoniness; seasonal water table; moderately slow to slow permeability.	Moderate: stoniness; slopes.	Severe: stoniness.....	Severe: stoniness.....	Severe: stoniness; slopes.
Severe: stoniness; slopes; seasonal water table; moderately slow to slow permeability.	Severe: slopes.....	Severe: slopes; stoniness.	Severe: slopes; stoniness.	Severe: stoniness; slopes.
Slight ²	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.
Moderate: slopes ²	Moderate: slopes; gravelly surface layer.	Moderate: slopes; gravelly surface layer.	Moderate: slopes; gravelly surface layer.	Severe: slopes.
Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Moderate: flooding.....	Moderate: flooding.....	Moderate: flooding.....	Slight.....	Moderate: flooding.
Severe: flooding.....	Moderate: flooding.....	Severe: flooding.....	Moderate: flooding.....	Moderate: flooding.
Moderate: moderately slow permeability.	Slight.....	Slight.....	Slight.....	Moderate: slopes.
Moderate: slopes; moderately slow permeability.	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes.
Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Moderate: moderately slow permeability.	Moderate: sandy to loamy surface layer.	Moderate: sandy to loamy surface layer; moderately slow permeability.	Moderate: sandy to loamy surface layer.	Moderate: sandy to loamy surface layer.
Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Moderate: sandy to loamy surface layer; moderately slow permeability.	Moderate: sandy to loamy surface layer.	Moderate: slopes; sandy to loamy surface layer.
Moderate: slopes; moderately slow permeability.	Moderate: slopes; sandy to loamy surface layer.	Moderate: slope; sandy to loamy surface layer; moderately slow permeability.	Moderate: slopes; sandy to loamy surface layer.	Severe: slopes.

TABLE 8.—*Soil interpretations for community*

Soil series and map symbols	Estimated degree and dominant kind of limitation			
	Low buildings		Septic tank disposal fields	Streets and parking lots
	With basements	Without basements		
Hinesburg—Continued HnD, HnE-----	Severe: slopes-----	Severe: slopes-----	Severe: slopes; moderately slow permeability.	Severe: slopes-----
Limerick: Le, Lf-----	Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.
Livingston: Lh-----	Severe: high water table; clayey subsoil or substratum.	Severe: high water table; clayey subsoil or substratum.	Severe: high water table; very slow permeability.	Severe: high water table; clayey subsoil or substratum.
Lk-----	Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table; very slow permeability.	Severe: flooding; high water table; clayey subsoil or substratum.
Lyman: LmB-----	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: slopes; shallow to bedrock.
LmC-----	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: slopes; shallow to bedrock.
LyD-----	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: rockiness; slopes.
LyE----- For limitations of Marlow soils in LmB, LmC, LyD, and LyE, see Marlow series.	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: shallow to bedrock; slopes.	Severe: slopes; rockiness.
Marlow: Marlow part of LmB-----	Moderate: slopes-----	Moderate: slopes-----	Severe: slow permeability.	Moderate: rockiness; slopes.
Marlow part of LmC-----	Severe: slopes-----	Severe: slopes-----	Severe: slow permeability; slopes.	Severe: slopes-----
Marlow part of LyD-----	Moderate to severe: slopes; rockiness.	Moderate to severe: slopes; rockiness.	Severe: slow permeability; slopes.	Severe: rockiness; slopes.
Marlow part of LyE-----	Severe: slopes-----	Severe: slopes-----	Severe: slow permeability; slopes.	Severe: slopes; rockiness.
MaB-----	Moderate: slopes-----	Moderate: slopes-----	Severe: slow permeability.	Moderate to severe: slopes.
MaC, MaD-----	Severe: slopes-----	Severe: slopes-----	Severe: slow permeability; slopes.	Severe: slopes-----
MeC-----	Severe: stoniness; slopes.	Severe: stoniness; slopes.	Severe: slow permeability; slopes.	Moderate to severe: stoniness; slopes.
MeE-----	Severe: stoniness; slopes.	Severe: stoniness; slopes.	Severe: slow permeability; slopes.	Severe: slopes-----

See footnotes at end of table.

development and recreational uses—Continued

Estimated degree and dominant kind of limitation—Continued				
Sanitary land fill	Picnic areas	Camp areas	Golf fairways and lawns	Playgrounds
Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: flooding; high water table.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: flooding; high water table.	Severe: flooding; high water table.
Severe: very slow permeability; high water table; clayey subsoil or substratum.	Severe: high water table; clayey surface layer.	Severe: high water table; clayey surface layer; very slow permeability.	Severe: high water table; clayey surface layer.	Severe: high water table; clayey surface layer; very slow permeability.
Severe: flooding; very slow permeability; high water table; clayey subsoil or substratum.	Severe: flooding; high water table; clayey surface layer.	Severe: flooding; high water table; clayey surface layer; very slow permeability.	Severe: flooding; high water table; clayey surface layer.	Severe: flooding; high water table; clayey surface layer; very slow permeability.
Severe: shallow to bedrock.	Moderate: slopes.....	Moderate: slopes.....	Moderate: rockiness; slopes.	Severe: slopes; shallow to bedrock.
Severe: slopes; shallow to bedrock.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes; shallow to bedrock.
Severe: shallow to bedrock; slopes.	Severe: slopes; rockiness.	Severe: slopes; rockiness.	Severe: rockiness; slopes.	Severe: slopes; shallow to bedrock; rockiness.
Severe: slopes; shallow to bedrock.	Severe: slopes; rockiness.	Severe: slopes; rockiness.	Severe: slopes; rockiness.	Severe: slopes; shallow to bedrock; rockiness.
Severe: rockiness.....	Moderate: slopes.....	Moderate: slopes; rockiness.	Moderate: rockiness; slopes.	Severe: slopes.
Severe: slopes; rockiness.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: rockiness; slopes.	Moderate to severe: rockiness; slopes.	Moderate to severe: rockiness; slopes.	Severe: rockiness; slopes.	Severe: slopes; rockiness.
Severe: slopes; rockiness.	Severe: slopes; rockiness.	Severe: slopes.....	Severe: slopes; rockiness.	Severe: slopes; rockiness.
Severe: slow permeability.	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes.
Severe: slopes; slow permeability.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: stoniness; slow permeability.	Moderate to severe: stoniness; slopes.	Severe: stoniness; slopes.	Severe: stoniness; slopes.	Severe: slopes; stoniness.
Severe: stoniness; slopes; slow permeability.	Severe: stoniness; slopes.	Severe: slopes; stoniness.	Severe: stoniness; slopes.	Severe: slopes; stoniness.

TABLE 8.—*Soil interpretations for community*

Soil series and map symbols	Estimated degree and dominant kind of limitation			
	Low buildings		Septic tank disposal fields	Streets and parking lots
	With basements	Without basements		
Messena: MnC.....	Severe: high water table.	Severe: high water table.	Severe: high water table; slopes; moderately slow to slow permeability.	Severe: high water table; slopes.
MoC.....	Severe: stoniness; high water table.	Severe: stoniness.....	Severe: high water table; slopes; moderately slow to slow permeability.	Severe: high water table; slopes.
Muck and peat: Mp.....	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Munson: MuD.....	Severe: seasonal water table; slopes.	Severe: slopes; seasonal water table.	Severe: slopes; seasonal water table; slow to very slow permeability.	Severe: slopes.....
MyB.....	Severe: seasonal water table.	Severe: seasonal water table.	Severe: seasonal water table; slow to very slow permeability.	Moderate to severe: seasonal water table; slopes; loamy to clayey subsoil or substratum.
MyC..... For limitations of Raynham soils in MyB and MyC, see the Raynham series.	Severe: seasonal water table.	Severe: seasonal water table.	Severe: slopes; seasonal water table; slow to very slow permeability.	Severe: slopes.....
Nellis: Nellis part of SuB.....	Slight.....	Slight.....	Moderate: slopes.....	Moderate: slopes; loamy subsoil or substratum.
Nellis part of SuC.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes.....
Nellis part of SuD.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....
Nellis part of SxC.....	Severe: stoniness.....	Severe: stoniness.....	Severe: slopes.....	Moderate to severe: loamy subsoil or substratum.
Nellis part of SxE..... For limitations of Stockbridge soils in SuB, SuC, SuD, SxC, and SxE, see the Stockbridge series.	Severe: stoniness.....	Severe: stoniness.....	Severe: slopes.....	Severe: slopes.....
Palatine: PaB.....	Severe: depth to bedrock is 20 to 40 inches.	Moderate: depth to bedrock is 20 to 40 inches.	Severe: depth to bedrock is 20 to 40 inches.	Severe: depth to bedrock is 20 to 40 inches.
PaC.....	Severe: depth to bedrock is 20 to 40 inches; slopes.	Moderate: depth to bedrock is 20 to 40 inches; slopes.	Severe: slopes; depth to bedrock is 20 to 40 inches.	Severe: slopes; depth to bedrock is 20 to 40 inches.
PaD, PaE.....	Severe: depth to bedrock is 20 to 40 inches; slopes.	Severe: slopes.....	Severe: slopes; depth to bedrock is 20 to 40 inches.	Severe: slopes; depth to bedrock is 20 to 40 inches.

See footnotes at end of table.

development and recreational uses—Continued

Estimated degree and dominant kind of limitation—Continued				
Sanitary land fill	Picnic areas	Camp areas	Golf fairways and lawns	Playgrounds
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table; stoniness.	Severe: high water table.	Severe: high water table; stoniness.	Severe: stoniness; high water table.	Severe: high water table; stoniness.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: slopes; seasonal water table; loamy and clayey subsoil or substratum.	Severe: slopes.....	Severe: slopes; seasonal water table; slow to very slow permeability.	Severe: slopes.....	Severe: slopes.
Severe: seasonal water table; loamy and clayey subsoil or substratum.	Moderate: seasonal water table.	Severe: seasonal water table; slow to very slow permeability.	Moderate: seasonal water table.	Moderate: slopes; seasonal water table; slow to very slow permeability.
Severe: seasonal water table; loamy and clayey subsoil or substratum.	Moderate: slopes; seasonal water table.	Severe: seasonal water table; slow to very slow permeability.	Moderate: slopes; seasonal water table.	Severe: slopes.
Slight.....	Slight.....	Slight.....	Slight.....	Moderate: stoniness; slopes.
Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes.
Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: stoniness.....	Moderate: stoniness; slopes.	Severe: stoniness.....	Severe: stoniness.....	Severe: stoniness; slopes.
Severe: slopes; stoniness.	Severe: slopes.....	Severe: slopes; stoniness.	Severe: slopes; stoniness.	Severe: stoniness; slopes.
Severe: depth to bedrock is 20 to 40 inches.	Slight.....	Slight.....	Moderate: depth to bedrock is 20 to 40 inches.	Moderate: depth to bedrock is 20 to 40 inches; slopes.
Severe: depth to bedrock is 20 to 40 inches.	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes; depth to bedrock is 20 to 40 inches.	Severe: slopes.
Severe: slopes; depth to bedrock is 20 to 40 inches.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.

TABLE 8.—*Soil interpretations for community*

Soil series and map symbols	Estimated degree and dominant kind of limitation			
	Low buildings		Septic tank disposal fields	Streets and parking lots
	With basements	Without basements		
Peacham: Pc.....	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Peru:				
PeA.....	Moderate: seasonal water table.	Slight.....	Severe: slow permeability.	Moderate: seasonal water table; slopes; loamy subsoil or substratum.
PeB.....	Moderate: seasonal water table; slopes.	Moderate: slopes.....	Severe: slow permeability.	Severe: slopes.....
PeC, PeD.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes; slow permeability.	Severe: slopes.....
PsC.....	Severe: stoniness; slopes.	Severe: stoniness; slopes.	Severe: slopes; slow permeability.	Moderate to severe: seasonal water table; loamy subsoil or substratum.
PsE.....	Severe: stoniness; slopes.	Severe: stoniness; slopes.	Severe: slopes; slow permeability.	Severe: slopes.....
Raynham:				
MyB.....	Severe: seasonal water table.	Severe: seasonal water table.	Severe: slow permeability; seasonal water table.	Moderate: seasonal water table; loamy subsoil or substratum; slopes.
MyC..... For limitations of Munson soils in MyB and MyC, see the Munson series.	Severe: seasonal water table.	Severe: seasonal water table.	Severe: slow permeability; slopes; seasonal water table.	Severe: slopes.....
Scantic: ScA, ScB.....	Severe: high water table.	Moderate: high water table.	Severe: moderately slow permeability; high water table.	Severe: high water table.
Scarboro: Sd.....	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Stetson:				
StA.....	Slight.....	Slight.....	Slight ¹	Slight to moderate: slopes.
StB.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes ¹	Moderate to severe: slopes.
StC.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes ¹	Severe: slopes.....

