United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Linn County, Missouri

How To Use This Soil Survey

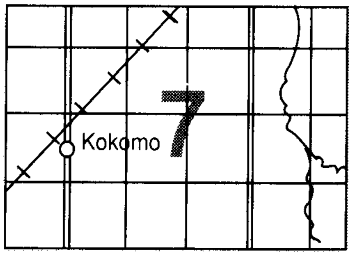
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

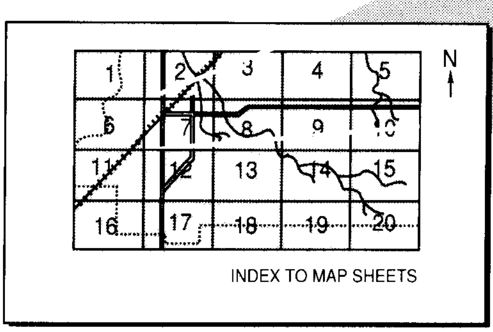
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



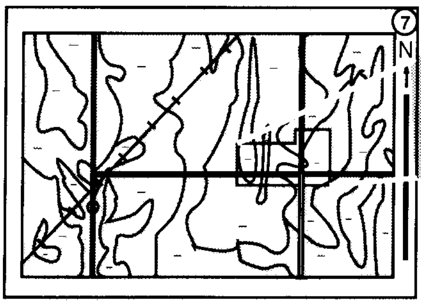
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

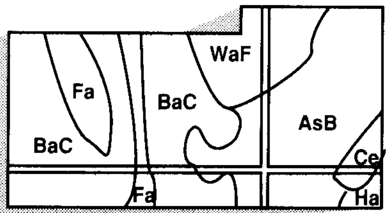


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The County Commission provided office space for the soil survey party. The survey is part of the technical assistance furnished to the Linn County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Contour stripcropping on Armstrong loam, 5 to 9 percent slopes, eroded.

Contents

Issued July 1990

Index to Map Units

* This map unit is represented by map symbol 10F on the detailed soil maps.

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Linn County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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Soil Survey of
Linn County, Missouri

By Ken E. Benham, Soil Conservation Service

Fieldwork by Ken E. Benham, Michael A. Cook, M. Lynn Duckworth, and Thomas L. Staggs, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Missouri Agricultural Experiment Station

LINN COUNTY is in the north-central part of Missouri, north of the Missouri River (fig. 1). It has an area of 397,568 acres, or 621.2 square miles. It is approximately rectangular, measuring about 27 miles from east to west and 24 miles from south to north. Linneus, the county seat, is in the west-central part of Linn County. In 1980, the population of Linneus was about 400. The largest cities in the county are Brookfield, which had a population of about 5,500 in 1980, and Marceline, which had a population of about 2,900. The population of the county was about 15,500 in 1980. The urban population was about 10,200, and the rural population was about 5,300 *(23)*.

The economy of the county is dominated by crop and livestock farming. Another important source of income, however, is a number of small- to medium-size manufacturing firms in the cities and towns. The number of people employed by the manufacturing firms ranges from a few to as many as about 600 employees, including cottage workers.

Linn County is bordered on the north by Sullivan County, on the east by Macon County, on the south by Chariton and Livingston Counties, and on the west by Livingston and Grundy Counties. Most of the uplands are gently sloping to moderately steep. The most gentle upland slopes are in the southwestern part of the county, and the steepest slopes are in the northeastern part. All of the major streams in the county flow to the south. The flood plains, especially those in the western part of the county, are unusually wide when compared with the size of the stream channels.

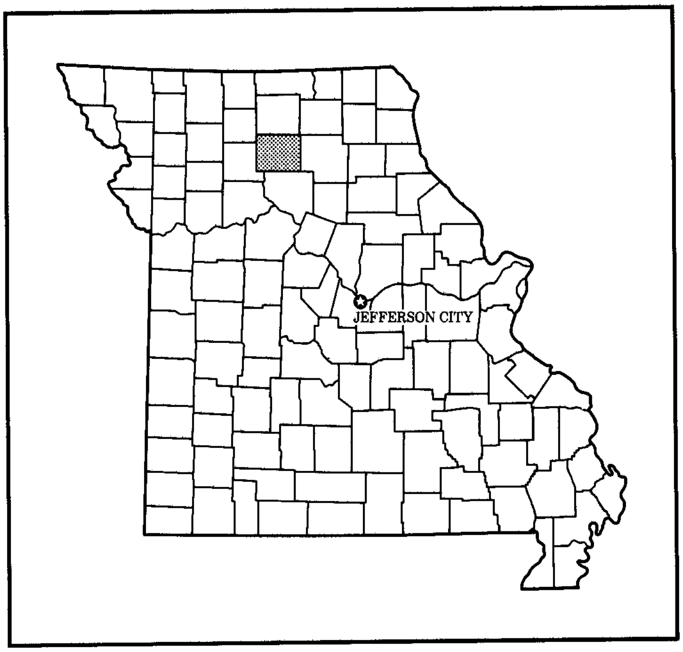

Figure 1.—Location of Linn County in Missouri.

Soil scientists determined that there are about 25 different kinds of soil in the county. The soils vary widely in texture, natural drainage, and other characteristics. The soils on the broader ridgetops in the uplands formed in loess. The soils on the upland side slopes and narrow ridgetops formed in loess over glacial till or entirely in glacial till. The soils in a few steep areas along Locust and Yellow Creeks are moderately deep to limestone and shale. Nearly all of the upland soils are well suited to cultivated crops; however, the moderately sloping and strongly sloping soils are subject to severe erosion. The soils on terraces and flood plains also are well suited to cultivated crops. The somewhat poorly drained and poorly drained soils on terraces are nearly level to moderately sloping. The moderately well drained to very poorly drained soils on bottom land are nearly level or depressional.

This soil survey updates the survey of Linn County published in 1945 *(14)*. It provides additional interpretive information and has larger maps, which show more detail than do the maps in the previous survey.

General Nature of the County

This section gives general information about the county. It describes climate, early history and development, physiography and drainage, transportation facilities, agriculture, and water supply.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

The consistent pattern of climate in Linn County is one of cold winters and long, hot summers. Heavy rains occur mainly in spring and early summer and again in the fall. The annual rainfall is normally adequate for corn and soybeans and for all grain crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Brookfield in the period 1951 to 1984. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 30 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Brookfield on January 10, 1982, is -21 degrees. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Brookfield on July 14, 1954, is 116 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total average annual precipitation is about 39 inches. Of this, 26 inches, or about 65 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 7.57 inches at Brookfield on July 15, 1958. Thunderstorms occur on about 53 days each year.

The average seasonal snowfall is about 20 inches. The greatest snow depth at any one time during the period of record was 25 inches. On the average, 15 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 12 miles per hour, in the spring.

Tornadoes and severe thunderstorms occur occasionally but are local in extent and of short duration. Hailstorms occur at times during the warmer part of the year but in an irregular pattern and only in small areas.

Early History and Development

In 1682, Sieur de la Salle claimed all of the territory west of the Mississippi River for France. The United States purchased this territory from France in 1803. At that time the area that would one day become Linn County was used for hunting by various Indian tribes, including the Sacs, Foxes, Pottawattamies, and Musquakies *(4)*. By the 1820's, the Indian population was on the decline and the Kentuckians who had settled in Howard and Chariton Counties were making hunting excursions through the survey area. The area was called the "Locust Creek Country" and was considered a hunter's paradise.

In the fall of 1831, which was 10 years after Missouri became a state, two Howard County hunters, James Pendleton and Joseph Newton, were the first to claim land and build a cabin in what would become Linn County. Several other families moved into the area in 1832. In January 1837, Linn County was split off from

Chariton County by an act of the state legislature. The county was named for United States Senator Lewis F. Linn from St. Genevieve.

Apparently, there was never any armed conflict between the Indian hunters and the white settlers. By 1840, the population of settlers in Linn County had increased to about 2,245 and the Indians had given up their hunting grounds and moved farther west.

In the 1840's, the only major east-to-west wagon road north of the Missouri River passed through Linn County. It was known as the "Bloomington Road," and it was heavily used by families migrating to California and Oregon in the late 1840's and 1850's *(18)*. By 1860, a railroad had been constructed through Linn County, connecting Hannibal on the east with St. Joseph on the west. The importance of the "Bloomington Road" was thereby diminished.

Men were recruited from Linn County for service on both the Union and Confederate sides during the Civil War. The railroad passing through the county was an important transport link for the Union forces. Union soldiers from Missouri, Iowa, and Illinois were stationed in the county for the purpose of guarding railroad bridges and train depots. No armed conflicts occurred in Linn County between Union and Confederate forces. The county's only casualties related to the Civil War were the result of occasional raids by small bands of bushwhackers.

The first important cash crop in Linn County was tobacco. Appreciable quantities of it were grown in the county from about 1845 to about 1860. It was shipped to the east coast and then exported to Europe. In the 1860's, American tobacco was replaced to a large extent in European markets by tobacco that was grown in India. After this time no significant quantities of tobacco were grown in Linn County.

Physiography and Drainage

Linn County lies in the glaciated region of northern Missouri. Glacial till is 70 to 110 feet thick in most of the areas on uplands. It does not occur, however, in a few upland areas, primarily along Locust Creek. It is more than 200 feet thick in buried major stream valleys.

The southwestern part of the county is the most gently sloping upland area. The lowest point in the county, about 660 feet above sea level, is near the southwest corner, where Locust Creek flows out of Linn County.

The eastern and northeastern parts are the most dissected areas in the county and have the steepest side slopes and the greatest elevation differences between the tops of the ridges and the valley floors. The highest point, about 1,010 feet above sea level, is along the Sullivan County line, near the northeast corner of the county.

All of the larger streams in the county flow from north to south. The eastern edge of the county is part of the Chariton River drainage basin. The rest of the county is part of the Grand River drainage basin. The present upland drainage system has developed almost entirely in the thick mantle of glacial till. The postglacial drainage pattern in the county is considerably different from the preglacial pattern *(16)*. Both the preglacial and postglacial streams, however, flowed toward the south.

Transportation Facilities

The principal east-west highway across Linn County is U.S. Route 36, which crosses the southern part of the county. The other major highways are State Routes 5, 11, 129, 130, and 139. The county also has a number of paved county roads.

Rail transportation is furnished to many towns in Linn County. One railroad crosses the county from east to west, serving the towns of Meadville, Laclede, Brookfield, and Bucklin. Another one crosses the southeastern part of the county, passing through the towns of Marceline and Bucklin. Marceline has an Amtrak passenger station.

Small airstrips are located near Brookfield and Marceline. They are used primarily by local businesses and citizens.

Agriculture

Linn County is still primarily a rural county, although a considerable population shift has occurred since horses were replaced by tractors. The population of the county in 1980 was slightly less than it was in 1870. The maximum population, about 25,500, was reached in 1900. During the last several decades, the population has continually declined, stabilizing at about the current level during the 1970's. Nearly all of the population loss has been from the rural areas. The number of farms has decreased from about 2,900 in 1900 to about 1,000 in 1980. There was a corresponding increase in farm size, from about 135 acres in 1900 to about 335 acres in 1980.

The biggest shift in cropping practices during this century involves soybean production. The acreage used for this crop increased from 9,600 acres in 1950 to 84,300 acres in 1979 *(6)*. This increase was at the expense of corn and pasture. The acreage used for corn dropped from a high of nearly 79,000 acres in 1909 to about 27,500 acres in 1979. Total corn production, however, was significantly higher in 1979 than it was in 1909.

During the past 70 years, the acreage used for wheat has fluctuated from a high of nearly 15,000 acres to a low of about 1,500 acres. Weather conditions at planting time and difficulties caused by excess soil moisture have a greater influence on the production of wheat than on that of any other crop. Wheat is the only significant fall-planted crop in the county.

The acreage used for grain sorghum has fluctuated less than that used for wheat during the last quarter of a century. In most years less than 10,000 acres in the county is planted to grain sorghum.

The acreage of hayland has ranged from about 50,000 to about 65,000 acres since 1930. No reliable data are available on the acreage of pasture in the county. This acreage has probably decreased to some extent in the last few years as the acreage used for soybeans has increased sharply.

The production of beef cattle is the largest livestock enterprise in the county. The number of beef cattle has exceeded 40,000 head each year since 1960, peaking at about 75,800 in 1975. In 1980, the number of beef cattle was about 56,300.

The number of hogs in Linn County responds more quickly to market prices than does the number of beef cattle. During the past 80 years, the number of hogs has ranged from about 40,000 to a little over 60,000.

Dairy cattle, sheep, and horses have become less significant in the economy of Linn County with each passing decade. The number of dairy cattle has gradually declined from about 11,000 head in 1930 to about 900 in 1980. The number of sheep has declined from about 34,900 head in 1940 to about 2,200 in 1978. The number of horses and ponies has declined from a high of about 14,500 head in 1910 to a low of about 360 in 1974. The current popularity of pleasure horses has resulted in a slight increase in the number of horses and ponies in the last several years.

Water Supply

Water from wells in the glacial till and the underlying consolidated bedrock is mineralized and of marginal quality for domestic use *(8)*. Yields seldom exceed 15 gallons per minute, which is sufficient for normal domestic use but inadequate for irrigation purposes or for municipal use. A few irrigation wells could be developed in some of the deeper till-filled valleys in the county.