See footnotes at end of table.

development and recreational uses—Continued

Estimated degree and dominant kind of limitation—Continued				
Sanitary land fill	Picnic areas	Camp areas	Golf fairways and lawns	Playgrounds
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: slow permeability; seasonal water table.	Slight.....	Moderate: seasonal water table; slow permeability.	Slight.....	Moderate: seasonal water table; slopes; stoniness; slow permeability.
Severe: slow permeability; seasonal water table.	Moderate: slopes.....	Moderate: seasonal water table; slow permeability; slopes.	Moderate: slopes.....	Severe: slopes.
Severe: slopes; slow permeability; seasonal water table.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: stoniness; slow permeability; seasonal water table.	Moderate to severe: slopes; stoniness.	Severe: slopes; stoniness.	Severe: stoniness; slopes.	Severe: stoniness; slopes.
Severe: slopes; slow permeability; stoniness; seasonal water table.	Severe: slopes.....	Severe: slopes; stoniness.	Severe: slopes; stoniness.	Severe: stoniness; slopes.
Severe: seasonal water table.	Moderate: seasonal water table.	Severe: seasonal water table.	Moderate: seasonal water table.	Moderate: seasonal water table; slopes; slow permeability.
Severe: seasonal water table.	Moderate: seasonal water table; slopes.	Severe: seasonal water table.	Moderate: seasonal water table; slopes.	Severe: slopes.
Severe: high water table; moderately slow to slow permeability.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Slight ²	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer; slopes.
Moderate: slopes ²	Moderate: slopes; gravelly surface layer.	Moderate: slopes; gravelly surface layer.	Moderate: slopes.....	Severe: slopes.
Severe: slopes ²	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.

TABLE 8.—*Soil interpretations for community*

Soil series and map symbols	Estimated degree and dominant kind of limitation			
	Low buildings		Septic tank disposal fields	Streets and parking lots
	With basements	Without basements		
Stockbridge: Stockbridge part of FsB.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Moderate to severe: rockiness; loamy subsoil or substratum; slopes.
Stockbridge part of FsC.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....
Stockbridge part of FsE..... For limitations of Farmington soils in FsB, FsC, and FsE, see the Farmington series.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....
SuB.....	Slight.....	Slight.....	Moderate: slopes.....	Moderate: slopes; loamy subsoil or substratum.
SuC.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes.....	Severe: slopes.....
SuD.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....
SxC.....	Severe: stoniness.....	Severe: stoniness.....	Severe: slopes.....	Moderate to severe: stoniness; slopes.
SxE.....	Severe: stoniness; slopes.	Severe: stoniness; slopes.	Severe: slopes.....	Severe: slopes.....
Terrace escarpments, silty and clayey: TeE.	Severe: slopes; seasonal water table.	Severe: slopes; seasonal water table.	Severe: slopes; seasonal water table; moderately slow to slow permeability.	Severe: slopes.....
Vergennes: VeB.....	Severe: clayey subsoil or substratum.	Severe: clayey subsoil or substratum.	Severe: very slow permeability.	Severe: clayey subsoil or substratum.
VeC.....	Severe: clayey subsoil or substratum.	Severe: clayey subsoil or substratum.	Severe: very slow permeability.	Severe: slopes; clayey subsoil or substratum.
VeD, VeE.....	Severe: slopes; clayey.	Severe: slopes; clayey subsoil or substratum.	Severe: slopes; very slow permeability.	Severe: slopes; clayey subsoil or substratum.
Whately Mapped only in undifferentiated groups with Enosburg soils.	Severe: high water table.	Severe: high water table.	Severe: very slow permeability; high water table.	Severe: high water table; clayey subsoil or substratum.
Winooski: Wo.....	Severe: flooding.....	Severe: flooding.....	Severe: flooding.....	Severe: flooding.....

¹ Possible pollution of nearby lakes, springs, or shallow wells.

development and recreational uses—Continued

Estimated degree and dominant kind of limitation—Continued				
Sanitary land fill	Picnic areas	Camp areas	Golf fairways and lawns	Playgrounds
Severe: rockiness.....	Moderate: slopes.....	Moderate: slopes; rockiness.	Moderate: slopes; rockiness.	Severe: slopes.
Severe: slopes; rockiness.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: slopes; rockiness.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Slight.....	Slight.....	Slight.....	Slight.....	Moderate: slopes; stoniness.
Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Moderate: slopes.....	Severe: slopes.
Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: stoniness.....	Moderate: slopes; stoniness.	Severe: stoniness.....	Severe: stoniness.....	Severe: stoniness; slopes.
Severe: slopes; stoniness.	Severe: slopes.....	Severe: slopes; stoniness.	Severe: slopes; stoniness.	Severe: stoniness; slopes.
Severe: slopes; seasonal water table.	Severe: slopes.....	Severe: slopes.....	Severe: slopes.....	Severe: slopes.
Severe: clayey subsoil or substratum; seasonal water table; very slow permeability.	Severe: clayey surface layer.	Severe: very slow permeability; clayey surface layer.	Severe: clayey surface layer.	Severe: clayey surface layer; very slow permeability.
Severe: clayey subsoil or substratum; seasonal water table; very slow permeability.	Severe: clayey surface layer.	Severe: very slow permeability; clayey surface layer.	Severe: clayey surface layer.	Severe: clayey surface layer; slopes; very slow permeability.
Severe: slopes; clayey subsoil or substratum; seasonal water table; very slow permeability.	Severe: clayey surface layer; slopes.	Severe: slopes; very slow permeability; clayey surface layer.	Severe: slopes; clayey surface layer.	Severe: clayey surface layer; slopes; very slow permeability.
Severe: high water table; loamy to clayey subsoil or substratum.	Severe: high water table.	Severe: high water table; very slow permeability.	Severe: high water table.	Severe: high water table; very slow permeability.
Severe: flooding.....	Moderate: flooding.....	Severe: flooding.....	Severe: flooding.....	Moderate: seasonal water table; flooding.

² Possible pollution of nearby lakes, springs, or shallow wells. If this soil material is used to cover rubbish, it will allow obnoxious odors to escape into the air quite frequently.

Permeability.—The rate at which water passes through the soil or its layers is the soil permeability, which is expressed in inches per hour. It is important in rating soils for septic tank effluent disposal. Permeability is closely related to the depth to the fragipan or dense till layer that is in most of the deeper soils on uplands and the finer textured soils in the lake-laid material.

Shallow to bedrock or depth to bedrock.—These depths affect many community and recreational uses of soils, especially where excavating or land leveling is needed. Excavating and leveling are needed particularly for septic tanks, basements, streets and parking lots, sanitary landfills, and landscaping. Establishing vegetation is difficult on soils that are shallow to bedrock; consequently, these soils are poor for playgrounds. Bedrock generally is between depths of 10 and 20 inches in the Farmington and Lyman soils and between depths of 20 and 40 inches in the Palatine soil. The acreage of soils that are shallow or only moderately deep over bedrock is extensive and is widely scattered throughout the county.

Rockiness.—Rocky soils have limited use for community and recreational purposes. These are soils that have bedrock exposures covering 2 to 10 percent of the land surface and are 100 to 300 feet apart. Very rocky soils have bedrock exposures covering 10 to 25 percent of the land surface and are 30 to 100 feet apart. Extremely rocky soils have bedrock exposures covering 25 to 50 percent of the land surface and are 10 to 30 feet apart. The Lyman-Marlow soils have the most extensive outcrops of bedrock. The largest acreage of the Lyman-Marlow soils is in the Green Mountains. Soils that are rocky, very rocky, or extremely rocky have moderate or severe limitations for many community development and recreational uses.

Slopes.—Soils, for most community and recreational purposes, are affected by the slopes. For example, nearly level Agawam soils have slight limitations, except for streets and parking. Soils that are moderately steep and steep have severe limitations for all community and recreational uses rated in table 8. Even in areas having severe limitations, the cost of overcoming the limitation is often justified. On the basis of slopes, the soils are rated according to the amount of earth moving that is required for a particular use (fig. 14).

Soil texture.—This texture is the relative proportion of sand, silt, and clay particles in a mass of soil. In the first five columns in table 8, a moderate or severe limitation refers to the subsoil, the substratum, or both. In the last four columns of table 8, limitations due to texture refer to that of the surface layer.

Stoniness.—Stony soils have limited use for some community and recreational purposes. Stony and extremely stony soils have stones larger than 10 inches in diameter. The stones are 30 to 100 feet and 2½ to 5 feet apart for stony and extremely stony soils, respectively. Stony soils have slight limitations except for playgrounds. Extremely stony soils have severe limitations except for septic tanks, picnic areas, and streets and parking. Marlow and Peru soils are the most extensive of the stony and extremely stony soils in the County. These soils are in the foothills of the Green Mountains.

Surfaces soil texture.—The relative proportion of sand, silt, and clay particles in the upper 4 to 10 inches of the soil profile is the surface soil texture. If fragments larger than sand and smaller than 10 inches in diameter (if rounded) or 6 inches in length (if flat) make up 15 percent or more, by volume, the appropriate term, gravelly, shaly, or other is included in the soil name, for example, Groton gravelly fine sandy loam. The content of coarse fragments and texture of the surface layer affect use for playgrounds, camp areas, picnic areas, and golf fairways and lawns.

Deep, excessively or somewhat excessively drained, nonstony or stony, nonrocky or rocky soils that are not subject to flooding, that have good stability or bearing capacity, and that are level to gently sloping have slight limitations for low buildings. Stetson gravelly fine sandy loam, 0 to 5 percent slopes is an example. The content of gravel in the surface layer of this soil gives it moderate limitations, however, for baseball, football, or other similar play areas. The Hadley soils have many desirable soil features for low buildings but are subject to flooding. Consequently, the Hadley soils have severe limitations for low buildings.

Because many soils on uplands are seasonally wet, very rocky or extremely rocky, extremely stony, shallow or moderately deep to bedrock, or have a dense, slowly permeable fragipan or till layer, they are less desirable for low buildings than other soils. Septic tank systems for sewage disposal must be carefully designed and basements must be waterproofed because of the dense fragipan or till layer in many of the deeper soils. The location, esthetic value, or other features, however, may outweigh the physical limitations of the soils. Examples are the Georgia, Marlow, Nellis, Stockbridge, Peru, Farmington, Lyman, Palatine, and other nearby soils on uplands. The Farmington and Lyman soils are shallow to bedrock. The Palatine soil is moderately deep to bedrock.

The Munson and Vergennes soils formed in glacial lake sediments. These fine-textured soils are very slowly permeable and unstable. If highways and railroads are built on these soils, vibrations caused by heavy traffic are transmitted to the soil mass and, in turn, to structures built on nearby soils. Buildings on these soils that are near highways and railroads commonly have cracked walls and ceilings, foundation failures, and other damages from the vibrations. Also, when these soils become saturated, they readily slip from their own weight where slopes are 25 percent or more. Structures, therefore, should not be built near the brink or at the foot of steep slopes on Munson and Vergennes soils.

Discussed in the following paragraphs are the community and recreational uses listed in table 8 and soil features considered in rating limitations for those uses.

Low buildings.—In table 8 the limitations of soils for low buildings are rated on the basis of year-round or seasonal use. Low buildings are of three stories or less and have basements averaging at least 5 feet below the normal ground level. Where these buildings are built without a basement, the depth to a seasonal water table is less restrictive. Not considered in the rating are limitations for septic effluent disposal, providing a water supply, stabilizing or maintaining plants, or access roads.



Figure 14.—An Eldridge soil is being leveled for community development.

The main soil features affecting the use of soils for low buildings are wetness, slope, depth to bedrock, stoniness, rockiness, texture, and flooding.

Septic tank disposal fields.—The ratings in table 8 are for limitations of soils used as drainage fields for the disposal of septic effluent from septic tanks that are adequately designed and installed. The source or supply of water is not considered in the ratings, but the possibility of pollution of lakes, springs, or shallow wells is indicated where the information is pertinent. Specific location of drainage fields for disposal of septic effluent requires careful investigation at the site of the proposed field. The main soil features affecting the use of soils for septic effluent disposal are permeability, wetness, depth to bedrock, slopes, and flooding.

Streets and parking lots.—The limitations of soils for streets and parking lots are about the same as those for highways. The ratings in table 8 are for soils in subdivisions where slopes generally are more restrictive than they are for highways. Specific engineering investigations and layout are required. More detailed infor-

mation on the limitations of soils for highways is given in the subsection "Engineering Uses of the Soils" elsewhere in the survey. The main soil features affecting the use of soils for streets and parking lots are wetness, slope, depth to bedrock, rockiness, stoniness, texture, and flooding.

Sanitary land fill.—The ratings in table 8 are for limitations of soils used at disposal areas for trash and garbage by land fill operations. In these operations a trench is dug, trash and garbage are placed in the trench, and the material is covered with soil material. No fill or borrow material from other soils is considered in the ratings. Pollution of lakes, rivers, streams, springs, or shallow wells is indicated where the information is pertinent. The main soil features affecting the use of soils for land fill are wetness, permeability, slope, depth to bedrock, stoniness, rockiness, texture, and flooding.

Picnic areas.—The soils in picnic areas are used mainly by children for walking or running. These picnic areas have tables and fireplaces for group activities

in contrast to smaller picnic sites along highways, trails, or streams. The water supply and sewage disposal system are not considered in the ratings in table 8. The main soil features affecting the uses are wetness, slope, depth to bedrock, stoniness, rockiness, texture of the surface layer, and flooding.

Camp areas.—In table 8 soil limitations are rated for tent and for trailer use. These soils are subject to frequent use during the camping season for both heavy foot and vehicular traffic. Camp areas generally provide accommodations for large groups of people, and they have a picnic table, a fireplace, and an unsurfaced parking area. Platforms for tents may be beside individual parking areas or farther away, but trailer sites and parking areas are contiguous. Sewage disposal systems, water supply, and access roads are not considered in the ratings. The main soil features affecting use are wetness, permeability, slope, depth to bedrock, stoniness, rockiness, texture of the surface layer, and flooding.

Golf fairways and lawns.—The ratings of limitations of soils used for golf fairways and lawns are based mainly on the suitability of soils for growing grass to provide lawns for low buildings and fairways for golf courses. These sites normally undergo light foot traffic and support light machines and carts. The main soil features affecting golf fairways and lawns are wetness, slope, depth to bedrock, stoniness, rockiness, texture of the surface layer, and flooding.

Playgrounds.—Limitations of soils are rated in table 8 for playgrounds used for baseball, football, soccer, or similar athletic events. Playgrounds generally are level and undergo heavy foot traffic. Borrow material or topsoil from other soils are not considered in the ratings. The main soil features affecting this use are wetness, permeability, slope, depth to bedrock, stoniness, rockiness, texture of the surface layer, and flooding.

Formation and Classification of the Soils

This section consists of three main parts. In the first part, the factors of soil formation are discussed. The second part is a discussion of the genesis of the soils in the county. The morphology of the soils is given in the section "Descriptions of the Soils." The third part is a discussion of the classification system.

Terms common in the current classification system that are used in this section are defined in the Glossary or in the reference "Soil Classification, a Comprehensive System" and its supplements (5, 9).

Factors of Soil Formation

The characteristics of a soil at a given point are determined by the interaction of (1) the physical, mineralogical, and chemical composition of the parent material; (2) the climate under which the soil profile has developed, (3) the plant and animal life in and on the soil, (4) the relief, or relative evaluation of the land, and drainage, and (5) the length of time the soil material has been in place. One or more of the factors may exert a dominating influence on the kind of soil formed

in a particular area. Commonly, however, the effect of any one factor is difficult to isolate, and the cumulative effects of all are evident. The differences in parent material, drainage, and age are of primary importance in causing differences among the soils in Chittenden County.

The most important morphological characteristics of the soil of Chittenden County are discussed in relationship to the factors of soil formation.

Parent material

The parent material of the soils in Chittenden County consists of deposits associated with glaciation and of alluvial, lacustrine, and organic deposits. The texture and mineralogical composition of the soils are directly related to the nature of the parent material. To a lesser degree, other soil features, such as drainage, depth to rock, and degree of horizonation also are related to the nature of the parent material.

A small acreage of the soils in Chittenden County is high in clay content or is underlain at a depth of 2 to 3 feet with clay. Soils such as the Covington, Livingston, and Vergennes are high in content of calcium, potassium, and magnesium because they formed in lacustrine and estuarine sediments that have a high content of clay and basic minerals. The clay minerals are mainly mica and interstratified mica-vermiculite. Vermiculite is present in small amounts. The very slow permeability and high calcium content of the parent material affect the kinds of soils formed. In Chittenden County, none of the soils of high clay content are well drained, and all of these soils have a base saturation of more than 50 percent.

Another important group of soils, including the Palatine, Nellis, and Massena soils, formed in glacial till that contained a high proportion of limestone and that, in general, was high in silt and low in clay content.

Glacial till, which is low in lime content, has a medium texture. Examples of soils formed from this till are in the Farmington, Stockbridge, Georgia, Cabot, and Peacham series.

Lyman, Peru, and Marlow soils formed in acid glacial till. Because these soils developed in glacial till that is low in content of basic minerals, they are naturally very low in fertility.

Since well-drained soils that formed in glacial till do not have excessive surface water or a perched water table close to the soil surface, the somewhat sandy texture and absence of bases contributed to the speed that illuvial horizons have developed and to the degree of this development. Soils that are not well drained also are like this but to a lesser degree.

Another feature of the glacial till that has affected soil characteristics is the compact till in the substratum. The grayish compact layer, called a fragipan, in soils such as Cabot, Marlow, Peru, and Peacham is considered to be inherited, at least in part, from the parent material. This layer has had a pronounced influence on soil characteristics, such as drainage, organic-matter content, and amount of translocation.

A small but important group of soils formed in glaciofluvial, deltaic, and beach deposits of sand and gravel. Adams, Colton, Deerfield, Duane, Groton, Stetson, and Windsor soils are examples of soils formed in glaciofluvial deposits. The soils are high in sand content and

low in silt and clay content. Many of them contain gravel and cobblestones.

Another group of soils that formed in water-laid deposits are the Belgrade, Hartland, and Raynham soils. They formed in glacial lacustrine silt loam and very fine sandy loam.

Chittenden County has soils that formed in water-deposited material that caused contrasting textural differences between soil horizons. This is the result of a layered parent material, and the soils are called bissequals. Most of these bisequal soils formed in glaciofluvial deposits on estuarine or glacial lacustrine deposits. Eldridge, Hinesburg, and Enosburg soils formed in sandy glaciofluvial, deltaic, and beach deposits over silt loam or very fine sandy loam glacial lacustrine deposits. Whately soils formed in sandy loam or fine sandy loam glaciofluvial deposits over clayey, or finer textured loamy, estuarine or glacial lacustrine deposits. Munson soils formed in silt loam or very fine sandy loam glacial lacustrine deposits over clayey, or finer textured loamy, estuarine or glacial lacustrine deposits.

Another small but important group of soils are the Hadley, Winooski, and Limerick. These soils formed in flood-plain sediments. Water-deposited sediments that are similar to those in which these soils formed are still being deposited on the soil surface. These materials contain a high proportion of very fine sand that has lesser amounts of silt, gravel, and stone fragments and generally only a little clay.

The organic soils of Chittenden County formed in deposits of decomposed reeds, sedges, and woody plants. In areas that have not been drained, the parent material of these soils is still collecting on the surface as plants die.

The unconsolidated deposits that cover the county vary in thickness. Where bedrock is less than about 40 inches from the soil surface, the soil-forming processes are affected. In general, little weathering of bedrock takes place during soil formation so that the bedrock contributes little parent material. The kind of bedrock at these depths, however, influences the nutrient uptake of plants and the subsequent recycling of nutrients in the soil.

The dominant textures of the soils of Chittenden County were inherited from the parent material. The textures range from sand to clay. Practically all coarse fragments in the soils are assumed to have been inherited from the parent material. Also, the weathering of bedrock to coarse fragments and the reduction of large stone fragments into smaller ones was of minor importance. During soil formation, there was a gross volume increase of the soil mass by such processes as development of structure and loosening by root penetration. Therefore, the percent of volume occupied by the coarse fragments in the solum is generally less than the percent of the volume in the substratum.

Soils formed in glacial till contain coarse fragments which comprise as much as 35 percent of the soil, by volume. Marlow, Stockbridge, and Nellis soils are examples of these soils formed in till. Palatine soils, also formed in till, have more than 35 percent coarse fragments, by volume, from a depth of 10 to less than 40 inches below the soil surface. The Colton, Groton, and Stetson soils that

formed in glaciofluvial materials have inherited from their parent material not only the texture of the fine-earth fraction but a high gravel and cobblestone content.

Climate

Chittenden County has a cool, humid, continental climate that is marked by extreme seasonal temperature changes. It has an annual precipitation of about 32 inches in the Champlain Valley and 40 inches in the Green Mountains. Its mean annual air temperature is about 46° F. in the Champlain Valley and 42° in the Green Mountains. The rainfall is fairly uniform during the growing season from May through September. The growing season (length in days of the freeze-free season) is about 150 days in the western part of the Champlain Valley and about 120 days in the Green Mountains. For more detailed information on climate, see the "Climate" subsection under "General Nature of the County."

All of Chittenden County was covered with ice thousands of years ago, and it was during that time and immediately afterwards that the major part of the parent material was deposited. From the end of the ice-covered period to the present time, there probably have been periods when the climate was slightly different than it is at present. All the climate-related features, however, in the soils of Chittenden County can be attributed to the effects of a similar climate.

Cool summers, well-distributed rainfall, and a cover of vigorously growing vegetation have interacted to supply large amounts of organic material to the soil surface. The organic matter that has accumulated on the surface has not decayed completely, because the summers have been neither very long nor very hot. In addition, the ground is frozen for several months each year. Consequently, a relatively large amount of organic matter has accumulated on the surface and in the upper part of many of the soils.

Frozen conditions during much of the year have held leaching to a moderate level. As a consequence, the concentration of bases and the pH in the C horizon are thought to be very similar to those of the original parent material. In addition, nutrients and bases from the annual fall of leaves and other vegetation are not readily lost from the surface layer because of the frozen soil.

Cool summers and cold winters have limited the rate of chemical reaction and the rate of mechanical breakdown of parent material. Consequently the weathering of the parent material into secondary minerals has not progressed as far as in the soils formed in similar parent material in warmer climates. Most of the soils that developed from parent material high in quartz contain a supply of readily weatherable minerals. Soils of the Adams, Colton, Duane, Deerfield, and Windsor series contain smaller amounts than other soils in the county. The morphology of Chittenden County soils indicates little clay mineral formation and little clay movement in the soils. Only soils of the Covington and Vergennes series have clay-enriched horizons.

Plant and animal life

In Chittenden County, the effects of animals and vegetation on soil formation is evident. The native vegetation of Chittenden County was mixed hardwoods and conifers. In general, the Champlain Valley was mainly covered

by stands of white pine, hemlock, oak, maple, and elm. The Green Mountains and their foothills were mainly covered by maple, birch, beech, red spruce, and hemlock. Wet soils and soils shallow to bedrock probably had the most conifers. Wet areas also have sphagnum and other mosses that contributed substantially to the accumulation of organic deposits. In these areas there now are mineral soils containing large amounts of organic matter or organic soils. Local differences in drainage and fairly minor changes in parent material, elevation, and other features contribute to differences in the density of forests, the percentage composition of species, and kinds of associated ground cover.

Vegetation generally is responsible for the amount of organic matter in the surface layer and the color of that layer. In soils such as the Adams, Marlow, and Colton, organic matter has played a dominant role in the development of the distinctive A2 and spodic horizons. Animals, such as earthworms, ants, cicada, and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients for plant food. In Chittenden County, the native forests have had more influence on soil formation than any other living organism. Man, however, has greatly influenced the surface layer where he has cleared the forest and plowed the soils. He has added fertilizer and lime to the soils and has made much of the county grassland. As yet, this change in land use has not resulted in a different classification of the soils in the county. Many areas originally cleared or harvested for timber now support excellent stands of yellow birch, maple, and beech. Aspen covers many of the heavily cutover areas. Presumably the soil-forming processes in the reforested areas are proceeding as they did before these areas were cleared or harvested for timber.