Surface water from the streams and impoundments in the county is less mineralized and therefore of better quality for domestic use than is well water. Several permanent streams flow partially or completely through Linn County, but all have a rather low flow during summer months. These streams are not reliable as the only source of water either for irrigation or for municipal use. Impoundments are the primary sources of water for most towns and for irrigation. Most of the soils in the uplands are suitable for the construction of ponds and small lakes for livestock water and for household use if necessary. Rural water districts currently supply many rural residents with water for household use.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The description, names, and delineations of the soils identified on the general soil map of this survey area do not fully agree with those in the surveys of adjacent counties published at a different date. Differences may be the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions.

Soil Descriptions

1. Portage-Fatima-Vesser Association

Deep, nearly level, very poorly drained, poorly drained, and moderately well drained soils formed in alluvium; on flood plains

This association is on broad flood plains along Locust Creek, the lower reaches of Parsons Creek, and the lower reaches of West and East Yellow Creeks. Slopes generally are less than 2 percent.

This association makes up about 11 percent of the survey area. It is about 43 percent Portage and similar soils, 19 percent Fatima soils, 19 percent Vesser and similar soils, and 19 percent minor soils (fig. 2).

Portage soils are very poorly drained and are in low slack-water areas. Typically, the surface layer is very dark gray silty clay. The subsurface layer and the subsoil are very dark gray clay. The substratum is dark gray clay.

Fatima soils are moderately well drained and are adjacent to stream channels or to former stream channels where the channels have been straightened. Typically, the surface layer is very dark grayish brown silt loam. The subsoil is silt loam. It is dark grayish brown in the upper part and brown in the lower part. The substratum is brown loam.

Vesser soils are poorly drained and are on the higher, moderately wide flood plains adjacent to the uplands. Typically, the surface layer is black and silt loam. The subsurface layer is very dark gray, gray, and dark gray silt loam. The subsoil is very dark gray, mottled silty clay loam.

Minor in this association are Blackoar, Gifford, and Chariton soils. Blackoar soils have much less clay than the Portage soils. They are near the existing or former stream channels. Gifford soils have more clay in the subsoil than the Vesser soils. They are gently sloping and moderately sloping and are on stream terraces. Chariton soils have more clay in the subsoil than the Vesser soils. They are on the higher terraces.

About 85 percent of this association is used for cultivated crops. Corn and soybeans are the main crops, but wheat and grain sorghum are also grown. Some areas are used for pasture or hayland. Several areas support native timber, primarily hardwoods.

This association is suited to cultivated crops. The primary management needs are a drainage system and flood control. Most of the cleared areas are somewhat protected against flooding by small levees, but large floods are quite damaging to crops. The association is suited to water-tolerant grasses and legumes for pasture and hay and to climatically adapted trees. Logging activities are restricted, however, by the flooding and the wetness.

This association generally is unsuitable for building

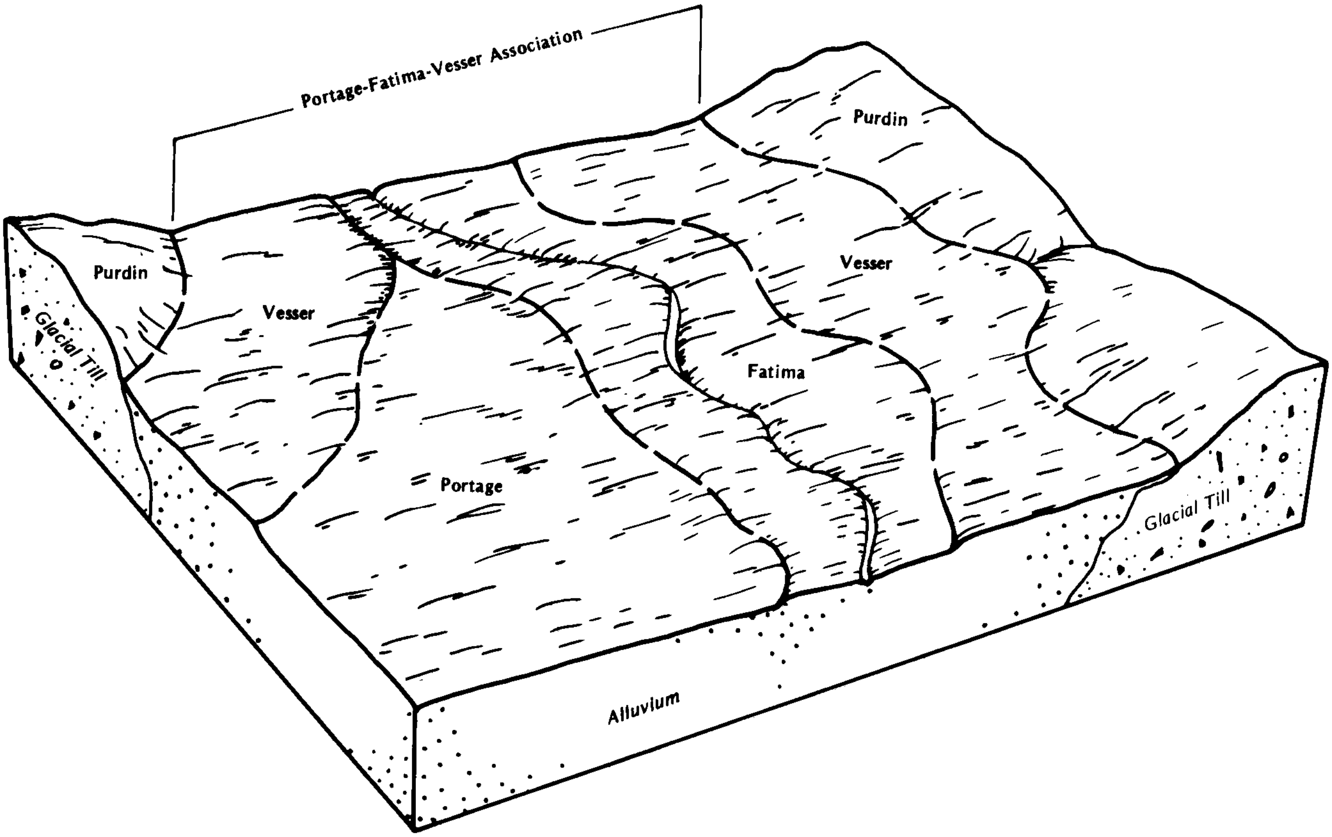

Figure 2.—Typical pattern of soils and parent material in the Portage-Fatima-Vesser association.

site development because of the flooding, the wetness, and a high shrink-swell potential.

2. Vesser-Blackoar-Fatima Association

Deep, nearly level, poorly drained and moderately well drained soils formed in alluvium; on flood plains

This association is on narrow and moderately wide flood plains along the upper reaches of Parsons and Yellow Creeks and along the smaller tributary streams. Slopes generally are less than 2 percent.

This association makes up about 7 percent of the survey area. It is about 32 percent Vesser and similar soils, 26 percent Blackoar and similar soils, 14 percent Fatima soils, and 28 percent minor soils.

Vesser soils are poorly drained and are in high positions on moderately wide flood plains adjacent to the uplands. Typically, the surface layer is black silt loam. The subsurface layer is very dark gray, gray, and dark gray silt loam. The subsoil is very dark gray, mottled silty clay loam.

Blackoar soils are poorly drained and are on flood plains along small streams and in areas adjacent to the stream channels on moderately wide flood plains. Typically, the surface layer and subsurface layer are very dark gray silt loam. The subsoil is dark gray and gray silt loam, and the substratum is dark gray silty clay loam.

Fatima soils are moderately well drained and are adjacent to stream channels or to former stream channels where the channels have been straightened. Typically, the surface layer is very dark grayish brown silt loam. The subsoil is silt loam. It is dark grayish brown in the upper part and brown in the lower part. The substratum is brown loam.

Minor in this association are Zook, Chequest, and Gifford soils. Zook and Chequest soils have more clay throughout than the major soils. They are on the slack-water parts of the flood plains. Gifford soils have more clay in the subsoil than the major soils. They are gently sloping and moderately sloping and are on the higher terrace escarpments.

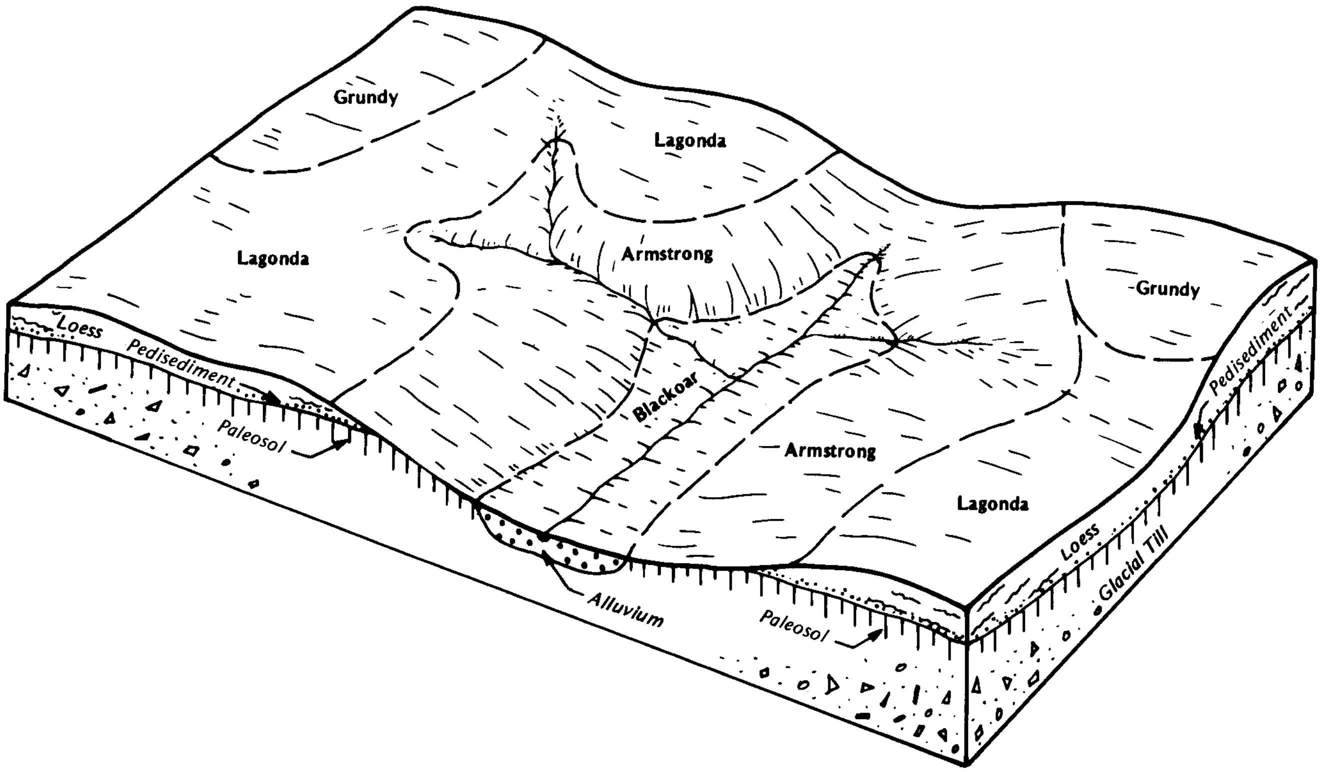

Figure 3.—Typical pattern of soils and parent material in the Lagonda-Armstrong-Grundy association.

About 80 percent of this association is used for cultivated crops. Corn and soybeans are the main crops, but wheat and grain sorghum are also grown. Some areas are used for pasture or hayland. Several areas support native trees, primarily soft maple, ash, water oak, and bur oak.

This association is well suited to cultivated crops. The primary management needs are a drainage system, flood protection in some unprotected areas, and diversions along the base of the uplands. The diversions help to prevent the accumulation of surface water on the flood plains. Many of the areas on the wider flood plains are somewhat protected against flooding by small levees, but large floods are quite damaging to crops.

The soils in this association are suited to water-tolerant grasses and legumes. Restricted grazing when the soils are wet is the main management need.

The soils in this association are suitable for trees. Logging activities are restricted, however, by the flooding and the wetness.

This association generally is unsuitable for building site development because of the flooding and the wetness.

3. Lagonda-Armstrong-Grundy Association

Deep, very gently sloping to strongly sloping, somewhat poorly drained soils formed in loess, pedisediments, and glacial till; on uplands

This association is on broad upland ridges and in narrow drainageways. Slopes range from 1 to 14 percent.

This association makes up about 15 percent of the survey area. It is about 42 percent Lagonda soils, 21 percent Armstrong and similar soils, 16 percent Grundy soils, and 21 percent minor soils (fig. 3).

Lagonda soils are gently sloping and moderately sloping and are on the narrower ridgetops and side slopes. Typically, the surface layer is very dark gray silt loam. The subsoil is dark grayish brown silty clay loam in the upper part and multicolored silty clay loam and silty clay in the lower part.

Armstrong soils are gently sloping to strongly sloping and are on side slopes and a few narrow ridgetops. Typically, the surface layer is very dark grayish brown clay loam or loam. The subsoil is dark brown, mottled clay loam in the upper part; strong brown and brown, mottled clay loam and clay in the next part; and dark yellowish brown and yellowish brown, mottled clay loam in the lower part. The substratum is strong brown, mottled clay loam.

Grundy soils are very gently sloping and gently sloping and are on ridgetops. Typically, the surface layer is very dark gray silt loam. The subsoil is very dark grayish brown, mottled silty clay loam in the upper part; dark grayish brown and grayish brown, mottled silty clay in the next part; and grayish brown, mottled silty clay loam in the lower part. The substratum is multicolored silty clay loam.