Relief and drainage

Chittenden County is in the glaciated part of the Appalachian system. The western part of the county is in the Champlain Lowland section of the Adirondack Province. The eastern part of the county is in the Green Mountain section of the New England Province.

In Chittenden County the difference in elevation between the lowest and highest points is approximately 4,290 feet. Most of the Champlain Valley is between 100 and 1,000 feet above sea level. The eastern edge of the county is dominantly between 1,000 and 3,000 feet. Mount Mansfield, the highest point in Vermont, is 4,393 feet above sea level.

The central and eastern parts of Chittenden County are drained by the Winooski River. The Lamoille River and its tributaries drain the northern part of Chittenden County. The Champlain Lowland also is drained by Malletts Creek, Indian Brook, Potash Brook, La Platte River, Lewis Creek, and numerous small streams that flow directly into Lake Champlain.

A large percentage of the moderately well drained soils has slopes ranging from 0 to 8 percent. Somewhat excessively drained soils dominantly have slopes of more than 20 percent. Many of these soils are shallow to bedrock and are located in the Green Mountains and their foothills. In the Champlain Valley, many of the excessively drained soils, such as the Adams, Colton,

Groton, Stetson, and Windsor, have coarse-textured parent material. A large proportion of these soils have slopes ranging from 3 to 20 percent.

Throughout the county, about one-fifth of the well-drained, somewhat excessively drained, and excessively drained soils commonly have slopes ranging from 3 to 15 percent slope. Within areas of relatively homogeneous parent material, many of the differences in soils are associated with differences in drainage.

Throughout the county a large proportion of the somewhat poorly drained, poorly drained, and very poorly drained soils has slopes of less than 3 percent. In the Green Mountains and their foothills, a small acreage of somewhat poorly drained and poorly drained soils has slopes ranging up to about 20 percent. The drainage of all these soils is affected by a seasonal high water table, seepage, and accumulation of surface water.

In areas in the Champlain Valley where the parent material is largely clay, the best drained soils are the moderately well drained Vergennes. Poorly drained and very poorly drained soils of clay are in areas that have very slow or slow surface runoff or are areas that pond water (fig. 15).

Soils in areas of excessive relief have a thinner solum and are shallower to bedrock than soils in less sloping areas. To a degree, this is because of the original depth of parent material. It also is partly the result of a higher rate of geological erosion in the steeper areas.

Time

The degree of soil development is related to the intensity of the soil-forming processes and the length of time these processes have acted on parent materials. In Chittenden County, the soil materials in the highlands have been exposed to weathering for about 12,500 thousand years. The glacial lacustrine and estuarine sediments are younger. Alluvium along streams is very young in terms of geologic time, and this material is still being deposited.

Distinctive illuvial horizons have had time to form in many of the soils at higher elevations in the county. Marlow and Peru are examples of soils that have distinctive horizons of this kind. These horizons form more quickly in soils that have sandy parent material and low contents of clay and bases. In soils of the Champlain Valley, there is less evidence of horizon differentiation. Nellis and Farmington soils have a bright-colored B horizon that is not an illuvial horizon. Many of the soils in Chittenden County have been in place long enough for a subsoil enriched in clay to have developed, but only Vergennes and Covington have such horizons. Probably more soils would have these horizons if conditions for clay formation and translocation had been more favorable. The parent material of soils, such as the Nellis and Palatine, could supply enough clay for formation of a clay-enriched horizon, but translocation proceeded slowly because of the high concentration of bases in the parent material.

Genesis of the Soils

The first part of this subsection highlights the major processes that have contributed to the differentiation



Figure 15.—Clayey Vergennes and Covington soils on an undulating landscape. A Farmington soil is in the foreground.

of horizons in Chittenden County soils and to the development of distinctive morphology for each kind of soil.

The most important soil-forming processes that have caused horizon differentiation in the soils of Chittenden County are the following: (1) accumulation and distribution within the horizon of organic matter, (2) progressive leaching of salts and carbonates, (3) chemical weathering, chiefly by hydrolysis, of the primary minerals into silicate clay minerals and their transfer to deeper layers, (4) chemical changes such as oxidation, reduction, and the hydration and the transfer or loss from the soil of the products of these changes, and (5) mechanical breakdown of coarse fragments into finer rock fragments and soil material.

Certain processes tend to modify, retard, or reverse the effects of these soil-forming processes. The most important of these modifying processes are (1) mixing of soil by windthrow, animal activity, or frost wedging, (2) the accumulation of fresh soil material through physical weathering or deposition, and (3) interception and subsequent recycling by plants of leached bases.

Organic matter has accumulated to some degree in all of the soils in Chittenden County. The organic soils formed in accumulated vegetation that has had the rate of decomposition retarded by saturation with water

and by the type of climate. The color of the surface layer of all mineral soils is a rough guide to the relative amount of organic matter. The surface layer of Livingston soils is black because of the organic matter in it. These soils contain the highest percentage of organic matter of the mineral soils in the county. With two exceptions, most of the soils have a sharp reduction in organic-matter content below the A horizon. Some soils formed in recent alluvium containing enough organic matter to appreciably affect their color to a depth of 24 inches or more. The second exception is the group of soils in the order Spodosols (7). In these soils, sesquioxides have been moved from the surface and subsurface layers and have been precipitated in the subsoil. The subsoil, especially the upper part, is higher in organic-matter content than the subsurface layer. Soils of this kind are members of the Adams, Agawam, Au Gres, Belgrade, Colton, Deerfield, Duane, Eldridge, Hartland, Hinesburg, Lyman, Marlow, Peru, Stetson, and Windsor series.

At least partial removal of salts and carbonates has taken place in the soils that formed in materials containing appreciable amounts of them. As a result, most of these soils are acid in the upper layers and removal of soluble salts has been complete. Removal of carbonates

has proceeded at different rates, depending upon the amount originally present and upon the drainage and texture of the soil. Soils of the Cabot, Covington, Enosburg, Farmington, Georgia, Groton, Livingston, Massena, Munson, Nellis, Palatine, Peacham, Raynham, Scantic, Scarboro, Stockbridge, Vergennes, and Whately series formed from slightly acidic to calcareous parent material. In all of these soils, the reaction of the surface layer is relatively high and acidity decreases with depth.

In Chittenden County, only the soils of the Champlain Valley and near the Browns River, Alder and Indian Brooks, and Jericho Center contain appreciable amounts of clay. The parent material of other soils contains only small amounts of clay, and soil formation apparently has produced only small amounts. In soils of the Vergennes, Covington, Livingston, and Munson series, the dominant clay minerals are interstratified mica-vermiculite and mica. In these soils, the clay content was inherited from the parent material.

Only Vergennes and Covington soils show evidence of appreciable clay accumulation in the subsoil. Soils at higher elevations show evidence of silt transferring to layers just below the subsoil. In the Marlow, Peru, and Cabot soils, these layers, called a fragipan, are dense and have a characteristic of brittleness as if they are slightly cemented. A fragipan restricts downward movement of water in these soils with a subsequent accumulation of transported materials.

Chemical changes have been an important part of horizon differentiation in many of the Chittenden County soils. Many of the chemical changes are not apparent, and a detailed study of the genesis of these soils has not been made. There are, however, some obvious features that are a result of chemical changes. Soils, such as the Nellis, owe the brown color of their subsoil to iron liberated from primary minerals. The iron coats the soil particles by precipitation, and subsequent oxidation of the iron gives the soil its characteristic color. Other soils, such as the Marlow, have a light-colored subsurface layer that has resulted from the solution of sesquioxides, and from the removal to lower horizons of these materials to form soluble metal-organic complexes. These complexes are precipitated as iron oxides in the subsoil and impart the reddish or brownish color to these horizons.

The horizons of many soils in Chittenden County have a characteristic morphology as the result of being saturated with water for extended periods. Mottling results when iron is reduced and segregated, as in the lower horizons of soils in the Belgrade, Deerfield, Duane, Eldridge, Georgia, Peru, and Vergennes series. Gleying results when a horizon is subjected to intense reduction during soil development. Horizons were intensively reduced during soil formation of the Covington, Enosburg, Massena, Munson, Peacham, Raynham, Scantic, Scarboro, Whately, and Livingston soils.

The principal agents of mechanical breakdown or rock fragments in Chittenden County have been freezing and thawing. The glacial till in which many of the soils formed contains many coarse fragments. Soils formed in this material contain appreciably more silt and very fine sand in the solum than the substratum or parent

material. The source of the finer material has not been established.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes then are grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The first system was adopted in 1938 (3) and revised later (8). The system currently used by the National Cooperative Soil Survey was adopted in 1965 (9). It is under continual study. Readers interested in the development of the system should refer to current literature (5).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 9 shows the classification of each soil series of Chittenden County by family, subgroup, and order, according to the current system. It also shows one category—the great soil group—of the 1938 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, Histosols, and, to some extent, Inceptisols, which occur in many different climates. The five soil orders in Chittenden County are Alfisols, Entisols, Histosols, Inceptisols, and Spodosols.

Alfisols are mineral soils that have a clay-enriched layer called an argillic horizon that is high in base saturation. In Chittenden County, the base status, that is the pH, of this argillic horizon is not so high as the original calcareous parent material. Alfisols in Chittenden County include soils formerly called Gray-Brown Podzolic soils and Low-Humic Gley soils.

Entisols are recent soils. They do not have genetic horizons or they have only the beginnings of such horizons. In Chittenden County, this order includes soils formerly called Humic Gley soils and Low-Humic Gley soils.

Histosols formed in organic deposits under water. They are composed of muck or peat. The classification of Histosols below the category of order was not in use during the time the soils were being mapped in

Chittenden County. In this county, the Histosols were formerly classified as Bog Soils.

include soils formerly called Brown Podzolic soils, Ground-Water Podzols, and Podzols.

Inceptisols most commonly are on young but not recent land surfaces. The horizons of these mineral soils do not have differences that result from intensive weathering or significant illuviation or eluviation; hence, their name is derived from the Latin *inceptum*, for beginning. In Chittenden County, this order includes soils that were formerly called Alluvial, Brown Forest, Half Bog, Humic Gley, and Low-Humic Gley soils and Sols Bruns Acides.

Suborder.—Orders are divided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. Suborders narrow the broad climatic range permitted in the orders. The soil properties used to differentiate suborders are mainly those that reflect either the presence or absence of waterlogging or the soil differences resulting from the climate or vegetation. Suborders are not shown in table 9.

Spodosols, from the Greek *spodos*, meaning wood ash, are mineral soils that contain organic colloids and iron and aluminum, which have accumulated in some parts of the B horizon. In Chittenden County, the Spodosols

Great groups.—Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay,

TABLE 9.—Soil series classified according to the current system of classification and the 1938 system

Series	Current classification system			Great soil groups of the 1938 classification system
	Family	Subgroup	Order	
Adams.....	Sandy, mixed, frigid.....	Typic Haplorthods.....	Spodosols.....	Podzols.
Agawam.....	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic.	Entic Haplorthods.....	Spodosols.....	Brown Podzolic soils.
Au Gres.....	Sandy, mixed, frigid.....	Entic Haplaquods.....	Spodosols.....	Ground-water Podzols.
Belgrade ¹	Coarse-silty, mixed, mesic.	Aquentic Haplorthods.....	Spodosols.....	Brown Podzolic soils.
Cabot.....	Coarse-loamy, mixed, frigid.	Typic Fragiaquepts.....	Inceptisols.....	Low-Humic Gley soils.
Colton ¹	Sandy-skeletal, mixed, frigid.	Typic Haplorthods.....	Spodosols.....	Podzols.
Covington.....	Very fine, illitic, mesic.....	Mollie Ochraqualfs.....	Alfisols.....	Low-Humic Gley soils.
Deerfield ¹	Sandy, mixed, mesic.....	Aquentic Haplorthods.....	Spodosols.....	Brown Podzolic soils.
Duane ²	Sandy-skeletal, mixed, frigid.	Aquic Haplorthods.....	Spodosols.....	Podzols.
Eldridge.....	Sandy over loamy, mixed, mesic.	Aquentic Haplorthods.....	Spodosols.....	Brown Podzolic soils.
Enosburg.....	Sandy over loamy, mixed, mesic.	Mollie Haplaquents.....	Entisols.....	Low-Humic Gley soils.
Farmington.....	Loamy, mixed, mesic.....	Lithic Eutrochrepts.....	Inceptisols.....	Sols Bruns Acides intergrading to Brown Forest soils.
Georgia.....	Coarse-loamy, mixed, mesic.	Aquic Dystric Eutrochrepts.	Inceptisols.....	Brown Forest soils intergrading toward Sols Bruns Acides.
Groton.....	Sandy-skeletal, mixed, mesic.	Typic Eutrochrepts.....	Inceptisols.....	Brown Forest soils.
Hadley.....	Coarse-silty, mixed, mesic.	Fluventic Dystrochrepts.....	Inceptisols.....	Alluvial soils.
Hartland.....	Coarse-silty, mixed, mesic.	Entic Haplorthods.....	Spodosols.....	Brown Podzolic soils.
Hinesburg.....	Sandy over loamy, mixed, mesic.	Entic Haplorthods.....	Spodosols.....	Brown Podzolic soils.
Limerick.....	Coarse-silty, mixed, nonacid, mesic.	Fluventic Haplaquepts.....	Inceptisols.....	Alluvial soils.
Livingston.....	Very fine, illitic, nonacid, mesic.	Mollie Haplaquepts.....	Inceptisols.....	Half Bog soils.
Lyman.....	Loamy, mixed, frigid.....	Lithic Haplorthods.....	Spodosols.....	Podzols.
Marlow ¹	Coarse-loamy, mixed, frigid.	Typic Fragiorthods.....	Spodosols.....	Podzols.
Massena.....	Coarse-loamy, mixed, nonacid, mesic.	Aeric Haplaquepts.....	Inceptisols.....	Low-Humic Gley soils.
Muck.....			Histosols.....	Bog soils.
Munson.....	Coarse-silty over clayey, mixed, nonacid, mesic.	Aeric Haplaquepts.....	Inceptisols.....	Sols Bruns Acides.
Nellis.....	Coarse-loamy, mixed, mesic.	Typic Eutrochrepts.....	Inceptisols.....	Brown Forest soils.
Palatine.....	Loamy-skeletal, mixed, mesic.	Typic Eutrochrepts.....	Inceptisols.....	Brown Forest soils.

See footnotes at end of table.

TABLE 9.—*Soil series classified according to the current system of classification and the 1938 system—Continued*

Series	Current classification system			Great soil groups of the 1938 classification system
	Family	Subgroup	Order	
Peacham.....	Coarse-loamy, mixed, frigid.	Humic Fragiaquepts.....	Inceptisols.....	Half Bog soils.
Peat.....			Histosols.....	Bog soils.
Peru.....	Coarse-loamy, mixed, frigid.	Aquic Fragiorthods.....	Spodosols.....	Podzols.
Raynham.....	Coarse-silty, mixed, nonacid, mesic.	Aeric Haplaquepts.....	Inceptisols.....	Sols Bruns Acides.
Scantic ¹	Fine, illitic, nonacid, mesic.	Typic Haplaquepts.....	Inceptisols.....	Low-Humic Gley soils.
Scarboro ¹	Mixed, mesic.....	Mollic Psammaquepts.....	Entisols.....	Humic Gley soils.
Stetson.....	Loamy-skeletal, mixed, frigid.	Typic Haplorthods.....	Spodosols.....	Podzols.
Stockbridge.....	Coarse-loamy, mixed, mesic.	Dystric Eutrochrepts.....	Inceptisols.....	Brown Podzolic soils.
Vergennes.....	Very fine, illitic, mesic.....	Glossaquic Hapludalfs.....	Alfisols.....	Gray-Brown Podzolic soils.
Whately.....	Coarse-loamy over clayey, mixed, nonacid, mesic.	Mollic Haplaquepts.....	Inceptisols.....	Humic Gley soils.
Windsor.....	Sandy, mixed, mesic.....	Entic Haplorthods.....	Spodosols.....	Brown Podzolic soils.
Winooski.....	Coarse-silty, mixed, mesic.	Aquic Fluventic Dystrochrepts.	Inceptisols.....	Alluvial soils.

¹ These soils are taxadjuncts. They are less acidic than the defined range for the series, but this difference does not affect their use and management.

² These soils are taxadjuncts. They are less acidic and the solum is thinner than the defined range for the series, but this difference does not affect their use and management.

iron, or humus has accumulated or those that have pans that interfere with growth of roots or movement of water. The features used are the self-mulching properties of clay, soil temperature, and major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium). The great groups in the current system are not shown in table 9. The name of each great group is the last word in the name of the subgroup.

Subgroups.—Great groups are divided into subgroups. One of the subgroups in each great group represents the central (typic) segment of the group, and the others, called intergrades, have the properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Aeric Fragiaquepts (Fragiaquepts which do not have the colors indicating typical wetness within depth of 30 inches from the soil surface).

Families.—Subgroups are divided into families on the basis of properties important to the growth of plants or to behavior of soils used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. An example of a family is the coarse-loamy, mixed, mesic family of the Typic Fragiaquepts.

Series.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics, and in arrangement in the profile. They are given the name of a geographic location near the place where that series was first observed and mapped. An example is the Hinesburg series.

General Nature of the County

Discussed in this section are the climate; physiography, geology and drainage; settlement and population; farming; industry, recreation, transportation, and markets in Chittenden County.

Climate ^a

Ample rainfall, moderately warm summers, and fairly cold winters are characteristic of Chittenden County. The climate is predominantly continental. A moderating influence is Lake Champlain. Because of the north-south orientation of the Champlain Valley, prevailing winds are in these directions. They tend to blow from the south in summer, but in winter north winds and south winds are about equal in frequency. Topography is only a minor influence on climate in the western part of the county, where elevations are mostly less than 500 feet above sea level. It is more important in the east, especially along the eastern edge of the county where many peaks of the Green Mountains rise to elevations of 2000 to more than 4000 feet. The influence of Lake Champlain is readily shown by the presence of the shore fruit belt. Inland highlands are more restricted to hay, pasture, and forests. Small-scale topographical features and even kinds of soil also affect climate near the ground. For example, low spots into which cold air drains during calm clear nights are frost prone. A soil having a high organic-matter content, such as Muck and peat, is a poor conductor of stored

^a By ROBERT E. LAUTZENHEISER, climatologist for Vermont, National Weather Service, U.S. Department of Commerce, Boston, Mass.

heat. The surface layer of Muck and peat therefore may cool much more during a calm clear night than that of a sandy soil in a comparable location.

A weather service observation station is located at Bur-

lington Airport, where climatological data (tables 10, 12, 13, 14, 15, and 16) are recorded that are representative of much of the western part of the county. Also, at the Huntington Center, climatological data (table 11) are re-

TABLE 10.—Temperature and precipitation, Burlington, Vermont

[Elevation, 332 feet; data for the period 1944 to 1967]

Month	Temperature					Precipitation						
	Average daily—			Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Average monthly snowfall	Days with—		
	Maximum	Minimum	Mean	Maximum temperature equal to or lower than—	Minimum temperature equal to or lower than—		Less than—	More than—		Snowfall 1 inch or more	Snow cover 1 inch or more	Precipitation 0.10 inch or more
^{°F.}	^{°F.}	^{°F.}	^{°F.}	^{°F.}	^{°F.}	Inches	Inches	Inches	Inches			
January	25.4	6.9	16.2	43	-11	1.95	0.8	3.4	17.8	5	26	6
February	27.1	7.6	17.4	42	-13	1.79	0.9	3.0	17.7	5	23	5
March	36.3	17.0	26.7	58	0	2.11	1.1	3.2	11.3	3	17	6
April	52.4	30.0	41.2	70	21	2.63	1.4	3.8	2.1	1	1	7
May	66.4	41.2	53.8	82	30	2.99	1.5	4.8	0.2	(¹)	(¹)	8
June	77.1	51.2	64.2	89	42	3.49	1.6	5.4	0	0	0	8
July	81.9	56.0	69.0	92	45	3.85	2.0	6.0	0	0	0	7
August	79.6	53.8	66.7	92	46	3.37	1.8	5.8	0	0	0	7
September	70.6	46.1	58.4	88	35	3.31	1.5	4.9	(²)	0	0	7
October	58.6	36.6	47.6	75	27	2.97	1.4	4.6	0.1	(¹)	(¹)	7
November	43.4	27.1	35.3	60	17	2.62	1.3	4.4	5.6	2	4	7
December	30.2	12.8	21.5	50	-9	2.13	0.8	3.9	15.8	4	19	5
Year	54.1	32.2	43.2	³ 94	⁴ -20	33.21	28.2	39.3	70.6	20	90	80

¹ Less than 0.5 inch a day.

² Trace.

³ Average annual highest maximum.

⁴ Average annual lowest minimum.

TABLE 11.—Precipitation, Huntington Center, Vermont

[Elevation, 700 feet]

Month	Precipitation						
	Average monthly total	One year in 10 will have—		Average monthly snowfall	Days with—		
		Less than—	More than—		Snowfall 1 inch or more	Snow cover 1 inch or more	Precipitation 0.10 inch or more
	Inches	Inches	Inches	Inches			
January	2.05	0.6	4.2	17.4	7	29	5
February	1.50	0.8	2.6	18.6	6	27	5
March	1.79	0.6	3.2	15.7	5	22	5
April	2.68	1.3	4.5	4.5	2	5	8
May	3.24	1.4	5.2	0.7	(¹)	(¹)	8
June	3.70	1.8	4.9	0	0	0	8
July	4.14	1.8	6.8	0	0	0	9
August	3.50	1.4	6.0	0	0	0	8
September	3.35	1.5	4.7	0	0	0	7
October	3.20	1.2	5.4	0.2	(¹)	(¹)	8
November	3.20	1.3	5.5	8.1	3	5	8
December	2.20	0.7	4.5	17.1	7	21	7
Year	34.55	28.4	39.2	82.3	30	109	86

¹ Less than 0.5 day.

TABLE 12.—Frequencies of selected temperature levels and averages of heating and growing degree-days, Burlington, Vermont

Month	Mean number of days with—				Accumulated heat units		
	Maximum temperatures of—		Minimum temperatures of—		Heating	Growing	
	90° F. or higher	32° F. or lower	32° F. or lower	0° F. or lower	Base 65° F.	Base 40° F.	Base 50° F.
	Days	Days	Days	Days	Degree-days	Degree-days	Degree-days
January	0	20	30	9	1513	0	0
February	0	17	27	8	1333	0	0
March	0	8	27	2	1187	0	0
April	0		15	0	714	130	25
May		0	3	0	353	435	165
June	2	0	0	0	90	730	430
July	3	0	0	0	28	905	595
August	3	0	0	0	65	835	525
September	1	0	1	0	207	560	265
October	0	0	8	0	539	270	75
November	0	3	18	0	891	60	0
December	0	17	29	5	1349	0	0
Year	9	66	159	24	8269	3925	2080

TABLE 13.—Probabilities of freezing temperatures in spring and fall, Burlington, Vermont

Probability	Dates for given probability and temperature				
	32° F. or lower	28° F. or lower	24° F. or lower	20° F. or lower	16° F. or lower
Spring:					
1 year in 10 later than	May 23	May 13	April 29	April 14	April 8
2 years in 10 later than	May 19	May 8	April 24	April 9	April 3
5 years in 10 later than	May 11	April 28	April 13	March 29	March 24
8 years in 10 later than	May 3	April 18	April 2	March 18	March 14
Fall:					
1 year in 10 earlier than	September 19	October 1	October 18	November 1	November 10
2 years in 10 earlier than	September 23	October 5	October 22	November 6	November 15
5 years in 10 earlier than	September 30	October 13	October 31	November 16	November 25
8 years in 10 earlier than	October 7	October 21	November 9	November 26	December 5

TABLE 14.—Average frequency of possible drying or drought periods ¹

Run length (days)	Number of possible runs of specified length												
	January	February	March	April	May	June	July	August	September	October	November	December	Annual
2	12.4	10.0	11.5	11.0	10.0	10.1	10.2	10.8	10.0	12.0	10.4	12.1	130.5
3	7.6	6.3	7.3	6.7	6.0	6.1	6.3	6.5	6.1	7.5	6.4	7.4	80.2
4	5.4	4.3	4.9	4.4	3.9	4.0	4.1	4.3	4.0	5.0	4.2	5.1	53.6
5	4.1	3.2	3.5	3.1	2.7	2.8	2.9	3.0	2.9	3.7	3.1	3.8	38.8
6-7	3.2	2.4	2.7	2.6	2.1	2.1	2.2	2.2	2.1	2.8	2.4	2.9	29.7
8-10	1.9	1.4	1.8	1.4	1.2	1.1	1.1	1.3	1.2	1.5	1.3	1.6	16.8
11-15	1.1	0.9	0.9	0.9	0.6	0.3	0.5	0.6	0.6	0.8	0.7	0.9	8.8
16-20	0.6	0.3	0.4	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.1	0.4	3.1
21-25	0.3	0.2	0.2	0.1		0.03	0.07		0.1	0.1	0.1	0.2	1.4
26-30	0.1	0.1	0.1	0.03		0.03			0.03	0.03	0.1	0.2	0.6
31-35	0.03	0.03	0.03	0.03						0.03	0.03	0.1	0.3
36-40	0.03		0.03										0.07
41-45	0.03		0.03										0.07
45+	0.03		0.03										0.07

¹ From data for 29 years, 1937-1966.