Minor in this association are Leonard, Kilwinning, Blackoar, and Fatima soils. The poorly drained Leonard soils are at the head of drainageways and on side slopes below the Lagonda and Grundy soils. The poorly drained Kilwinning soils are on ridgetops above the Lagonda soils. The nearly level, poorly drained Blackoar and moderately well drained Fatima soils are on flood plains along the smaller streams.

Most of this association is used for cultivated crops. The main crops are corn, soybeans, and wheat. Several areas are used for pasture or hayland. Only a few areas of the minor soils support native hardwoods.

This association is well suited to cultivated crops. The primary management need is controlling water erosion on the relatively long side slopes.

The soils in this association are well suited to climatically adapted grasses and legumes. Water erosion and overgrazing are the main concerns in managing pasture.

The forested acreage is on the narrow, strongly sloping uplands and in small areas of bottom land. Thinning and culling the stands generally can help to increase production.

This association is suited to building site development. Wetness and a high shrink-swell potential are the main limitations. The major soils are suitable as sites for sewage lagoons in most areas, but septic tank absorption fields function poorly because of the wetness and restricted permeability.

4. Armstrong-Purdin Association

Deep, gently sloping to moderately steep, somewhat poorly drained and moderately well drained soils formed in glacial till; on uplands

This association is on convex ridgetops and moderately dissected side slopes. Slopes range from 2 to 20 percent.

This association makes up about 62 percent of the survey area. It is about 55 percent Armstrong and similar soils, 26 percent Purdin and similar soils, and 19 percent minor soils (fig. 4).

Armstrong soils are somewhat poorly drained and are gently sloping to strongly sloping. They are on narrow, rounded ridgetops and on side slopes. Typically, the surface layer is very dark grayish brown clay loam or loam. The subsoil is dark brown, mottled clay loam in the upper part; strong brown and brown, mottled clay loam and clay in the next part; and dark yellowish brown and yellowish brown, mottled clay loam in the lower part. The substratum is strong brown, mottled clay loam.

Purdin soils are moderately well drained and are strongly sloping and moderately steep. They are on side slopes. Typically, the surface layer is very dark grayish brown loam or clay loam. The subsoil is dark yellowish brown clay loam in the upper part and yellowish brown, mottled clay loam in the lower part. The substratum is multicolored clay loam.

Minor in this association are Lagonda, Leonard, Kilwinning, Blackoar, and Colo soils. Lagonda soils do not have glacial sand in the upper part. They are on some of the broader ridgetops. The poorly drained Leonard soils are at the head of drainageways and on side slopes above the Armstrong soils. The poorly drained Kilwinning soils are on the broader ridgetops. The poorly drained Blackoar and Colo soils are on flood plains along the smaller streams.

Approximately 60 percent of this association is used for cultivated crops. The main crops are soybeans, corn, and wheat, but grain sorghum is also grown. Most of the untilled acreage is used for pasture, hayland, or timber. The forested acreage is in the steeper upland areas or narrow areas of bottom land where clearing generally is not practical.

The gently sloping and moderately sloping soils in this association are well suited to row crops and wheat if adequate erosion-control measures are applied. Water erosion is a major concern in cultivated areas.

This association is well suited to hay and pasture. The slope and the hazard of erosion are the main concerns. Gullying is a problem in overgrazed pastures.

The forested acreage supports mixed hardwoods. Improving these stands can help to increase production. The equipment limitation restricts logging activities in the steeper areas, and erosion is a hazard along logging roads and skid trails.

This association is suitable for building site

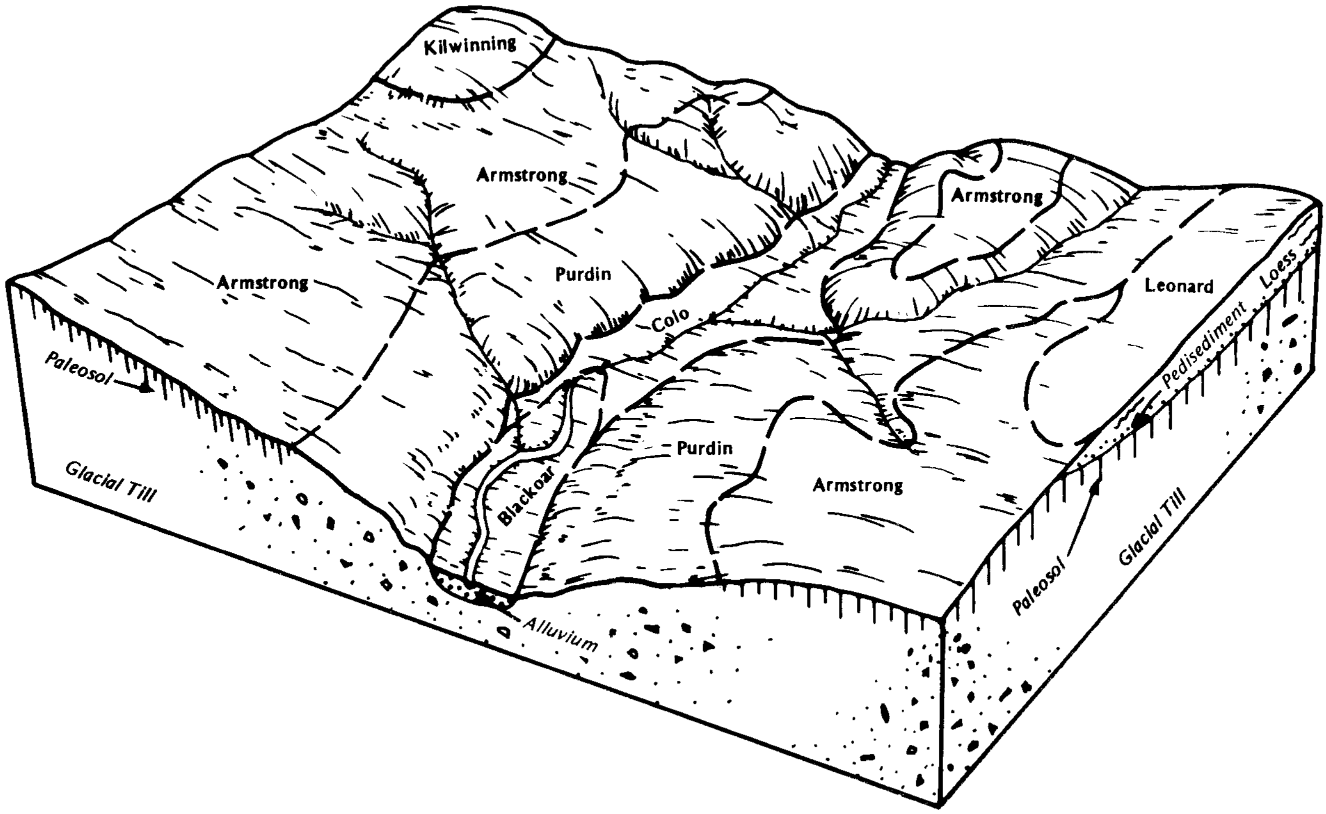

Figure 4.—Typical pattern of soils and parent material in the Armstrong-Purdin association.

development, but wetness, a high shrink-swell potential, and the slope are moderate or severe limitations. The association is suitable as a site for sewage lagoons in most gently sloping and moderately sloping areas. It is generally unsuitable as a site for septic tank absorption fields because of the wetness, restricted permeability, and in places the slope.

5. Winnegan-Keswick Association

Deep, moderately sloping to steep, moderately well drained soils formed in glacial till; on uplands

This association is on narrow, convex ridgetops and side slopes highly dissected by narrow, V-shaped drainageways. Slopes range from 5 to 35 percent.

This association makes up about 5 percent of the survey area. It is about 60 percent Winnegan and similar soils, 19 percent Keswick and similar soils, and 21 percent minor soils (fig. 5).

Winnegan soils are strongly sloping to steep and are on narrow, rounded ridgetops and side slopes. Typically, the surface layer is very dark grayish brown loam or clay loam. The subsurface layer is brown loam. The subsoil is yellowish brown loam and dark yellowish brown, mottled clay loam. The substratum is dark yellowish brown, mottled clay loam.

Keswick soils are moderately sloping and strongly sloping and are on rounded ridgetops and a few of the upper side slopes. Typically, the surface layer is dark grayish brown clay loam. The subsoil is brown, mottled clay loam and clay in the upper part and strong brown, mottled clay and yellowish brown, mottled clay and clay loam in the lower part. The substratum is yellowish brown, mottled clay loam.

Minor in this association are Gosport, Blackoar, Colo, and Fatima soils. The moderately deep Gosport soils are on the lower side slopes. The poorly drained Blackoar and Colo soils are on flood plains along the smaller streams. Fatima soils are on flood plains along the larger streams and a few of the smaller streams.

About 90 percent of this association was originally

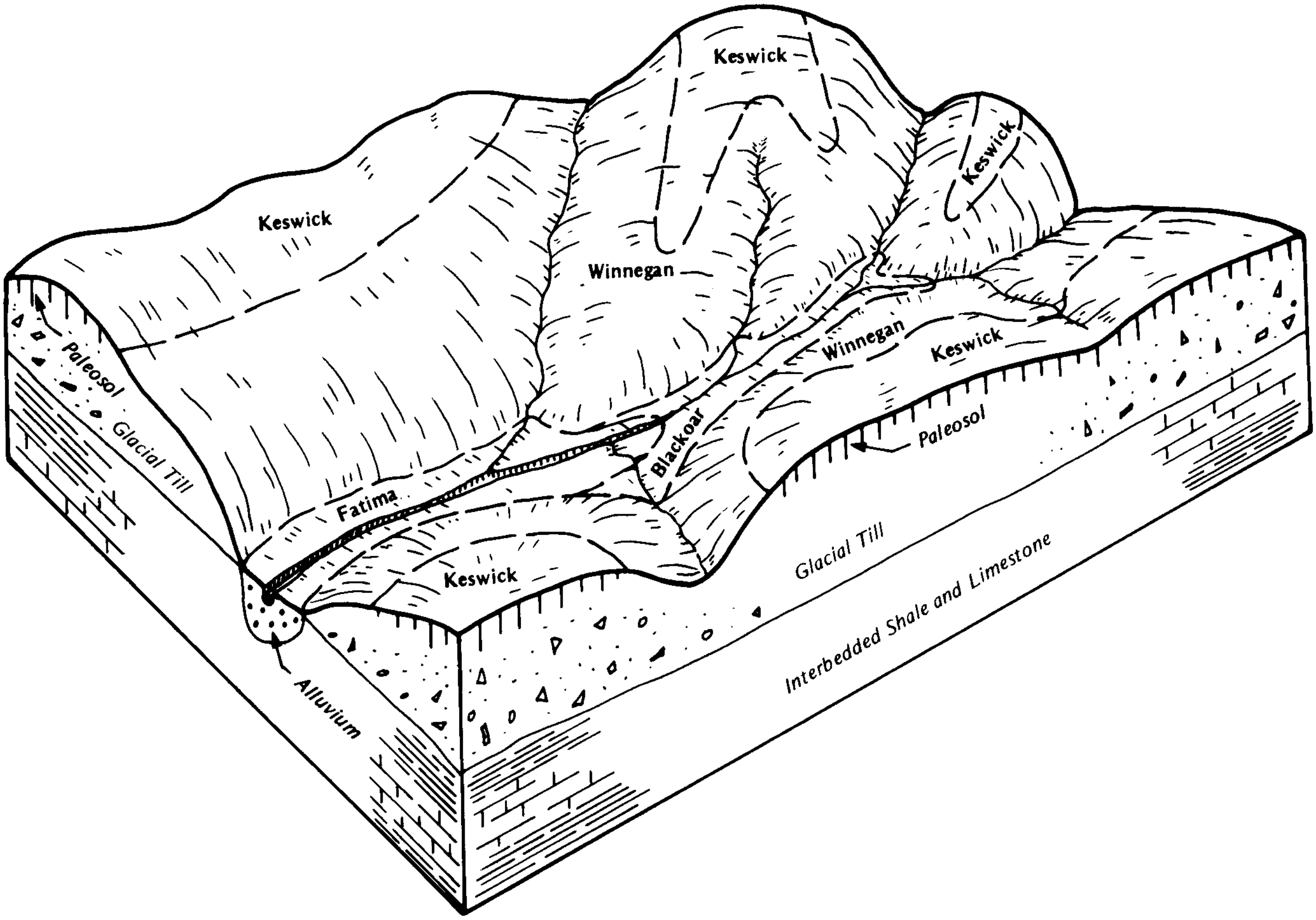

Figure 5.—Typical pattern of soils and parent material in the Winnegan-Keswick association.

forested, but a significant part of these forested areas has been cleared. Only a small part of this association is used for cultivated crops. The main crops are soybeans, corn, wheat, and grain sorghum. Most of the cleared acreage is used for hay or pasture. Some of the pastured areas support scattered trees, and numerous tracts of timber remain in the steeper dissected areas.

Most of this association is not suited to row crops because of the slope and the highly erosive nature of the soils. The soils on narrow ridgetops and flood plains along small streams are suited to wheat.

The slope and the hazard of erosion are the main concerns in pastured areas. Overgrazing can result in severe erosion and gullying.

The existing timber is mostly in the steeper areas and on narrow bottom land that cannot be easily cleared and is not suitable for crops. Improving these stands can help to increase production. Logging activities are difficult in the steeper areas, and erosion is a hazard along logging roads and skid trails.