TABLE 15.—Average frequency of drying or drought periods¹

Run length (days)	Number of discrete runs of specified length												
	January	February	March	April	May	June	July	August	September	October	November	December	Annual
2	0.3	0.3	0.3	0.7	0.8	0.5	0.7	0.7	0.6	0.4	0.4	0.4	6.1
3	0.4	0.4	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.4	0.5	0.3	6.0
4	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.3	0.3	4.3
5	0.4	0.4	0.2	0.3	0.2	0.4	0.4	0.4	0.5	0.3	0.3	0.2	4.0
6-7	0.5	0.4	0.4	0.4	0.3	0.7	0.6	0.5	0.4	0.7	0.5	0.5	5.9
8-10	0.3	0.2	0.5	0.3	0.5	0.6	0.6	0.5	0.5	0.4	0.5	0.5	5.4
11-15	0.3	0.5	0.4	0.6	0.5	0.2	0.3	0.4	0.4	0.5	0.5	0.4	5.0
16-20	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0	0.2	1.4
21-25	0.1	0.1	0.2	0.1	0	0	0.1	0	0.03	0.1	0.1	0.1	0.8
26-30	0.1	0.1	0	0	0	0.03	0	0	0.03	0.03	0.03	0.1	0.2
26-40	0	0	0	0	0	0	0	0	0	0	0	0	0
41-45	0	0	0	0	0	0	0	0	0	0	0	0	0
46+	0.03	0	0.03	0	0	0	0	0	0	0	0	0	0.07

¹ From data for 29 years, 1937-1966.

corded that are representative of a valley in the rougher foothills area of the eastern part of the county. For every 1000 feet of increase in elevation, climate in the eastern highlands averages 3° F. to 4° cooler than in the western part of the county. To obtain estimates of climatological data for other locations in the county, allowances should be made for location, elevation, and local topographic features.

Temperature.—The warmest month, July, averages about 70° F. except for an average temperature nearer 60° in the highest elevations of the county. The number of days when the temperature is 90° or higher averages 10 or less throughout the county in most summers, but may vary from none to as many as 20 to 30. Nights are almost always cool, even in the warmest summers. Table 10 contains extreme temperatures expected to occur with the stated probability. These temperatures, which should occur at least four times a month in at least 2 years in 10, generally are near the average monthly extreme. They may be used as a rough estimate of the extremes to be expected each month for any year.

Table 12 shows the average frequency of specified temperatures by month. Also shown are heating degree-days and growing degree-days. Degree-days are computed by recording each day the average temperature varies from a selected temperature base and then summarizing these variations for the month, the season, or the year. The temperature selected as a base and the variations to be recorded depend upon the purpose. A base of 65° is used for heating degree-days, as this is the lowest daily average temperature for which no heating is required for homes. To get the variation for one day, the actual average temperature, if less than 65°, is subtracted from 65°. For example, a day averaging 55° has 10 heating degree-days. In contrast, a day averaging 65° or higher has no heating degree-days, because no heating is required. Heating degree-days are useful in calculating the amount of fuel needed in an average year and in comparing a particular season with the average. They are used by gas, electric, and fuel companies in estimating fuel and power requirements and in scheduling fuel delivery.

Knowledge of growing degree-days is useful in planning when to plant and harvest crops. Growing degree-days accumulate when the average temperature is higher than the lowest temperature at which plants continue to grow. They are calculated by subtracting this base temperature from the actual average for the day. Data in table 12 are calculated for two standard bases: 40°, for cool-weather crops, such as grasses, potatoes, and peas; and 50° for warm-weather crops, such as tomatoes and corn. Thus, a day that has an average temperature of 60° has 20 growing degree-days for cool-weather crops but only 10 for warm-weather crops.

A substantial number of growing degree-days in a given month does not necessarily indicate that it is safe to plant sensitive crops. A damaging freeze is possible.

Table 13 shows the probability of freezing temperatures after specified dates in spring and before specified dates in fall. For example, at Burlington, there is 1 chance in 10 that the temperature will drop to 32° or lower after May 23. The 50-50 chance date is May 11. A 32° freeze is usually seriously damaging to very sensitive plants, but hardier crops can withstand even lower temperatures. The average date of the last freeze in spring varies from early in May along the Lake Champlain shore to the middle of May over much of the county and to the end of May at some of the highest elevations. The average date of the first freeze in fall varies from the middle of September in the extreme eastern highlands to after October 1 along Lake Champlain. The average length of the freeze-free season varies from about 150 days along the shore to only 110 days in the extreme eastern part of the county. The average season may be even shorter in some local "frost pockets," which are generally low boggy areas in the highlands. In an occasional year frost may threaten these areas even in midsummer. On the other hand, some urban and well-protected areas may have frost-free seasons of more than 150 days.

Precipitation.—In the western half of the county, annual rainfall generally is about 32 to 35 inches except at the higher elevations, where it ranges from 40 to 50

TABLE 16.—Weather record

Month	Record maximum precipitation in—				Snowfall record maximum in—		Relative humidity				Wind	
	24 hours	6 hours	3 hours	1 hour	1 month	24 hours	1 a.m., e.s.t.	7 a.m., e.s.t.	1 p.m., e.s.t.	7 p.m., e.s.t.	Average speed	Prevailing direction
	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Miles per hour</i>	
January.....	1.56	0.83	0.76	0.38	41.3	14.5	77	79	67	75	9.9	S.
February.....	1.60	0.76	0.45	0.14	34.3	16.5	77	77	65	72	9.6	S.
March.....	1.62	1.16	0.78	0.42	28.0	12.6	77	76	60	69	9.4	N.
April.....	1.43	1.18	1.06	0.43	7.0	6.1	77	74	54	64	9.5	S.
May.....	2.26	2.26	2.26	2.16	3.9	3.5	80	72	53	62	9.1	S.
June.....	4.45	2.78	1.83	1.60	0	0	84	76	55	66	8.3	S.
July.....	2.48	2.32	1.73	1.49	0	0	84	77	54	66	7.9	S.
August.....	3.59	2.41	2.18	1.03	0	0	85	81	56	70	7.6	S.
September.....	2.77	1.66	1.32	0.99	(³)	(³)	85	83	59	75	8.3	S.
October.....	2.77	2.08	2.07	1.96	0.8	0.8	82	83	59	74	8.8	S.
November.....	4.49	1.83	1.15	0.71	14.4	10.1	79	81	68	76	9.8	S.
December.....	2.60	1.26	0.82	0.40	36.2	14.9	79	79	68	76	10.0	S.
Year.....	4.49	2.78	2.26	2.16	41.3	16.5	81	78	60	70	9.0	S.

¹ In Langleys, or gram-calories per square centimeter.

² Less than 0.5 day.

³ Trace.

inches or more on the highest ridges. There are no dry or rainy seasons, but precipitation during the summer usually is 75 to 100 percent greater than during the winter. The ample precipitation during the summer is a favorable factor for crop growth. There are, however, usually short but fairly common dry spells in summer. During these dry spells there always is an adequate supply of irrigation water because the seasonal total precipitation is ample as compared with the rest of the nation.

Snowfall varies considerably from one winter to another. It may also vary greatly from place to place in the same season. The average seasonal snowfall is between 60 and 80 inches in most of the county but is as much as 100 inches at some of the highest elevations. A continuous snow cover, 1 inch deep or more, occurs for at least a month practically every winter. In some winters the snow cover may not last this long at the lower elevations. At Burlington the average duration is 61 days, starting on December 28 and ending by February 26; the extremes range from 16 to 134 days.

At Burlington the average seasonal maximum depth of snow is 15 inches. The date of the maximum depth of snow usually is February 8. In most of the eastern part of the county, the average depth is around 2 feet maximum per season. At the highest elevations, however, it is considerably deeper, and the maximum depth is reached later in the season.

In most of Chittenden County, the minimum depth of snow is about 6 to 12 inches, whereas the maximum depth is from 2 to 4 feet.

For Burlington, the seasonal occurrence of snowfall in 1 day is as follows:

Amount in inches	Frequency in days per season	
	Average	Extremes
1 or more.....	20	11 to 31
2 or more.....	11	5 to 20
4 or more.....	4	0 to 8
8 or more.....	1	0 to 3
10 or more.....	0.4	0 to 2

Tables 10 and 11 contain additional snowfall data.

Dry or drought periods.—The average frequency of drought and dry periods is important for farm planning. Frequencies were calculated from the Burlington daily records.

Table 14 gives the average monthly and annual number of droughty runs of specified length. An explanation of the term "run" may be required. Any day that had less than 0.15 inch precipitation was counted as dry, with one exception. If any day had 0.05 inches or more, and the next day had enough precipitation to make a total of 0.20 inch or more for 2 days, both days were counted as wet days. All runs of 2 consecutive days or more were tabulated. If a run ended in another month, it was assigned to the month in which the larger part of the period occurred.

A long run also may be considered to contain several shorter runs. For example, a 12-day run contains, in effect, three four-day runs or four three-day runs. A knowledge of the short runs may be especially useful in planning hay harvesting or other operations that require relatively short drying periods. For this reason, the average number of all possible runs of various lengths were also computed and are listed in Table 15. Because these do not appear to vary much from one

for Burlington, Vermont

Wind— Continued	Sunshine			Daytime sky				Number of days that have—		
Fastest mile	Percent of possible	Average number of hours daily	Average daily solar radiation on horizontal surface ¹	Cloud cover	Clear	Partly cloudy	Cloudy	Precipi- tation of 0.01 inch or more	Thunder- storms	Heavy fog
<i>Miles per hour</i>				<i>Percent</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>			
57	39	3.6	135	75	5	6	20	14	0	1
50	46	4.8	230	72	5	6	17	12	0	1
56	52	6.2	323	70	6	7	18	13	(?)	1
52	48	6.5	399	72	5	7	18	12	1	1
40	55	8.1	474	69	5	10	16	13	3	1
42	60	9.3	541	66	5	11	14	11	5	1
42	63	9.6	485	63	5	14	12	12	6	1
54	61	8.5	407	62	7	11	13	12	6	1
45	55	6.9	361	63	7	10	13	11	2	3
70	49	5.4	237	66	7	9	15	11	1	2
72	30	2.9	105	81	3	5	22	14	(?)	1
47	33	2.9	109	79	3	7	21	14	(?)	1
72	51	6.2	317	70	63	103	199	148	25	15

place to another, they may be used as estimates for any part of the county.

Table 16 contains additional data available for Burlington. They are based upon 22 years of record or more, except for data on solar radiation, which are averages for a period of only 3 years.

Storms.—Thunderstorms occur on an average of 20 to 30 days a year, though the number varies considerably. Most of these storms do little damage; instead, they bring beneficial rain. But heavy rains that accompany the more severe storms cause soil erosion and injure plants. Spring and summer storms are accompanied by hail about once or twice a year at a given location, but the hailstones seldom are numerous enough to cause extensive crop or property damage. Some local damage may be severe. Hurricanes affect Chittenden County only about once in 20 years. Strong winds and heavy rains from coastal storms, or "northeasters," are more frequent. They usually do not cause serious damage, however, because Chittenden County is located far inland and is sheltered by the Green Mountains. Tornadoes have struck in Chittenden County but are not common, and they usually affect only a small area. Personal injuries and significant property damage are rare, yet the danger should not be minimized.

Physiography, Geology, and Drainage ⁷

The Champlain Lowland and Green Mountain physiographic subdivisions are both present in Chittenden County. The Champlain Lowland, about 12 to 15 miles

wide, is an area of low relief with isolated hills that reaches an elevation of 600 to 700 feet. The Lowland is bounded on the west by Lake Champlain and on the east by the Green Mountains. Elevations over the entire county range from about 95 feet on the Milton-Georgia Township shore to 4,393 feet on Mount Mansfield, which is the highest point in Vermont.

The major structural features of both physiographic subdivisions are oriented in a north-south direction. The most prominent feature in the eastern part of the county is the Green Mountain Anticlinorium, and in the Champlain Lowland it is the Champlain and Hinesburg Thrusts. The entire county was subjected to severe glacial erosion, but because this erosion was governed by preglacial structural features, the overall topography of the area was not greatly altered. The glacial drift deposits are thickest at the bottom of the highlands and near Lake Champlain.

The Champlain Lowland contains the most nearly horizontal and least altered rocks in Vermont. Limestones, dolomites, and shales are abundant over the entire area. In places, these sedimentary rocks have been slightly metamorphosed to quartzites, marbles, and slates. The Lowland is part of a slight downfold, or syncline, known as the Hinesburg Synclinorium. This downfold is situated between the Champlain and Hinesburg Thrusts, and its axis approximately parallels the north-south direction of the thrusts. The rocks of the Lowland area range from Lower Cambrian to Lower Ordovician in age. The youngest rocks are at the center of the syncline. East of the Champlain Thrust, there is a gradual transition from a calcareous or dolomitic

⁷ By CHARLES A. FOSTER, geologist, Soil Conservation Service.

facies in the south to a more clayey and sandy facies in the north.

The thrusts of the Champlain Lowland were formed during the Taconic Orogeny of Late Ordovician time and are part of a major fault zone that extends from Pennsylvania, up the Hudson Valley, and through Lake Champlain into Canada. In Chittenden County the Champlain Thrust has placed Lower Cambrian dolomites over Middle Ordovician shales and limestones. The Thrust is located on the edge of Lake Champlain and approximately parallels the lake throughout the length of the county.

Several of the small isolated hills (Cobble Hill and Arrowhead Mountain) in the Lowland are blocks of rock that have separated from the underlying rocks by faulting. These isolated hills may be erosional remnants of a thrust sheet or may have moved into place by gravity sliding.

In the early Paleozoic era, the area which is now the Green Mountains was part of a huge geosynclinal trough in which sedimentary rocks, such as siltstones, graywackes, and shales were accumulating. In middle or late Devonian time, the trough was uplifted and subjected to intense regional metamorphism during what is referred to as the Vermontian Orogeny. During this period of unrest, the sedimentary rocks were altered to schists, gneiss, phyllites, and other highly metamorphosed rocks. The original sedimentary deposits were thick and extensive, and the contacts of the metamorphic rocks are very gradational.

Vermont was invaded by ice in the pre-Wisconsin stages of glaciation, but evidence of these earlier advances have been destroyed by a more recent readvance in the Late Wisconsin Glaciation. The following is a sequence of events in the Champlain Basin during the ice advances of the Pleistocene epoch (6).

The first continental ice sheet advanced from the northeast, and dense till was deposited over the entire area. When the ice sheet came into contact with the Green Mountains, its direction was shifted to approximately north-south. This shift in direction increased the scouring of the Champlain Valley. A glacial lake occupied the valley as the ice retreated, and lacustrine silt and clay were deposited. But the ice sheet later readvanced and covered or removed most of this lacustrine silt. This advance was also from the northeast, but evidence indicates that the larger valleys may have provided local passageways for the ice.

During the retreat of this last great ice sheet, a huge glacial lake, known as Lake Vermont, formed in the Champlain and adjacent valleys. Wave-cut terraces on higher slopes indicate that Lake Vermont had several levels, because lower outlets formed in the natural barrier to the south. During this period of submergence, great quantities of lacustrine material accumulated in the Champlain Valley and Lowland areas. Calving must have taken place at the terminus of the ice sheet as it retreated because striated cobbles and boulders are scattered throughout the lacustrine clay and silt. Lake Vermont was drained when the ice dam left the St. Lawrence Valley. A worldwide rise in sea level submerged the Champlain Basin to form what is known as the Champlain Sea. This invasion was short lived,

and the sea began to retreat slowly as the land began its post-glacial uplift. This uplift and retreat of the sea continued until the land reached its present elevations.

The presence of residual boulders on the summits of higher peaks indicates that continental glaciers did cross the Green Mountains, and striations on bedrock show that the last ice sheets moved across the area in a southeasterly direction. Stewart (6) maintains that the almost complete absence of till at an elevation of more than 3,100 feet is not because of removal after deposition; the drift never was deposited, because the great quantity of water associated with the melting glacier transported all smaller particles to lower elevations. Some terrace and varved lake sediments, however, are found on the higher slopes of several mountains below the 3100-foot level. These sediments were probably deposited at the margins of stagnated ice that was left in the valleys during the waning of the ice sheet. Great quantities of lacustrine clays, silts, sands, and beach gravel are found in the Winooski Valley. This lacustrine material was either deposited in large glacial lakes, such as in Lake Vermont, or in smaller marginal glacial lakes.

Drainage in the central and eastern parts of Chittenden County is controlled by the Winooski River drainage system. The Winooski River flows about 30° north and divides the county into two nearly equal parts. In the Green Mountains the drainage system is superimposed from a former erosion surface, and stream courses have developed independently of the underlying bedrock structure. In the Lowland area, the Winooski River crosses gently sloping glacial lake deposits, and here its course has been determined by the original slope of the land. On its lower course, the Winooski River meanders sluggishly across its own flood plain, which in places is 3 miles wide, before it empties into Lake Champlain.

The Lamoille River and its tributaries drain the northern part of Chittenden County. The Lamoille River flows approximately east-west and empties into Lake Champlain 6 miles north of the Winooski River. Only the extreme lower part of the Lamoille River flows across the irregular rolling plains of glacial lake deposits of Chittenden County. The lower course of the river also has been determined by the original slope and irregularities of the land.

The Champlain Lowland also is drained by Malletts Creek, Indian Brook, Potash Brook, La Platte River, Lewis Creek, and numerous small streams that flow directly into Lake Champlain.

Settlement and Population ⁸

Chittenden County, with an area of 340,480 acres, lies in the northern midsection of the Champlain Valley. Burlington, a city of 38,000 ⁹ inhabitants, borders on Lake Champlain. It is Vermont's largest city and is the home of the University of Vermont and the State College of Agriculture.

⁸ By ROBERT M. TOWNE, district conservationist, Soil Conservation Service.

⁹ Estimate from Assessor's Office, Burlington, April 14, 1968.

The first inhabitants of Chittenden County were the Abnaki Tribe of the Algonquin Indians. The French, before the conquest of Canada, were the first European occupants of the county. Chittenden County was organized October 22, 1787. The population has steadily increased since 1900.

Farming

Champlain Valley was once the breadbasket of the Northeast. Competition from the more fertile lands of the Midwest, however, soon forced Chittenden County farmers to turn to beef production. Then, competition from the West caused the farmers to change from beef production to sheep raising. The Marino breed of sheep, which was developed and bred in Vermont, became known throughout the world for the fine quality of its wool and mutton.

By the 1800's the population of the cities in the East began to expand. The population growth caused an increased demand for dairy products, especially butter. At the same time, competition from the sheep industry in the West forced Vermont farmers to seek new enterprises, which resulted in emphasis on butter production. The butter production enterprise, however, lasted only through the early 1900's. The demand for fluid milk, plus good railroad transportation facilities, made it more profitable to produce and ship fluid milk to urban markets. Fluid milk production has been the chief farming enterprise from that time to the present.

The farmland in Chittenden County is used mostly for forage crops and a small acreage of corn for silage that are fed to dairy animals.

A study of recent trends in farming shows that the number of farms is decreasing while the acreage per farm is increasing in Chittenden County. The U.S. Census of Agriculture shows that the number of commercial farms 10 to 2,000 acres in size decreased from 743 in 1959 to 557 in 1964. The average size of farms increased from 252 acres to 273 acres in the same period. The total area in farms decreased from 219,945 acres in 1959 to 192,478 acres in 1964.

"Dairy Farming Trends in Vermont" (Research Report, Agricultural Economics, Misc. Pub. 49, July 1967) reports that the total number of dairy herds decreased from 869 in 1953 to 369 in 1966. The average size of herds of five cows or more increased in number from 29.6 in 1953 to 49.7 in 1966.

A few general livestock or poultry farms are in Chittenden County. Apple orchards and vegetable growing are of minor importance in this county.

Industry, Recreation, Transportation, and Markets

The decrease in the number of farms in Chittenden County has resulted in the development of new and enlarged industries. The shift of available farm labor to industrial labor and the influx of new families to make up the industrial labor force has brought about great changes in land use. Land has been diverted from farming to such uses as development for housing and

industry, improved highways, schools, recreation, and other facilities to meet the needs of the expanding population, especially in the Burlington area.

The shortage of farm labor has made it necessary to rely upon expensive labor-saving equipment. This, in turn, has made it unprofitable to operate small farms, and consequently much of the land has been absorbed to make larger dairy farms for efficiency of operation. According to the agricultural economists of the University of Vermont, College of Agriculture, farming in the future will be carried on mostly in the larger river valleys and in the Champlain Valley, where larger tracts of land are available.

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Glossary

Acidity. See Reaction, soil.

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 crumbs, blocks, or prisms, are called pedes. 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 or rivers.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

- Available water capacity** (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
- Base saturation.** The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Bisequal soil.** See sequum.
- Calcareous.** Containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
- Catena.** A sequence, or "chain," of soils on a landscape, developed from one kind of parent material but having different characteristics because of differences in relief and drainage.
- 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.
- Cobblestones.** Rounded fragments of rock, 3 to 10 inches in diameter.
- Complex, soil.** A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.
- 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; will 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.
- 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.
- Drainage, internal soil.** The downward movement of water through the soil. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Terms used are *none*, *very slow*, *slow*, *medium*, *rapid*, and *very rapid*.
- 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 clay but is rich in silt or very fine sand. The layer is seemingly cemented when dry, has a hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When 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 material transported by glacial ice and then deposited; also includes the assorted and unassorted materials deposited by streams flowing from glaciers.
- Glacial till** (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.
- Glaciofluvial deposits** (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.
- Gley soil.** A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral grey in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.
- Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil 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 it is therefore 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 by accumulation of clay, sesquioxides, humus, or some combination of these; by prismatic or blocky structure; by redder or stronger colors; or by some combination of these characteristics. The 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. This layer, commonly called the soil parent material, is presumed to be like that from which the overlying horizons were formed in most soils. If the underlying 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.
- Lacustrine deposit** (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.
- Leached layer.** A layer from which the soluble materials have been dissolved and washed away by percolating water.
- Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and low capacity for supporting loads.
- 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.
- Mottled.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.
- Munsell 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.
- Parent material.** The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.
- Ped.** An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod, which is a mass of soil brought about by digging or other disturbance.
- Permeability.** The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

pH		pH	
Extremely acid-----	below 4.5	Neutral -----	6.6 to 7.3
Very strongly acid--	4.5 to 5.0	Mildly alkaline-----	7.4 to 7.8
Strongly acid-----	5.1 to 5.5	Moderately alkaline--	7.9 to 8.4
Medium acid-----	5.6 to 6.0	Strong alkaline-----	8.5 to 9.0
Slightly acid-----	6.1 to 6.5	Very strongly alkaline -----	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rocky. Enough bedrock exposed to interfere with tillage but not to make intertilled crops impracticable.

Rocky, extremely. Enough rock outcrops to make use of all machinery impracticable.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sequum. A sequence in a soil profile consisting of an eluvial horizon and its related illuvial horizon, if present. Two sequa may be present in a single profile, and that soil could then be called a bisequal soil.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of the 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.

Stony. Containing enough stones to interfere with tillage but not to make intertilled crops impracticable.

Stony, extremely. Containing enough stones to make use of all machinery impracticable.