This association is suitable for building site development. The slope, the wetness, and the shrink-swell potential are the major limitations affecting building site development and onsite sewage disposal.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Armstrong clay loam, 5 to 9 percent slopes, eroded, is a phase in the Armstrong series.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

The description, names, and delineations of the soils identified on the soil maps of this survey area do not fully agree with those in the surveys of adjacent counties published at a different date. Differences may be the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

1B2—Armstrong loam, 2 to 5 percent slopes, eroded. This gently sloping, somewhat poorly drained soil is on narrow, rounded ridgetops and the upper side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are long and narrow and range from 10 to 80 acres in size.

Typically, the surface layer is very dark gray, friable loam about 7 inches thick. The subsoil is about 42 inches thick. It is dark brown, mottled, firm clay loam in the upper part; strong brown and yellowish brown, mottled, firm clay in the next part; and yellowish brown, mottled, firm clay loam in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm clay loam. In some severely eroded areas, the surface layer is clay loam. In places, the surface layer is silt loam and the upper part of the subsoil is silty clay loam. In some areas the upper part of the subsoil has no gray or no red mottles. In other areas the subsoil is much grayer.

Permeability is slow. Surface runoff is medium. Natural fertility also is medium, and organic matter content is moderate. The available water capacity is moderate. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops or for pasture. This soil is suited to corn, soybeans, grain sorghum, and wheat. Water erosion is a moderate hazard if cultivated crops are grown. Applying a system of conservation tillage that leaves a protective cover of crop residue on the surface reduces the hazard of erosion. Erosion-control measures help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, red clover, tall fescue, orchardgrass, timothy, reed canarygrass, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A few areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock helps to achieve a higher seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

This soil generally is unsuitable as a site for septic tank absorption fields because of the slow permeability and the wetness. Sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

1C2—Armstrong clay loam, 5 to 9 percent slopes, eroded. This moderately sloping, somewhat poorly drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 20 to 400 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 9 inches thick. The subsoil is about 41 inches thick. It is dark brown and brown, mottled, firm clay loam in the upper part; strong brown and dark yellowish brown, mottled, firm and very firm clay in the next part; and yellowish brown, mottled, very firm clay loam in the lower part. The substratum to a depth of 60 inches or more is strong brown, mottled, very firm clay loam. In some severely eroded areas, the surface layer is brown clay loam. In a few places, the surface layer is silt loam or loam and the upper part of the subsoil is silty clay loam. In some areas the upper part of the subsoil has no gray or no red mottles. In other areas the subsoil is much grayer.

Permeability is slow. Surface runoff is medium. Natural fertility also is medium, and organic matter content is moderately low. The available water capacity is moderate. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, grain sorghum, and wheat. Further water erosion is a hazard if cultivated crops are grown. Some areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour or to be stripcropped. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to control erosion. Returning crop residue to the soil or adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, red clover (fig. 6), reed canarygrass, tall fescue, orchardgrass, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

Figure 6.—Red clover on Armstrong clay loam, 5 to 9 percent slopes, eroded.

A few areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock helps to achieve a higher seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

This soil generally is unsuitable as a site for septic tank absorption fields because of the slow permeability and the wetness. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

1C3—Armstrong clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, somewhat poorly drained soil is on side slopes in the uplands. Typically, water erosion has removed most of the original surface soil. The present surface layer is mostly subsoil material. Individual areas are irregular in shape and range from 15 to 60 acres in size.

Typically, the surface layer is dark brown, firm clay loam about 3 inches thick. The subsoil is brown and strong brown, mottled, firm and very firm clay about 27 inches thick. The substratum to a depth of 60 inches or more is yellowish brown, mottled, very firm clay and clay loam. In some places the surface layer is 4 to 7 inches thick, and in other places it is loam. In some areas the upper part of the subsoil has no mottles. In other areas the subsoil is much grayer.

Permeability is slow. Surface runoff is medium. Natural fertility and organic matter content are low. The available water capacity is moderate. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is sticky when wet, and it cannot be easily tilled.

Most areas are used for pasture or hay. This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Establishing a good stand of vegetation may be difficult. Tilling and seeding during periods of optimum moisture and growing conditions can help to establish a good ground cover and thus decrease the hazard of further erosion.

A few areas are cultivated, mostly in conjunction with the less eroded adjacent areas. This soil is suited to cultivated crops only if they are grown on a limited basis. Gullies, poor tilth, low fertility, and a severe hazard of further water erosion are problems if cultivated crops are grown. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to control erosion. Returning crop residue to the soil or adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock helps to achieve a higher seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 3C.

1D2—Armstrong clay loam, 9 to 14 percent slopes, eroded. This strongly sloping, somewhat poorly drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. The subsoil is about 36 inches thick. It is brown, mottled, firm clay loam in the upper part and dark brown, mottled, firm clay in the lower part. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm clay loam. In some severely eroded areas, the surface layer is brown clay loam. In places the slope is less than 9 percent.

Included with this soil in mapping are areas of the moderately well drained Purdin soils on the ends of ridges. These soils make up about 10 percent of the unit.

Permeability is slow in the Armstrong soil. Surface runoff is rapid. Natural fertility is medium, and organic matter content is moderately low. The available water capacity is moderate. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to soybeans and corn only if these crops are grown on a limited basis. The hazard of further water erosion is severe. The soil is suited to wheat if water erosion is controlled. Crop rotations that include several years of pasture and hay crops are effective in controlling erosion. Only a few areas have slopes that are long enough or smooth enough to be terraced. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to control erosion, maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is a serious management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A few areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock helps to achieve a higher seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suited to building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness. Designing dwellings so that they conform to the natural slope of the land minimizes the need for land shaping.

This soil is unsuitable as a site for septic tank absorption fields because of the slow permeability, the wetness, and the slope. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action. Designing the roads and streets so that they conform to the natural slope of the land minimizes the need for cutting and filling.

The land capability classification is IVe. The woodland ordination symbol is 3C.

1D3—Armstrong clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, somewhat poorly drained soil is on side slopes in the uplands. Typically, water erosion has removed most of the original surface soil. The present surface layer is mostly subsoil material. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is dark grayish brown, firm clay loam about 5 inches thick. The subsoil is yellowish brown, mottled, firm and very firm clay loam about 43 inches thick. The substratum to a depth of 60 inches or more is yellowish brown, mottled, very firm clay loam. In some places the surface layer is loam. In other places the upper part of the subsoil has no mottles.

Included with this soil in mapping are areas of the moderately well drained Purdin soils on the steeper, short slopes. These soils make up about 10 percent of the unit.

Permeability is slow in the Armstrong soil. Surface runoff is rapid. Natural fertility and organic matter content are low. The available water capacity is moderate. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is sticky when wet and cannot be easily tilled.

Most areas are used for pasture or hay, and a few areas are used for cultivated crops. Because of the hazard of severe water erosion, this soil is unsuited to cultivated crops. It is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is the main management problem. Establishing a good stand of vegetation may be difficult. Tilling and seeding during periods of optimum moisture and growing conditions can help to establish a good ground cover and thus decrease the hazard of further erosion. Brush control may be needed.

This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock helps to achieve a higher seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using reinforced concrete and backfilling with sand and gravel can minimize the damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability, the slope, and the wetness, this soil is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action. Designing the roads and streets so that they conform to the natural slope of the land minimizes the need for cutting and filling.

The land capability classification is VIe. The woodland ordination symbol is 3C.

2D2—Purdin loam, 9 to 14 percent slopes, eroded. This strongly sloping, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 15 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. The subsoil is firm clay loam about 43 inches thick. It is dark yellowish brown in the upper part and yellowish brown and mottled in the lower part. The substratum to a depth of 72 inches or more is mottled yellowish brown, light brownish gray, and dark yellowish brown, very firm clay loam. In places the surface layer is brown or dark grayish brown clay loam. In a few areas mottles are within the upper 10 inches of the subsoil.

Included with this soil in mapping are small areas of the moderately deep Gosport soils in narrow bands on the lower side slopes. Also included are small areas of the somewhat poorly drained Armstrong soils, primarily in narrow bands on the upper parts of the landscape. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Purdin soil. Surface runoff is rapid. Natural fertility is medium, and organic matter content is moderate. The available water capacity is high. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as pasture or hayland. This soil is well suited to red clover, ladino clover, birdsfoot trefoil, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is a serious management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suited to corn, soybeans, and grain sorghum only if these crops are grown on a limited basis. The hazard of water erosion is severe. The soil is suited to wheat if erosion is controlled. Crop rotations that include several years of pasture and hay crops are effective in controlling erosion. Only a few areas have slopes that are long enough and smooth enough to be terraced (fig. 7). A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to control erosion, maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

A few areas support native hardwoods. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can help to prevent the structural damage caused by shrinking and swelling.

Figure 7.—Narrow-base terraces on Purdin loam, 9 to 14 percent slopes, eroded.

Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness. Designing dwellings so that they conform to the natural slope of the land minimizes the need for land shaping.

This soil generally is unsuitable as a site for septic tank absorption fields because of the slow permeability. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action. Designing the roads and streets so that they conform to the natural slope of the land minimizes the need for cutting and filling.

The land capability classification is IVe. The woodland ordination symbol is 3A.

2D3—Purdin clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed most of the original surface soil. The present surface layer is mostly subsoil material. Individual areas are irregular in shape and range from 15 to 45 acres in size.

Typically, the surface layer is dark brown, mottled, firm clay loam about 5 inches thick. The subsoil is mottled, firm clay loam about 24 inches thick. It is dark yellowish brown in the upper part and yellowish brown in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, mottled, very firm clay loam. In places the surface layer is very dark grayish brown loam.

Included with this soil in mapping are areas of the moderately deep Gosport soils in narrow bands on the lower side slopes. Also included are small areas of the somewhat poorly drained Armstrong soils, primarily in narrow bands on the upper parts of the landscape. Included soils make up about 5 percent of the unit.

Permeability is slow in the Purdin soil. Surface runoff is rapid. Natural fertility and organic matter content are low. The available water capacity is high. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is sticky when wet, and it cannot be easily tilled.

Most areas are used for pasture, but some are cultivated. Because of a severe hazard of water erosion, this soil is unsuited to cultivated crops. It is well suited to ladino clover, red clover, birdsfoot trefoil, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is the main management problem. Establishing a good stand of vegetation may be difficult. Tilling and seeding during periods of optimum moisture and growing conditions help to establish a good ground cover and thus greatly decrease the hazard of further erosion. Brush control probably is needed.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness. Designing dwellings so that they conform to the natural slope of the land minimizes the need for land shaping.

Because of the slow permeability, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action. Designing the roads and streets so that they conform to the natural slope of the land minimizes the need for cutting and filling.

The land capability classification is VIe. The woodland ordination symbol is 3A.

2E2—Purdin clay loam, 14 to 20 percent slopes, eroded. This moderately steep, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 5 inches thick. The subsoil to a depth of 60 inches or more is clay loam. It is yellowish brown and firm in the upper part and light yellowish brown, mottled, and firm and very firm in the lower part. In some places the dark surface layer is more than 6 inches thick, and in other places the soil has a surface layer of brown clay loam or dark grayish brown loam.

Included with this soil in mapping are areas of the moderately deep Gosport soils on the lower parts of the side slopes. These soils make up about 5 percent of the unit.

Permeability is slow in the Purdin soil. Surface runoff is rapid. Natural fertility is medium, and organic matter content is moderately low. The available water capacity is high. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil.

The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture, but a few areas are used for cultivated crops. Because of the slope and a severe hazard of water erosion, this soil is unsuited to cultivated crops. It is well suited to red clover, ladino clover, birdsfoot trefoil, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is a serious management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. Brush control probably is needed.

A few areas support native hardwoods. This soil is suited to trees. Water erosion and the equipment limitation are management concerns. Because of the slope, logging roads and skid trails should be constructed on the contour. This measure minimizes the concentration of water. Seeding of disturbed areas may be necessary after harvesting. Operating logging equipment is hazardous on these slopes. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be necessary.

This soil generally is unsuitable for building site development because of the slope. The cost of designing the buildings and of preparing the site for construction could be restrictive.

The land capability classification is VIe. The woodland ordination symbol is 3R.

2E3—Purdin clay loam, 14 to 20 percent slopes, severely eroded. This moderately steep, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed most of the original surface soil. The present surface layer is mostly subsoil material. Individual areas are irregular in shape and range from 5 to 75 acres in size.

Typically, the surface layer is about 7 inches thick. It is mixed very dark grayish brown and yellowish brown, friable clay loam. The subsoil is about 38 inches thick. It is yellowish brown, mottled, firm clay loam and clay in the upper part and light yellowish brown, mottled, firm clay loam in the lower part. The substratum to a depth of 60 inches or more is light brownish gray, mottled, very firm clay. In places the surface layer is very dark grayish brown loam.

Included with this soil in mapping are areas of the moderately deep Gosport soils on the lower side slopes. These soils make up about 5 percent of the unit.

Permeability is slow in the Purdin soil. Surface runoff is rapid. Natural fertility and organic matter content are low. The available water capacity is high. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is sticky when wet.

Most areas are used for pasture, but a few are cultivated. Because of the slope and a severe hazard of water erosion, this soil is unsuited to cultivated crops. It is well suited to red clover, ladino clover, birdsfoot trefoil, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is the main management problem. Establishing a good stand of vegetation may be difficult. Tilling and seeding during periods of optimum moisture and growing conditions can help to establish a good ground cover and thus greatly decrease the hazard of further erosion. Measures that control brush and maintain fertility are needed.

A few abandoned areas have regenerated to brush. This soil is suited to trees. Water erosion and the equipment limitation are management concerns. Because of the slope, logging roads and skid trails should be constructed on the contour. This measure minimizes the concentration of water. Seeding of disturbed areas may be necessary after harvesting. Operating logging equipment is hazardous on these slopes. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be necessary.

This soil generally is unsuitable for building site development because of the slope. The cost of designing the buildings and of preparing the site for construction could be restrictive.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

3B—Kilwinning silt loam, 1 to 5 percent slopes. This very gently sloping and gently sloping, poorly drained soil is on the wider ridgetops in the uplands. Individual areas are irregular in shape and range from 40 to 300 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 41 inches thick. It is dark grayish brown, mottled, firm silty clay in the upper part and grayish brown, mottled, firm silty clay and silty clay loam in the lower part. The substratum to a depth of about 60 inches or more is light brownish gray, mottled, friable silty clay loam. In some places the dark surface layer is less than 6 inches thick. In other places the subsoil is clay loam or clay below a depth of 30 to 40 inches. In a few areas the upper part of the subsoil has dark red and yellowish red mottles.

Included with this soil in mapping are areas of Lagonda soils. These soils have a dark surface layer that is thicker than that of the Kilwinning soil. They generally are in the steeper areas near drainageways. Also included, on nearly level, broad ridgetops, are soils that have a thick subsurface layer of dark gray or gray silt loam. Included soils make up about 10 to 15 percent of the unit.

Permeability is very slow in the Kilwinning soil. Surface runoff is slow or medium. Natural fertility is medium, and organic matter content is moderate. The available water capacity is high. A perched water table generally is at a depth of about 1 to 2 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are cultivated. This soil is suited to corn, soybeans, grain sorghum, and wheat. If cultivated crops are grown, water erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and crop rotations can help to control erosion. Returning crop residue to the soil or adding other organic material can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is moderately well suited to birdsfoot trefoil, reed canarygrass, and switchgrass. It is moderately suited to ladino clover, tall fescue, big bluestem, and indiangrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation may be a management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suitable for building site development if footings and foundations are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the very slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

4D2—Winnegan clay loam, 9 to 14 percent slopes, eroded. This strongly sloping, moderately well drained soil is on narrow, rounded ridgetops and side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas generally are elongated and range from 5 to 35 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 4 inches thick. The subsoil is firm clay loam about 39 inches thick. It is strong brown in the upper part and yellowish brown and mottled in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, mottled, very firm clay loam. In places the surface layer is very dark grayish brown loam about 6 inches thick. In a few areas red or gray mottles are within the upper 10 inches of the subsoil.

Included with this soil in mapping are areas of the somewhat poorly drained Gorin soils on narrow ridgetops. Also included are areas of the moderately deep Gosport soils in narrow bands on the lower side slopes. Included soils make up about 10 percent of the unit.

Permeability is slow in the Winnegan soil. Surface runoff is rapid. Natural fertility and organic matter content are low. The available water capacity is high. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture, hayland (fig. 8), or trees. This soil is well suited to ladino clover, birdsfoot trefoil, red clover, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is the main management

Figure 8.—Hay on Winnegan clay loam, 9 to 14 percent slopes, eroded. Soybeans are on the bottom land in the background.

problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. Brush management generally is needed.

Some areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Selective cutting and thinning of undesirable trees can improve most stands.

Because of a severe hazard of water erosion, this soil is suited to corn, soybeans, and grain sorghum only if these crops are grown on a limited basis. It is suited to wheat if erosion is controlled. A system of conservation tillage that leaves a protective cover of crop residue on the surface and winter cover crops can help to control erosion, maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by wetness. Designing dwellings so that they conform to the natural slope of the land minimizes the need for land shaping.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Sewage lagoons can function adequately if the site can be leveled and if measures that control seepage, such as placing a compacted layer of slowly permeable material on the bottom and sides of the lagoons, are applied.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action. Designing the roads and streets so that they conform to the natural slope of the land minimizes the need for cutting and filling.

The land capability classification is IVe. The woodland ordination symbol is 3A.

4D3—Winnegan clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed most of the original surface soil. The present surface layer is mostly subsoil material. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable clay loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, firm clay loam. The lower part of the subsoil and the substratum to a depth of 60 inches or more are yellowish brown, mottled, firm clay loam. In places the surface layer is grayish brown loam. In a few areas red or grayish brown mottles are within the upper 10 inches of the subsoil.

Included with this soil in mapping are areas of the moderately deep Gosport soils in narrow bands on the lower side slopes. These soils make up about 5 percent of the unit.

Permeability is slow in the Winnegan soil. Surface runoff is rapid. Natural fertility and organic matter content are very low. The available water capacity is moderate. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable but tends to crust if tilled when wet.

Most areas are used for pasture or hay. A few are cultivated. Because of the slope and a severe hazard of water erosion, this soil is unsuited to cultivated crops. It is well suited to ladino clover, birdsfoot trefoil, red clover, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. Excessive erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is the main management problem. Establishing a good stand of vegetation may be difficult. Tilling and seeding during periods of optimum moisture and growing conditions can help to establish a good ground cover and thus greatly decrease the hazard of further erosion. Measures that control brush and maintain fertility are needed.

A few areas have regenerated to brush. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness. Building sites can be leveled or the buildings designed so that they conform to the slope.

Because of the slow permeability, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is VIe. The woodland ordination symbol is 3A.

4E2—Winnegan clay loam, 14 to 20 percent slopes, eroded. This moderately steep, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas generally are elongated and range from 15 to 150 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 4 inches thick. The subsoil is clay loam about 27 inches thick. It is brown and friable in the upper part; dark yellowish brown, mottled, and firm in the next part; and yellowish brown, mottled, and firm in the lower part. The substratum to a depth of 60 inches or more is yellowish brown and light brownish gray, mottled, firm clay loam and sandy clay loam. In some severely eroded areas, the surface layer is firm subsoil material. In a few places grayish brown mottles are within the upper 10 inches of the subsoil.

Included with this soil in mapping are areas of the moderately deep Gosport soils in narrow bands on the lower side slopes. These soils make up about 5 percent of the unit.

Permeability is slow in the Winnegan soil. Surface runoff is rapid. Natural fertility and organic matter content are low. The available water capacity is high. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled within a moderate range in moisture content.

Most areas are used for pasture or trees. This soil is unsuited to cultivated crops because of the slope and a severe hazard of water erosion. It is well suited to red clover, ladino clover, birdsfoot trefoil, tall fescue, timothy, reed canarygrass, and switchgrass. It is moderately well suited to orchardgrass, alfalfa, smooth bromegrass, big bluestem, and indiangrass. Excessive water erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is a serious management problem. Tilling and seeding during periods of optimum moisture and growing conditions can help to establish a good ground cover and thus greatly decrease the hazard of further erosion. Measures that control brush and maintain fertility are needed.

Large areas support native hardwoods. This soil is suited to trees. Water erosion and the equipment limitation are management concerns. Because of the slope, logging roads and skid trails should be constructed on the contour. Seeding of disturbed areas may be necessary after harvesting. Operating logging equipment is hazardous on these slopes. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be necessary. Selective cutting and thinning of undesirable trees can improve most stands.

This soil generally is unsuitable for building site development because of the slope. The cost of designing the buildings and of preparing the site for construction could be restrictive.

The land capability classification is VIe. The woodland ordination symbol is 3R.

4E3—Winnegan clay loam, 14 to 20 percent slopes, severely eroded. This moderately steep, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed most of the original surface soil. The present surface layer is mostly subsoil material. Individual areas generally are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 3 inches thick. It is mottled and has pockets of yellowish brown clay. The subsoil is yellowish brown, mottled, firm clay about 12 inches thick. The substratum to a depth of 60 inches or more is light olive brown, mottled, firm clay loam. In places the surface layer is dark grayish brown loam about 6 inches thick.

Included with this soil in mapping are areas of the moderately deep Gosport soils in narrow bands on the lower side slopes. These soils make up about 10 percent of the unit.

Permeability is slow in the Winnegan soil. Surface runoff is rapid. Natural fertility and organic matter content are very low. The available water capacity is moderate. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable when moist but sticky when wet.

Most areas are used for pasture or have reverted to brush. Because of the slope and a severe hazard of water erosion, this soil is unsuited to cultivated crops. It is well suited to ladino clover, birdsfoot trefoil, red clover, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. Excessive water erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is a serious management problem. Establishing a good stand of vegetation may be difficult. Tilling and seeding during periods of optimum moisture and growing conditions can help to establish a good ground cover and thus greatly decrease the hazard of further erosion. Measures that control brush and maintain fertility are needed.

A few abandoned areas have regenerated to brush. This soil is suited to trees. Water erosion and the equipment limitation are management concerns. Because of the slope, logging roads and skid trails should be constructed on the contour. Seeding of disturbed areas may be necessary after harvesting. Operating logging equipment is hazardous on these slopes. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be necessary. Selective cutting and thinning of undesirable trees can improve most stands.

This soil generally is unsuited to building site development because of the slope. The cost of designing the buildings and of preparing the site for construction could be restrictive.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

4F—Winnegan loam, 20 to 35 percent slopes. This steep, moderately well drained soil is on side slopes in the uplands. Individual areas generally are elongated and range from 10 to more than 200 acres in size.

Typically, the surface layer is very dark grayish brown, very friable loam about 2 inches thick. The subsurface layer is brown, mottled, friable loam about 4 inches thick. The subsoil is about 32 inches thick. It is yellowish brown, firm loam and clay loam in the upper part and yellowish brown and dark yellowish brown, mottled, firm clay loam in the lower part. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled, very firm clay loam. In a few places the surface layer is brown clay loam.

Included with this soil in mapping are small areas of the moderately deep Gosport soils in narrow bands on the lower side slopes. These soils make up about 5 percent of the unit.

Permeability is slow in the Winnegan soil. Surface runoff is very rapid. Natural fertility and organic matter content are low. The available water capacity is high. A perched water table generally is at a depth of 2.0 to 3.5 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is very friable throughout a moderate range in moisture content.

Most areas are used for trees or pasture, and large areas support native hardwoods. Because of the slope and a severe hazard of water erosion, this soil is unsuited to cultivated crops. It is suited to trees. Water erosion and the equipment limitation are management concerns. Because of the slope, logging roads and skid trails should be constructed on the contour. Seeding of disturbed areas may be necessary after harvesting. Operating logging equipment is hazardous on these slopes. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be necessary. Selective cutting and thinning of undesirable trees can improve most stands.

This soil is well suited to ladino clover, birdsfoot trefoil, red clover, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, smooth bromegrass, big bluestem, and indiangrass. The equipment limitation and the hazard of water erosion during seedbed preparation are management concerns. Excessive water erosion results if the stands of grasses are depleted by overgrazing. Establishing a good stand of vegetation may be difficult. A no-till method of seeding new stands of grasses and legumes helps to control water erosion. Applying chemicals helps to control competing vegetation. Measures that control brush and maintain fertility may be needed.

This soil generally is unsuited to building site development because of the slope. The cost of designing the buildings and of preparing the site for construction could be restrictive.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

5B2—Leonard silt loam, 2 to 5 percent slopes, eroded. This gently sloping, poorly drained soil is on the upper side slopes and at the head of drainageways in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 25 to 180 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsoil is about 45 inches thick. It is dark grayish brown, mottled, friable and firm silty clay loam in the upper part and grayish brown, mottled, firm silty clay in the lower part. The substratum to a depth of 60 inches or more is coarsely mottled strong brown and light brownish gray, firm silty clay. In some severely eroded areas, the surface layer is dark grayish brown silty clay loam or clay loam.

Included with this soil in mapping are a few areas of the somewhat poorly drained Armstrong soils on the lower parts of the landscape. Also included are areas of the somewhat poorly drained Lagonda soils near the upper parts of the landscape. Included soils make up about 5 percent of the unit.

Permeability is slow in the Leonard soil. Surface runoff is medium. Natural fertility also is medium, and organic matter content is moderately low. The available water capacity is moderate. A perched water table generally is at a depth of 0.5 foot to 2.0 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a moderate range in moisture content.

Most areas are used for cultivated crops or pasture. This soil is suited to corn, soybeans, grain sorghum, and wheat. Water erosion is a moderate hazard in cultivated areas. It can be controlled by a combination of terraces and grassed waterways or tile outlets, by stripcropping, and by a system of conservation tillage that leaves a protective cover of crop residue on the surface. Returning crop residue to the soil can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is moderately well suited to birdsfoot trefoil, reed canarygrass, and switchgrass. It is moderately suited to ladino clover, tall fescue, big bluestem, and indiangrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

7B—Grundy silt loam, 1 to 5 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on convex ridgetops and the lower foot slopes in the uplands. Individual areas are long and narrow and range from 80 to 400 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is about 41 inches thick. It is dark grayish brown, mottled, firm silty clay in the upper part and grayish brown, mottled, firm silty clay and silty clay loam in the lower part. The substratum to a depth of 68 inches or more is mottled light brownish gray and yellowish brown, firm silty clay loam. In a few eroded areas the soil is dark to a depth of less than 10 inches. In other eroded areas the clayey subsoil has been mixed with the silty surface layer. In places the lower part of the subsoil has glacial sand and pebbles.

Included with this soil in mapping are areas of a nearly level, poorly drained soil that has a thick, dark gray subsurface layer. This included soil makes up less than 5 percent of the unit.