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).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Any layer lying beneath the solum, or true soil; the C or R horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil (engineering). Soil material containing organic matter and suitable as a surfacing for shoulders and slopes.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit	Woodland suitability group
			Symbol	Symbol
PeB	Peru stony loam, 5 to 12 percent slopes-----	58	IIIe-5	3o1
PeC	Peru stony loam, 12 to 20 percent slopes-----	59	IVe-5	3r1
PeD	Peru stony loam, 20 to 30 percent slopes-----	59	VIe-2	3r1
PsC	Peru extremely stony loam, 0 to 20 percent slopes-----	59	VIIIs-2	3x1
PsE	Peru extremely stony loam, 20 to 60 percent slopes-----	60	VIIIs-2	3x3
Qd	Quarries-----	60	VIIIs-2	---
Rk	Rock land-----	62	VIIIs-2	---
ScA	Scantic silt loam, 0 to 2 percent slopes-----	63	IVw-3	5w1
ScB	Scantic silt loam, 2 to 6 percent slopes-----	63	IVw-3	5w1
Sd	Scarboro loam-----	64	Vw-1	5w3
StA	Stetson gravelly fine sandy loam, 0 to 5 percent slopes-----	65	IIIs-2	4o1
StB	Stetson gravelly fine sandy loam, 5 to 12 percent slopes-----	65	IIIe-8	4o1
StC	Stetson gravelly fine sandy loam, 12 to 20 percent slopes-----	65	IVe-6	4r1
Sub	Stockbridge and Nellis stony loams, 3 to 8 percent slopes-----	66		
	Stockbridge part-----	--	IIe-2	3o2
	Nellis part-----	--	IIe-2	2o1
SuC	Stockbridge and Nellis stony loams, 8 to 15 percent slopes-----	66		
	Stockbridge part-----	--	IIIe-2	3o2
	Nellis part-----	--	IIIe-2	2o1
SuD	Stockbridge and Nellis stony loams, 15 to 25 percent slopes-----	67		
	Stockbridge part-----	--	IVe-2	3r4
	Nellis part-----	--	IVe-2	2r1
SxC	Stockbridge and Nellis extremely stony loams, 3 to 15 percent slopes-----	67		
	Stockbridge part-----	--	VIIIs-2	3x2
	Nellis part-----	--	VIIIs-2	2x1
SxE	Stockbridge and Nellis extremely stony loams, 15 to 60 percent slopes-----	67		
	Stockbridge part-----	--	VIIIs-2	3x4
	Nellis part-----	--	VIIIs-2	2x2
TeE	Terrace escarpments, silty and clayey-----	68	-----	---
VeB	Vergennes clay, 2 to 6 percent slopes-----	69	IIe-1	4c1
VeC	Vergennes clay, 6 to 12 percent slopes-----	69	IIIe-1	4c2
VeD	Vergennes clay, 12 to 25 percent slopes-----	70	IVe-1	4c3
VeE	Vergennes clay, 25 to 60 percent slopes-----	70	VIIe-2	4c3
Wo	Winooski very fine sandy loam-----	73	IIw-1	3o1

^{1/}Unsuitable for commercial timber production.

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit	Woodland suitability group
			Symbol	Symbol
EwB	Enosburg and Whately soils, 3 to 8 percent slopes-----	30		
	Enosburg part-----	--	IIIw-3	4w1
	Whately part-----	--	IIIw-3	5w3
FaC	Farmington extremely rocky loam, 5 to 20 percent slopes-----	31	VIIIs-2	5x1
FaE	Farmington extremely rocky loam, 20 to 60 percent slopes-----	32	VIIIs-2	5x2
FsB	Farmington-Stockbridge rocky loams, 5 to 12 percent slopes-----	32	IIIe-3	4d1
FsC	Farmington-Stockbridge rocky loams, 12 to 20 percent slopes----	33	IVe-3	4d2
FsE	Farmington-Stockbridge rocky loams, 20 to 60 percent slopes----	33	VIIe-2	4d3
Fu	Fill land-----	33	-----	---
Fw	Fresh water marsh-----	34	VIIIw-1	(1/)
GeB	Georgia stony loam, 3 to 8 percent slopes-----	35	Iw-2	3o1
GeC	Georgia stony loam, 8 to 15 percent slopes-----	35	IIIe-5	3o1
GgC	Georgia extremely stony loam, 0 to 15 percent slopes-----	35	VIIIs-2	3x1
GgE	Georgia extremely stony loam, 15 to 60 percent slopes-----	35	VIIIs-2	3x3
GrA	Groton gravelly fine sandy loam, 0 to 5 percent slopes-----	36	IIIs-1	5s1
GrB	Groton gravelly fine sandy loam, 5 to 12 percent slopes-----	36	IVs-1	5s1
GrC	Groton gravelly fine sandy loam, 12 to 20 percent slopes-----	37	VIIs-1	5s2
GrD	Groton gravelly fine sandy loam, 20 to 30 percent slopes-----	37	VIIIs-2	5s2
GrE	Groton gravelly fine sandy loam, 30 to 60 percent slopes-----	37	VIIIs-2	5s3
Hf	Hadley very fine sandy loam-----	38	I-1	3o2
Hh	Hadley very fine sandy loam, frequently flooded-----	38	Iw-1	3o2
HlB	Hartland very fine sandy loam, 2 to 6 percent slopes-----	39	IIE-4	3o2
HlC	Hartland very fine sandy loam, 6 to 12 percent slopes-----	39	IIIe-4	3r2
HlD	Hartland very fine sandy loam, 12 to 25 percent slopes-----	39	IVe-2	3r5
HlE	Hartland very fine sandy loam, 25 to 60 percent slopes-----	40	VIIe-2	3r6
HnA	Hinesburg fine sandy loam, 0 to 3 percent slopes-----	41	IIs-2	4s4
HnB	Hinesburg fine sandy loam, 3 to 8 percent slopes-----	41	IIs-2	4s4
HnC	Hinesburg fine sandy loam, 8 to 15 percent slopes-----	41	IIIe-8	4s4
HnD	Hinesburg fine sandy loam, 15 to 25 percent slopes-----	41	IVe-6	4s5
HnE	Hinesburg fine sandy loam, 25 to 60 percent slopes-----	42	VIIe-2	4s5
Le	Limerick silt loam-----	43	IIIw-2	4w3
Lf	Limerick silt loam, very wet-----	43	VIIw-1	---
Lh	Livingston clay-----	44	IVw-4	(1/)
Lk	Livingston silty clay, occasionally flooded-----	44	VIIw-1	(1/)
LmB	Lyman-Marlow rocky loams, 5 to 12 percent slopes-----	45	IIIe-3	4d1
LmC	Lyman-Marlow rocky loams, 12 to 20 percent slopes-----	46	IVe-3	4d2
LyD	Lyman-Marlow very rocky loams, 5 to 30 percent slopes-----	46	VIIs-1	4x3
LyE	Lyman-Marlow very rocky loams, 30 to 60 percent slopes-----	47	VIIIs-2	4x4
MaB	Marlow stony loam, 5 to 12 percent slopes-----	48	IIIe-2	3o2
MaC	Marlow stony loam, 12 to 20 percent slopes-----	48	IVe-2	3r4
MaD	Marlow stony loam, 20 to 30 percent slopes-----	49	VIe-2	3r4
MeC	Marlow extremely stony loam, 5 to 20 percent slopes-----	49	VIIIs-2	3x2
MeE	Marlow extremely stony loam, 20 to 60 percent slopes-----	50	VIIIs-2	3x4
MnC	Massena stony silt loam, 0 to 15 percent slopes-----	51	IIIw-4	4w4
MoC	Massena extremely stony silt loam, 0 to 15 percent slopes-----	51	VIIIs-2	4x2
Mp	Muck and peat-----	51	VIIw-1	---
MuD	Munson and Belgrade silt loams, 12 to 25 percent slopes-----	52		
	Munson part-----	--	IVe-1	4w6
	Belgrade part-----	--	IVe-1	3r5
MyB	Munson and Raynham silt loams, 2 to 6 percent slopes-----	53		
	Munson part-----	--	Iw-3	4w5
	Raynham part-----	--	IIIw-1	4w5
MyC	Munson and Raynham silt loams, 6 to 12 percent slopes-----	53	IIIe-1	4w5
PaB	Palatine silt loam, 3 to 8 percent slopes-----	55	IIE-2	2o1
PaC	Palatine silt loam, 8 to 15 percent slopes-----	55	IIIe-2	2o1
PaD	Palatine silt loam, 15 to 25 percent slopes-----	55	IVe-2	2r1
PaE	Palatine silt loam, 25 to 60 percent slopes-----	55	VIIe-2	2r2
Pc	Peacham stony silt loam-----	56	Vw-1	---
PeA	Peru stony loam, 0 to 5 percent slopes-----	58	Iw-2	3o1

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and of the soil series to which it belongs. Dashed line indicates that mapping unit was too variable to rate. Other information is given in tables as follows:

Acreage and extent, table 1, p. 11.
 Estimated yields, table 2, p. 75.
 Woodland, table 3, p. 82.
 Wildlife, table 4, p. 88.

Engineering uses of soils, tables
 5, 6, and 7, pp. 102 through 115.
 Community development, table 8,
 p. 118.

Map symbol	Mapping unit	Described on page	Capability unit	Woodland suitability group
			Symbol	Symbol
AdA	Adams and Windsor loamy sands, 0 to 5 percent slopes-----	13	IIIs-1	4s1
AdB	Adams and Windsor loamy sands, 5 to 12 percent slopes-----	13	IVs-1	4s1
AdD	Adams and Windsor loamy sands, 12 to 30 percent slopes-----	13		
	Adams part-----	--	VIIs-1	4s2
	Windsor part-----	--	VIIIs-2	5s2
AdE	Adams and Windsor loamy sands, 30 to 60 percent slopes-----	13		
	Adams part-----	--	VIIIs-2	4s3
	Windsor part-----	--	VIIIs-2	5s3
AgA	Agawam fine sandy loam, 0 to 5 percent slopes-----	15	IIIs-2	4o1
AgD	Agawam fine sandy loam, 12 to 30 percent slopes-----	15	IVe-2	4r1
AgE	Agawam fine sandy loam, 30 to 60 percent slopes-----	15	VIIe-2	4r2
An	Alluvial land-----	16	-----	---
Au	Au Gres fine sandy loam-----	16	IVw-5	4w1
Be	Beaches-----	17	VIIIs-2	---
B1A	Belgrade and Eldridge soils, 0 to 3 percent slopes-----	18		
	Belgrade part-----	--	IIw-3	3o1
	Eldridge part-----	--	IIw-4	4o4
B1B	Belgrade and Eldridge soils, 3 to 8 percent slopes-----	18		
	Belgrade part-----	--	IIw-3	3o1
	Eldridge part-----	--	IIw-4	4o4
B1C	Belgrade and Eldridge soils, 8 to 15 percent slopes-----	18		
	Belgrade part-----	--	IIIe-4	3r2
	Eldridge part-----	--	IIIe-7	4o4
B1D	Belgrade and Eldridge soils, 15 to 25 percent slopes-----	19		
	Belgrade part-----	--	IVe-1	3r5
	Eldridge part-----	--	IVe-6	4r5
Bo	Blown-out land-----	19	VIIIs-2	---
Br	Borrow pits-----	19	-----	---
CaA	Cabot stony silt loam, 0 to 3 percent slopes-----	20	IIIw-4	4w2
CaC	Cabot stony silt loam, 3 to 15 percent slopes-----	21	IIIe-6	4w2
CbA	Cabot extremely stony silt loam, 0 to 3 percent slopes-----	21	VIIIs-2	4x1
CbD	Cabot extremely stony silt loam, 3 to 25 percent slopes-----	21	VIIIs-2	4x1
CoA	Colton gravelly loamy sand, 0 to 5 percent slopes-----	23	IIIs-1	4s1
CoB	Colton gravelly loamy sand, 5 to 12 percent slopes-----	23	IVs-1	4s1
CoC	Colton gravelly loamy sand, 12 to 20 percent slopes-----	24	VIIs-1	4s2
CsD	Colton and Stetson soils, 20 to 30 percent slopes-----	24		
	Colton part-----	--	VIIIs-2	4s2
	Stetson part-----	--	VIe-1	4r1
CsE	Colton and Stetson soils, 30 to 60 percent slopes-----	24		
	Colton part-----	--	VIIIs-2	4s3
	Stetson part-----	--	VIIe-2	4r2
Cv	Covington silty clay-----	25	IVw-3	5w1
DdA	Duane and Deerfield soils, 0 to 5 percent slopes-----	27		
	Duane part-----	--	IIw-4	4o3
	Deerfield part-----	--	IIIw-3	4o3
DdB	Duane and Deerfield soils, 5 to 12 percent slopes-----	27	IIIe-7	4o3
DdC	Duane and Deerfield soils, 12 to 20 percent slopes-----	28	IVe-6	4r5
EwA	Enosburg and Whately soils, 0 to 3 percent slopes-----	29		
	Enosburg part-----	--	IIIw-3	4w1
	Whately part-----	--	IIIw-3	5w3

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