Permeability is slow in the Grundy soil. Surface runoff is slow or medium. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and wheat. Water erosion is a moderate hazard in cultivated areas. It can be controlled by a combination of contour farming and grassed waterways and by a system of conservation tillage that leaves a protective cover of crop residue on the surface. In a few places terraces may also be necessary. Measures that control water erosion can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand or gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

9B2—Lagonda silt loam, 2 to 5 percent slopes, eroded. This gently sloping, somewhat poorly drained soil is on ridgetops and side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 30 to 200 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark grayish brown, friable silty clay loam in the upper part; dark grayish brown, mottled, firm silty clay and silty clay loam in the next part; and mottled light brownish gray and yellowish brown, firm silty clay loam and very firm clay loam in the lower part. In some areas the very dark gray surface layer is more than 10 inches thick. In other areas the subsoil is grayer and has more clay. In places the lower part of the subsoil has less sand.

Included with this soil in mapping are some areas of Armstrong soils, which have sand and pebbles throughout. These soils are along drainageways in the uplands. They make up about 5 to 10 percent of the unit.

Permeability is slow in the Lagonda soil. Surface runoff is medium. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. A perched water table generally is at a depth of 1.5 to 3.0 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a moderate range in moisture content.

Most areas are cultivated (fig. 9). This soil is suited to corn, soybeans, grain sorghum, and wheat. Further water erosion is a hazard if cultivated crops are grown. Slopes generally are long enough and smooth enough for terraces and contour farming. If these measures are applied, grassed waterways are needed. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and crop rotations that include grasses and legumes can help to control water erosion. Adding crop residue or other organic material to the surface can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

9C2—Lagonda silt loam, 5 to 9 percent slopes, eroded. This moderately sloping, somewhat poorly drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 20 to 120 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 2 inches thick. The subsoil is about 44 inches thick. It is dark grayish brown, mottled, friable silty clay loam and firm silty clay in the upper part and multicolored, firm silty clay loam in the lower part. The substratum to a depth of 66 inches or more is grayish brown, mottled, firm silty clay loam. In some severely eroded areas, the surface layer is dark grayish brown silty clay loam. In places the soil is very dark gray to a depth of more than 10 inches.

Included with this soil in mapping are small areas of Armstrong soils, which have sand and pebbles throughout. These soils are on the steeper convex slopes. They make up about 5 percent of the unit.

Permeability is slow in the Lagonda soil. Surface

Figure 9.—Soybeans and corn on Lagonda silt loam, 2 to 5 percent slopes, eroded.

runoff is medium. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. A perched water table generally is at a depth of 1.5 to 3.0 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a moderate range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and wheat. Water erosion is a moderate hazard in areas that are used for row crops or small grain. Contour farming, a combination of terraces and grassed waterways or tile outlets, no-till farming, stripcropping, and a system of conservation tillage that leaves a protective cover of crop residue on the surface help to control erosion. Adding crop residue or other organic material to the surface can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

10F2—Gosport silty clay loam, 9 to 35 percent slopes, eroded. This moderately deep, strongly sloping to steep, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is mottled, firm silty clay about 22 inches thick. It is yellowish brown in the upper part and light olive brown in the lower part. Weathered shale bedrock is at a depth of about 26 inches. In places the soil is more than 50 inches deep over weathered bedrock. In a few severely eroded areas, the surface layer is brown or yellowish brown silty clay. In a few places it is fine sandy loam.

Included with this soil in mapping are areas of the deep Winnegan soils in narrow bands on the upper parts of the landscape. These soils make up about 10 percent of the unit.

Permeability is very slow in the Gosport soil. Surface runoff is rapid or very rapid. Natural fertility is low, and organic matter content is moderately low. The available water capacity is low. The shrink-swell potential is high in the subsoil.

Most areas are used for timber or pasture, and many areas support native hardwoods. Because of a severe hazard of water erosion, this soil is unsuited to cultivated crops. It is suited to trees. The hazard of water erosion, the equipment limitation, and the windthrow hazard are management concerns. Because of the slope, logging roads and skid trails should be constructed on the contour. This measure minimizes the concentration of water. Seeding of disturbed areas may be necessary after harvesting. Operating logging equipment is hazardous on these slopes. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be necessary. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, big bluestem, and indiangrass. It is moderately suited to orchardgrass, smooth bromegrass, and switchgrass. The more shallow rooted and drought tolerant species grow best. Excessive water erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is a serious management problem. In some areas seedbed preparation is very difficult because of the slope or rock outcrops, or both. In these areas, no-till methods should be used to seed new stands of grasses and legumes and chemicals should be applied to control competing vegetation. In areas where a seedbed can be prepared, tilling and seeding during periods of optimum moisture and growing conditions can help to establish a good ground cover and thus minimize further erosion. Measures that control brush and maintain fertility are needed.

This soil generally is unsuitable for building site development because of the slope. The cost of designing the buildings and of preparing the site for construction could be restrictive.

The land capability classification is VIIe. The woodland ordination symbol is 2R.

12C2—Keswick clay loam, 5 to 9 percent slopes, eroded. This moderately sloping, moderately well drained soil is on rounded ridgetops and side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are elongated and range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 6 inches thick. The subsoil is about 43 inches thick. It is brown, mottled, friable clay loam in the upper part; mottled brown, strong brown, and yellowish brown, firm clay in the next part; and yellowish brown, mottled, very firm clay loam in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, mottled, very firm clay loam. In places the surface layer is silt loam. In some severely eroded areas, it is brown clay loam subsoil material.

Included with this soil in mapping are areas of Winnegan soils on the lower parts of the landscape and on some ridgetops. These soils are less clayey than the Keswick soil. They make up about 15 percent of the unit.

Permeability is slow in the Keswick soil. Surface runoff is medium. Natural fertility and organic matter content are low. The available water capacity is moderate. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or for cultivated crops. This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suited to corn, soybeans, grain sorghum, and wheat. Further water erosion is a hazard if cultivated crops are grown. This hazard can be reduced by a combination of terraces and grassed waterways or tile outlets and by a system of conservation tillage that leaves a protective cover of crop residue on the surface. Adding crop residue or other organic material to the surface can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

A few areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

12D2—Keswick clay loam, 9 to 14 percent slopes, eroded. This strongly sloping, moderately well drained soil is on side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 60 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 4 inches thick. The subsoil is about 35 inches thick. It is mottled brown and dark yellowish brown, firm clay loam in the upper part and yellowish brown, mottled, firm clay loam and clay in the lower part. The substratum to a depth of 60 inches or more is mottled gray and brown, firm clay loam. In some severely eroded areas, the surface layer is brown, firm clay loam subsoil material.

Included with this soil in mapping are some areas of Winnegan soils on ridgetops and on the steeper side slopes. These soils are less clayey than the Keswick soil. Also included are some areas of the moderately deep Gosport soils on the lower side slopes. Included soils make up about 15 percent of the unit.

Permeability is slow in the Keswick soil. Surface runoff is rapid. Natural fertility and organic matter content are low. The available water capacity is moderate. A perched water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust if tilled when wet.

Most areas are used for pasture or hay, and a few areas are cultivated. This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. Excessive water erosion results if the stands of grasses are depleted by overgrazing. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. Brush control probably is needed.

Because of a severe hazard of water erosion, this soil is suited to corn, soybeans, and grain sorghum only if these crops are grown on a limited basis. It is suited to wheat if erosion is controlled. A few areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour or to be stripcropped. If terraces are constructed, grassed waterways or tile outlets are needed. A system of conservation tillage that leaves a protective cover of crop residue on the surface and winter cover crops can help to control erosion. Adding crop residue or other organic material to the surface improves fertility and tilth and increases the rate of water infiltration.

A few areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the soil is dry or frozen. Planting container-grown nursery stock can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 3C.

14B—Gorin silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on narrow, rounded upland ridgetops and a few of the adjacent side slopes. Individual areas generally are long and narrow and range from 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 37 inches thick. It is brown, mottled, firm silty clay loam in the upper part; grayish brown, mottled, firm silty clay in the next part; and multicolored, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is multicolored, firm clay loam. In some areas glacial sand and pebbles are within a depth of 20 inches.

Permeability is slow. Surface runoff is medium. Natural fertility is low, and organic matter content is moderately low. The available water capacity is high. A perched water table generally is at a depth of 2 to 4 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture, hay, timber, or cultivated crops. This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suited to corn, soybeans, grain sorghum, and wheat. Water erosion is a moderate hazard if cultivated crops are grown. Applying a system of conservation tillage that leaves a protective cover of crop residue on the surface helps to control erosion. Erosion-control measures can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

A few areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

14C2—Gorin silt loam, 5 to 9 percent slopes, eroded. This moderately sloping, somewhat poorly drained soil is on narrow, rounded ridgetops and side slopes in the uplands. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 10 to 35 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 50 inches thick. It is dark yellowish brown, friable silty clay loam and grayish brown, mottled, firm silty clay in the upper part and light brownish gray and light yellowish brown, mottled, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm clay. In some severely eroded areas, the surface layer is brown silty clay loam. In places glacial sand and pebbles are within a depth of 20 inches.

Included with this soil in mapping are a few areas of the moderately well drained Winnegan soils on the lower side slopes and on a few ridgetops. These soils make up about 5 percent of the unit.

Permeability is slow in the Gorin soil. Surface runoff is medium. Natural fertility and organic matter content are low. The available water capacity is high. A perched water table generally is at a depth of 2 to 4 feet during most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a moderately wide range in moisture content.

Most areas are used for pasture, hay, timber, or cultivated crops. This soil is well suited to ladino clover and is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A few areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the ground is dry or frozen. Planting container-grown nursery stock can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suited to corn, soybeans, grain sorghum, and wheat. If cultivated crops are grown, further water erosion is a hazard. A few areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour or to be stripcropped. If terraces are constructed, grassed waterways or tile outlets are needed. A system of conservation tillage that leaves a protective cover of crop residue on the surface and winter cover crops help to control water erosion. Adding crop residue or other organic material to the surface improves fertility and tilth and increases the rate of water infiltration.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

22B—Olmitz loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on high terraces, on foot slopes, and on uplands. Individual areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 5 inches thick. The subsurface layer is about 21 inches of very dark grayish brown, friable loam and very dark gray, friable clay loam. The subsoil to a depth of 60 inches or more is brown clay loam. It is friable in the upper part and firm in the lower part. In places, the surface layer is dark brown sandy clay loam and the subsoil is yellowish brown. In a few places the subsoil is grayer as a result of seepage from the adjacent uplands. In some areas the subsoil is thinner and has more sand.

Included with this soil in mapping are areas of Purdin and Winnegan soils on the upper parts of the foot slopes. These soils are steeper than the Olmitz soil and have glacial pebbles. They make up about 10 percent of the unit.

Permeability is moderate in the Olmitz soil. Surface runoff is slow or medium. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops, and a few are used for pasture or hay. This soil is suited to corn, soybeans, grain sorghum, and wheat. Water erosion is a hazard. It can be controlled by a diversion between cultivated areas and the adjacent uplands. Other erosion-control measures include contour farming, contour stripcropping, and a system of conservation tillage that leaves a protective cover of crop residue on the surface. These measures can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration. Most areas are too narrow for terracing.

This soil is well suited to alfalfa, birdsfoot trefoil, ladino clover, red clover, orchardgrass, reed canarygrass, smooth bromegrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. Water erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings and foundations can minimize the damage caused by poor surface drainage around dwellings or by gutter failure.

Septic tank absorption fields can function properly in areas of this soil if the laterals are long enough to overcome the moderate permeability. Sewage lagoons can function adequately if the site can be leveled and if seepage is controlled. Sealing the lagoon helps to prevent seepage.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable base material minimizes the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage, and mixing additives or coarser textured material with the soil can help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

25—Chariton silt loam. This nearly level, poorly drained soil is on stream terraces. In most areas it is subject to rare flooding. Individual areas are irregular in shape and range from 5 to 60 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is grayish brown, friable silt loam about 6 inches thick. The subsoil is about 43 inches thick. The upper part is dark grayish brown, mottled, firm silty clay. The next part is grayish brown, mottled, firm silty clay. The lower part of the subsoil and the substratum to a depth of 60 inches or more are grayish brown, mottled, firm silty clay loam. In some places the dark surface layer is more than 10 inches thick, and in other places the dark colors extend into the upper part of the subsoil. In some areas the surface layer is dark grayish brown.

Included with this soil in mapping are the gently sloping Gifford soils along the edges of the mapped areas and along small drainageways. Also included are areas of Vesser soils, which have less clay than the Chariton soil and are in slightly lower positions on the landscape. Included soils make up about 10 percent of the unit.

Permeability is slow in the Chariton soil. Surface runoff also is slow. Natural fertility is medium, and organic matter content is moderate. The available water capacity is high. A perched water table generally is within a depth of 1.5 feet in most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is suitable for corn, soybeans, grain sorghum, and wheat. Wetness is the main management problem. Shallow parallel ditches can improve surface drainage. In many areas a diversion can prevent the flow of additional surface water from the adjacent uplands. A system of conservation tillage that leaves a protective cover of crop residue on the surface or other good residue-management measures can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is moderately well suited to reed canarygrass and is moderately suited to birdsfoot trefoil and ladino clover. The main management problem is wetness. Restricted grazing during wet periods can help to keep the pasture in good condition.

A few areas remain wooded. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the soil is dry or frozen. Planting container-grown nursery stock can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is not suitable for building site development unless the high shrink-swell potential, the wetness, and the hazard of flooding are overcome. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness. Surface drainage can be improved and the flood hazard reduced by constructing dwellings on raised, well compacted fill material above the level of flooding.

Properly constructed sewage lagoons, surrounded by levees, can be used for waste disposal if municipal sewerlines are unavailable. Sealing the bottom and sides of the lagoon with slowly permeable, clayey material can help to prevent excessive seepage and the contamination of ground water.

This soil is suitable as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and strengthening the subgrade with crushed rock or other suitable material can minimize the road damage caused by low strength, wetness, and flooding. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by wetness, frost action, and shrinking and swelling.

The land capability classification is IIw. No woodland ordination symbol is assigned.

27B—Gifford silt loam, 2 to 5 percent slopes. This gently sloping, poorly drained soil is on undulating stream terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from about 10 to 50 acres in size.

Typically, the surface soil is about 8 inches of very dark grayish brown, friable silt loam and firm silty clay loam. The subsoil is about 41 inches thick. The upper part is grayish brown, mottled, firm silty clay. The next part is gray, mottled, firm silty clay. The lower part of the subsoil and the substratum to a depth of 60 inches or more are light brownish gray, mottled, firm silty clay loam. In places the dark surface layer is less than 6 inches thick. In a few areas the surface layer is silty clay loam.

Included with this soil in mapping are a few areas of the nearly level Chariton soils. These soils have a thick, grayish brown subsurface layer and generally are adjacent to the uplands and on the flatter parts of the landscape. They make up about 5 to 10 percent of the unit.

Permeability is very slow in the Gifford soil. Surface runoff is medium. Natural fertility also is medium, and organic matter content is moderate. The available water capacity also is moderate. A perched water table generally is at a depth of 0.5 foot to 2.0 feet in most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and wheat. Water erosion is a hazard in the larger areas. It can be controlled by a combination of terraces and grassed waterways or tile outlets. A diversion at the base of the adjacent uplands can intercept surface water and make the soil easier to till in spring months. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is moderately well suited to reed canarygrass and is moderately suited to birdsfoot trefoil and ladino clover. Water erosion during seedbed preparation is a major management concern. Wetness is also a concern. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. Species that can withstand wetness grow best. Restricted grazing during wet periods can help to keep the pasture in good condition.

This soil is unsuitable for building site development unless special measures are applied to minimize the effects of shrinking and swelling, wetness, and flooding. The hazard of flooding can be reduced by constructing dwellings on raised, well compacted fill material above flood levels. Properly designing and constructing footings and foundations, using adequately reinforced concrete, and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the very slow permeability and the wetness, this soil is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons, surrounded by levees, can function adequately if municipal sewerlines are unavailable.

This soil is suitable as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and strengthening the subgrade with crushed rock or other suitable material minimize the road damage caused by low strength and by flooding. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by wetness, frost action, and shrinking and swelling.

The land capability classification is IIe. No woodland ordination symbol is assigned.

27C2—Gifford silt loam, 5 to 9 percent slopes, eroded. This moderately sloping, poorly drained soil is on dissected terraces and on terrace rims. It is subject to rare flooding. Typically, water erosion has removed some of the original surface layer and the remaining surface soil has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from about 5 to 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is brown, mottled, firm silty clay loam in the upper part; mottled brown and light brownish gray, firm silty clay in the next part; and coarsely mottled light gray and yellowish brown, firm silty clay loam in the lower part. In places the dark surface layer is less than 6 inches thick.

Included with this soil in mapping are a few areas of the nearly level Chariton soils, which have a thick, grayish brown subsurface layer. These soils generally are adjacent to the uplands on the flattest parts of the mapped areas. They make up 5 percent or less of the unit.

Permeability is very slow in the Gifford soil. Surface runoff is medium. Natural fertility also is medium, and organic matter content is moderately low. The available water capacity is moderate. A perched water table generally is at a depth of 0.5 foot to 2.0 feet in most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be fairly easily tilled throughout a moderate range in moisture content.

Most areas are used for cultivated crops or for pasture. This soil is suitable for corn, soybeans, grain sorghum, and wheat. Water erosion is a severe hazard in cultivated areas. It can be controlled in the larger areas by a system of conservation tillage that leaves a protective cover of crop residue on the surface, by contour stripcropping, or by a combination of terraces and grassed waterways or tile outlets. A diversion at the base of the adjacent uplands can intercept surface water and make the soil easier to till in spring months. Good crop residue management can help to maintain fertility and the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is moderately well suited to reed canarygrass and is moderately suited to birdsfoot trefoil and ladino clover. Water erosion during seedbed preparation is the main management problem. Wetness is also a concern. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. Species that can withstand wetness grow best. Restricted grazing during wet periods can help to keep the pasture in good condition.

This soil is not suitable for building site development unless special measures are applied to minimize the effects of shrinking and swelling, wetness, and flooding. The hazard of flooding can be reduced by constructing dwellings on raised, well compacted fill material above flood levels. Properly designing and constructing footings and foundations, using adequately reinforced concrete, and backfilling with sand or gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Because of the very slow permeability and the wetness, this soil is unsuitable as a site for septic tank absorption fields. Properly constructed sewage lagoons, surrounded by levees, can function adequately if municipal sewerlines are unavailable. If lagoons are constructed, some leveling of the site will be needed.

This soil is suitable as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and strengthening the subgrade with crushed rock or other suitable material minimize the road damage caused by low strength and by flooding. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by wetness, frost action, and shrinking and swelling.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

29—Humeston silt loam. This nearly level, poorly drained soil is on second bottoms. Many areas are occasionally flooded, unless they are protected by levees. Individual areas are irregular in shape and range from about 10 to 90 acres in size.

Typically, the surface layer is very dark grayish brown and very dark gray, friable silt loam about 14 inches thick. The subsurface layer is dark gray, mottled, friable and firm silt loam about 12 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm silty clay loam. It is very dark gray in the upper part and grayish brown in the lower part. In places the dark surface layer is thinner. In some areas the subsoil has more clay, and in a few other areas it has less clay.

Included with this soil in mapping are areas of Blackoar, Chequest, and Fatima soils. Blackoar soils, which have less clay in the lower part than the Humeston soil, and the moderately well drained Fatima soils are adjacent to the stream channels. Chequest soils do not have a subsurface layer. They are on the lower parts of the flood plains, farther from the stream channels. Included soils make up about 15 percent of the unit.

Permeability is very slow in the Humeston soil. Surface runoff is slow. Natural fertility is medium, and organic matter content is moderate. The available water capacity is high. A seasonal high water table generally is within a depth of 1 foot in most winter and early spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops, but a few are used for hay or pasture. This soil is suitable for corn, soybeans, grain sorghum, and wheat. Wetness and flooding are the main management problems. Shallow parallel ditches can improve surface drainage. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration in cultivated areas. In many areas a diversion at the base of the adjacent uplands can prevent additional surface water from flowing onto this soil. In some years flooding can cause crop damage and can delay planting.

This soil is moderately well suited to reed canarygrass and is moderately suited to birdsfoot trefoil and ladino clover. The wetness and the flooding are the main management problems.

This soil generally is not suitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIIw. No woodland ordination symbol is assigned.

31A—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil primarily is on the flood plains along the smaller streams. It is frequently flooded for brief periods. Individual areas are long and narrow and range from about 5 to more than 60 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 7 inches thick. The subsurface layer is very dark gray and black, friable and firm silty clay loam about 23 inches thick. The subsoil to a depth of about 52 inches is mottled black and dark gray, firm silty clay loam. The substratum to a depth of 67 inches or more is dark gray, mottled, firm silty clay loam. Some areas have overwash of silt loam less than 12 inches thick. In places the soil is silt loam throughout and is lighter in color. In a few places the substratum has layers of silty clay.

Permeability is moderate. Surface runoff is slow. Natural fertility and organic matter content are high. The available water capacity also is high. The seasonal high water table is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is moderate throughout the profile. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture, but some of the larger areas are used for cultivated crops. This soil is moderately suited to reed canarygrass. Wetness and flooding are the main management problems and should be considered if hay production is planned.

This soil is suitable for corn, soybeans, and grain sorghum. Wetness is the main problem. Shallow parallel ditches can improve surface drainage. The hazard of flooding is a minor problem. Most damaging floods do not occur during the growing season for summer crops if planting is moderately delayed. Returning crop residue to the soil improves tilth and increases the rate of water infiltration.

This soil generally is unsuitable for building site development and onsite waste disposal because of the wetness and the flooding.

The land capability classification is IIIw. No woodland ordination symbol is assigned.

31B—Colo silty clay loam, 2 to 5 percent slopes. This gently sloping, poorly drained soil is on the flood plains along the smaller streams. It is frequently flooded for very brief periods. Individual areas are long and narrow and range from about 5 to more than 60 acres in size.

Typically, the surface soil is very dark gray, friable and firm silty clay loam about 13 inches thick. The subsurface layer is black, firm silty clay loam about 29 inches thick. The substratum to a depth of 60 inches or more is dark gray, mottled, firm silty clay. Some areas have overwash of silt loam less than 12 inches thick.

Permeability is moderate. Surface runoff is medium. Natural fertility and organic matter content are high. The available water capacity also is high. A seasonal high water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is moderate throughout the profile. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture, but some of the larger areas are used for cultivated crops. This soil is moderately suited to reed canarygrass. Wetness and flooding are the main management problems and should be considered if hay production is planned.

This soil is suitable for corn, soybeans, and grain sorghum. Flooding can cause crop damage in some years. Planting somewhat later than normal can minimize crop damage. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration in cultivated areas.

This soil generally is unsuitable for building site development and onsite waste disposal because of the wetness and the flooding.

The land capability classification is IIIw. No woodland ordination symbol is assigned.

35—Blackoar silt loam. This nearly level, poorly drained soil is on the relatively narrow flood plains along small tributary streams. In most areas it is frequently flooded for brief periods. Individual areas range from about 20 to more than 400 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 6 inches thick. The subsurface layer also is very dark gray, friable silt loam. It is about 11 inches thick. The subsoil is friable and firm silt loam about 33 inches thick. The upper part is dark gray, and the lower part is gray and mottled. The substratum to a depth of 60 inches or more is dark gray, mottled, firm silty clay loam. In some places the very dark gray surface soil is less than 10 inches thick, and in other places the lower layers are browner. In a few places a more clayey buried soil is at a depth of more than 30 inches. In a few areas the surface layer is silty clay loam, which in places is overwash.

Included with this soil in mapping are areas of the moderately well drained Kennebec and Fatima soils adjacent to stream channels. These soils make up about 15 percent of the unit.

Permeability is moderate in the Blackoar soil. Surface runoff is slow. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. A seasonal high water table generally is within a depth of 1 foot during most winter and early spring months. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops or pasture. This soil is suitable for corn, soybeans, grain sorghum, and wheat; however, the crop damage caused by flooding and wetness is common. The flooding is often of such short duration that in some years flood damage is not severe. Most areas are too narrow to be tilled separately from the adjacent upland or terrace soils. In some of the wider areas, diversions at the base of the slope can prevent water from flowing onto the bottom land. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is moderately suited to reed canarygrass. The wetness and the flooding are the main management problems and should be considered when the grazing system is designed or if hay production is planned.

A small acreage is forested. This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the soil is dry or frozen. Planting container-grown nursery stock can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

36—Chequest silty clay loam. This nearly level or depressional, poorly drained soil is on the larger flood plains. Most areas that are not protected by levees are frequently flooded. Individual areas are irregular in shape and range from about 10 to more than 200 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 5 inches thick. The subsurface layer is very dark gray, firm silty clay loam about 5 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm silty clay loam. It is dark gray in the upper part and gray in the lower part. In some places the dark surface soil is more than 18 inches thick, and in other places the subsoil contains more clay. In a few areas the soil has less clay in the lower part.

Included with this soil in mapping are areas of the somewhat poorly drained Vesser soils. These soils are in the slightly higher landscape positions. They make up about 10 percent of the unit.

Permeability is moderately slow in the Chequest soil. Surface runoff is slow. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. A seasonal high water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is high throughout the profile. The surface layer is friable when dry but sticky when wet and is somewhat difficult to till.

Most areas are used for cultivated crops or trees. This soil is suitable for corn, soybeans, and grain sorghum. The flooding and the wetness are the main management problems. Shallow parallel ditches can improve the poor surface drainage. Planting of crops may be delayed in some years because of the flooding and the wetness. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration in cultivated areas. Fall tillage can improve tilth in the surface layer and generally allows earlier seeding in the spring.

This soil is moderately well suited to reed canarygrass and is moderately suited to ladino clover and birdsfoot trefoil. The species that can withstand wetness grow best. The wetness and the flooding are the main management problems. They should be considered when the grazing system is designed or if hay production is planned.

This soil is suited to trees. The equipment limitation is a management concern. Equipment should be used only when the soil is dry or frozen.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 7W.

37—Zook silty clay loam. This nearly level, poorly drained soil is on the larger flood plains. Most areas are not protected by levees and are frequently flooded for brief periods. Individual areas are irregular in shape and range from about 10 to more than 75 acres in size.

Typically, the surface layer is black, firm silty clay loam about 8 inches thick. The subsurface layer is about 37 inches of black, firm silty clay loam and black and very dark gray, mottled, firm silty clay. The subsoil to a depth of 60 inches or more is dark gray, mottled, firm silty clay. In places the surface layer is silt loam to a depth of 10 to 15 inches. In some areas the soil has less clay and is lighter gray in the lower part. In other areas the subsoil has more clay and is lighter gray throughout.

Included with this soil in mapping are small areas of Humeston soils adjacent to the uplands. These soils are less clayey in the upper layers than the Zook soil. They make up about 5 percent of the unit.

Permeability is slow in the Zook soil. Surface runoff is slow or very slow. Natural fertility and organic matter content are high. The available water capacity is moderate. A seasonal high water table generally is within a depth of 3 feet during most winter and early spring months. The shrink-swell potential is high throughout the profile. The surface layer is firm when dry but sticky when moist and cannot be easily tilled.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and grain sorghum. Planting of crops may be delayed in some years because of the flooding and the wetness. Shallow parallel ditches can improve the poor surface drainage in some areas. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration in cultivated areas. Fall tillage can improve tilth in the surface layer and generally allows earlier seeding in the spring.

This soil is moderately well suited to reed canarygrass and is moderately suited to ladino clover and birdsfoot trefoil. The species that can withstand wetness and flooding grow best. The wetness and the flooding are the main management problems. They should be considered when the grazing system is designed or if hay production is planned.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. No woodland ordination symbol is assigned.

38—Landes loam. This nearly level, moderately well drained soil is on the small natural levees opposite the point bars of the larger stream channels. It also extends across the entire width of some narrow flood plains. Most areas are not protected by levees and are frequently flooded for brief periods. Individual areas range from about 5 to 25 acres in size.

Typically, the surface layer is dark brown, friable loam about 8 inches thick. The subsurface layer is dark brown, friable fine sandy loam about 9 inches thick. The subsoil is brown, friable fine sandy loam about 23 inches thick. The substratum to a depth of 60 inches or more is brown and light brownish gray, friable fine sandy loam and loamy fine sand. In places the substratum has more silt and is grayer. In a few areas the soil has overwash of fine sandy loam as much as 10 inches thick.

Included with this soil in mapping, primarily on the flood plains along small streams, are areas of Fatima and Kennebec soils. These soils typically are in abandoned stream channels and adjacent to the uplands. They are less sandy throughout than the Landes soil. Also, Fatima soils have grayer mottles in the lower part of the solum and Kennebec soils are dark to a depth of 36 inches or more. The included soils make up about 15 percent of the unit.

Permeability is moderately rapid in the Landes soil. Surface runoff is slow. Natural fertility is medium, and organic matter content is moderately low. The available water capacity is high. A seasonal high water table generally is at a depth of 4 to 6 feet during most winter and early spring months. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops, but a significant acreage is woodland. This soil is suitable for corn, soybeans, and grain sorghum. Planting of crops may be delayed in some years because of the flooding and the wetness. The flooding generally is of short duration, but a small amount of flood damage can be expected in some years.

This soil is well suited to trees. The frequent flooding affects woodland less than it does other land uses. No major hazards or limitations affect timber management.

A few areas are used for pasture. This soil is well suited to ladino clover, reed canarygrass, tall fescue, and switchgrass. It is moderately well suited to birdsfoot trefoil, red clover, orchardgrass, smooth bromegrass, timothy, big bluestem, and indiangrass. Droughtiness and flooding are the main management problems. The species most suitable for planting are those that are deep rooted and resistant to flood damage. The hazard of flooding should be considered when the grazing system is designed or if hay production is planned.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 10A.

39—Kennebec silt loam. This nearly level, moderately well drained soil is on narrow flood plains. It is frequently flooded for brief periods. Individual areas range from about 5 to 60 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 15 inches thick. The subsurface layer is black, friable silt loam about 30 inches thick. The substratum to a depth of 70 inches or more is dark grayish brown, mottled, friable silt loam. In some areas the soil is stratified with lighter colored material below the surface layer. In places the content of clay in some of the layers below the surface layer averages more than 30 percent.

Included with this soil in mapping are intermingled areas of Blackoar and Landes soils. Blackoar soils are grayer in the lower part than the Kennebec soil. Landes soils contain more sand throughout the solum than the Kennebec soil. The included soils make up about 15 percent of the unit.

Permeability is moderate in the Kennebec soil. Surface runoff is slow. Natural fertility and organic matter content are high. The available water capacity also is high. A seasonal high water table generally is at a depth of 3 to 5 feet during most winter and early spring months. The shrink-swell potential is moderate throughout the profile. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for woodland, pasture, or cultivated crops. This soil is well suited to trees. The frequent flooding affects woodland less than it does other land uses. No major hazards or limitations affect timber management.

This soil is well suited to alfalfa, birdsfoot trefoil, ladino clover, red clover, orchardgrass, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to smooth bromegrass, big bluestem, and indiangrass. Flooding is the main management problem. The species that can withstand flooding grow best. The hazard of flooding should be considered when the grazing system is designed or if hay production is planned.

This soil is suitable for corn, soybeans, and grain sorghum. The flooding is often of such short duration that in some years flood damage is not severe. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration in cultivated areas.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 3A.

40—Portage silty clay. This nearly level or depressional, very poorly drained soil is on the larger flood plains. In most areas it is frequently flooded for brief periods. It also is ponded for brief periods. Individual areas are irregular in shape and range from about 25 to more than 500 acres in size.

Typically, the surface layer is very dark gray, friable silty clay about 5 inches thick. The subsurface layer is very dark gray, mottled, firm clay about 7 inches thick. The subsoil is very dark gray, mottled, firm and very firm clay about 31 inches thick. The substratum to a depth of 60 inches or more is dark gray, mottled, very firm clay. In some areas the soil has less clay within a depth of 28 inches. In places the lower part of the subsoil is grayer. In a few areas the soil is more silty and less clayey below a depth of about 30 inches.

Included with this soil in mapping are areas of a Portage soil outside the levees. This included soil is frequently flooded and ponded for long periods. It makes up about 3 percent of the unit.

Permeability is very slow in this Portage soil. Surface runoff also is very slow. Natural fertility is medium, and organic matter content is moderate. The available water capacity also is moderate. A seasonal high water table generally is above the surface or within a depth of 1 foot during most winter and early spring months. The shrink-swell potential is very high throughout the profile. The surface layer cannot be easily tilled under most moisture conditions. If it is tilled when wet, this soil becomes very cloddy and cannot be easily managed.

Most areas are used for cultivated crops. This soil is suitable for corn, soybeans, grain sorghum, and wheat. The wetness and the flooding are the main management problems. The very slow surface runoff and very poor internal drainage make removal of excess water from cultivated areas difficult. Shallow parallel ditches and land grading can improve surface drainage. Good crop residue management can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration. Fall tillage also can improve tilth in the surface layer and usually allows earlier seeding in the spring.

This soil is moderately well suited to reed canarygrass and is moderately suited to ladino clover and birdsfoot trefoil. The species that can withstand wetness and flooding grow best. The wetness and the flooding are the main management problems. They should be considered when the grazing system is designed or if hay production is planned.

This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only when the soil is dry or frozen. Planting container-grown nursery stock can improve seedling survival. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

41—Vesser silt loam. This nearly level, poorly drained soil is on high flood plains. Most areas are occasionally flooded, unless they are protected by levees. Individual areas are irregular in shape and range from about 5 to more than 350 acres in size.

Typically, the surface layer is black, friable silt loam about 8 inches thick. The subsurface layer is very dark gray, gray, and dark gray, friable silt loam about 19 inches thick. The subsoil to a depth of 64 inches or more is very dark gray, mottled, firm silty clay loam. In many places, the dark surface layer is much thinner and the remainder of the solum is lighter gray. In some areas the surface layer is silty clay loam. In other areas the subsoil has more clay below a depth of about 30 inches.

Included with this soil in mapping are areas of Chequest and Colo soils. Chequest soils are more clayey than the Vesser soil. They are on the slightly lower parts of the landscape. Colo soils have dark upper layers that are thicker than those of the Vesser soil. They are adjacent to the uplands, in areas where small drainageways flow out onto the wider flood plains. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Vesser soil. Surface runoff is slow. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. A seasonal high water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is moderate throughout the profile. The surface layer is friable and can be easily tilled throughout a moderately wide range in moisture content.

Most areas are used for cultivated crops. This soil is suitable for corn, soybeans, grain sorghum, and wheat. Planting of crops may be delayed in some years because of the flooding and the wetness. In some years flood damage is minimal. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration in cultivated areas. In some areas a diversion along the base of the adjacent uplands can help to keep additional surface water away from this soil.

This soil is moderately suited to reed canarygrass. The wetness and the flooding are the main management problems. They should be considered when the grazing system is designed or if hay production is planned.

This soil is not suitable for building site development unless special measures are used to protect the sites from the flooding and the wetness. In some areas surface drainage can be improved and the flood hazard reduced by constructing dwellings on raised, well compacted fill material above the level of flooding. Constructing the foundations and footings with adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

Properly constructed sewage lagoons, surrounded by levees, can be used for waste disposal if municipal sewerlines are unavailable.

This soil is suitable as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and strengthening the subgrade with crushed rock or other suitable material can minimize the road damage caused by flooding and by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by wetness, frost action, and shrinking and swelling.

The land capability classification is IIw. No woodland ordination symbol is assigned.

43—Fatima silt loam. This nearly level, moderately well drained soil typically is on flood plains adjacent to the larger streams and along some small streams. Many areas are not protected by levees and are frequently flooded. Individual areas are elongated and range from about 50 to more than 300 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 15 inches thick. The subsoil is dark grayish brown and brown, friable silt loam about 19 inches thick. The substratum to a depth of 60 inches or more is brown, friable loam. In some areas the soil is brown silt loam to a depth of 40 inches or more and has a few grayish brown or pale brown mottles in the lower part.

Included with this soil in mapping are areas of Blackoar soils. These soils generally are adjacent to the uplands. They have a dark surface layer that is thicker than that of the Fatima soil and have a lighter gray substratum. They make up about 10 percent of the unit.

Permeability is moderate in the Fatima soil. Surface runoff is slow. Natural fertility is high, and organic matter content is moderate. The available water capacity is high. A seasonal high water table generally is at a depth of 3 to 5 feet during most winter and early spring months. The shrink-swell potential is low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as woodland, but a few are used for cultivated crops or pasture. This soil is well suited to trees. The frequent flooding affects woodland less than it does other land uses. No major limitations or hazards affect timber management.

This soil is suitable for corn, soybeans, grain sorghum, and wheat. The flooding is often of such short duration on the flood plains along small streams that flood damage is not severe, and most of the cultivated crops are grown in these areas. Because the flooding is longer in duration and more damaging to grain crops, a relatively small acreage of the flood plains along the larger streams is tilled. The few areas that are protected by levees are tilled. A system of conservation tillage that leaves a protective cover of crop residue on the surface can help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration in cultivated areas.

A few areas are used for pasture. This soil is well suited to birdsfoot trefoil, ladino clover, red clover, orchardgrass, reed canarygrass, tall fescue, timothy, and switchgrass. It is moderately well suited to alfalfa, smooth bromegrass, big bluestem, and indiangrass. Flooding is the main management problem. The species that can withstand flooding grow best. The hazard of flooding should be considered when the grazing system is designed or if hay production is planned.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 5A.

90—Udorthents, nearly level. These nearly level, somewhat poorly drained soils are on scalped uplands and terraces. They occur as excavated areas that were used for highway and railroad fill. Individual areas are irregular in shape and range from 4 to 25 acres in size.

Typically, the surface layer is brown, firm clay loam about 1 inch thick. The substratum is very firm clay loam more than 60 inches thick. The upper part is dark yellowish brown and mottled; the next part is yellowish brown and mottled; and the lower part is mottled yellowish brown, brown, and grayish brown. In some areas the surface layer is silty clay loam and is thicker. Some areas are gently sloping and moderately sloping. In places the substratum is clay.

Permeability is slow. Surface runoff is medium or rapid. Natural fertility and organic matter content are very low. The available water capacity is low. A seasonal high water table generally is at a depth of 1 to 3 feet during most winter and early spring months. The shrink-swell potential is moderate in the substratum. The surface layer is firm and is difficult to till under most moisture conditions. It becomes cloddy and cannot be easily managed if tilled when too wet.

Most areas are used for cultivated crops, hay, or pasture. These soils are poorly suited to soybeans, grain sorghum, and winter wheat because of seasonal wetness, low available water capacity during summer months, and compaction. If cultivated crops are grown, water erosion is a hazard in the steeper areas. It can be controlled by a system of conservation tillage that leaves a protective cover of crop residue on the surface and by winter cover crops. Additions of crop residue or other organic material improve fertility and tilth and increase the rate of water infiltration.

These soils are moderately well suited to ladino clover and are moderately suited to birdsfoot trefoil, reed canarygrass, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. Compaction and water erosion during seedbed preparation are the main management problems. Timely tillage and a quickly established ground cover can help to prevent excessive soil loss.

These soils are suitable for building site development if foundations and footings are properly designed and constructed. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the structural damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

These soils are unsuitable as sites for septic tank absorption fields because of the slow permeability and the wetness. Properly constructed sewage lagoons can function adequately if the lagoons are sealed with suitable material to prevent seepage.

These soils are suitable as sites for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material helps to prevent the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. No woodland ordination symbol is assigned.

94F—Lenzburg silty clay loam, 2 to 35 percent slopes. This gently sloping to steep, well drained soil is on upland mine spoils. Individual areas are elongated and range from 4 to 150 acres in size.

Typically, the surface layer is grayish brown, friable silty clay loam about 2 inches thick. The substratum to a depth of 60 inches or more is grayish brown, olive gray, and light olive gray, firm silty clay loam.

Permeability is moderately slow. Surface runoff is slow to rapid. Natural fertility and organic matter content are very low. The available water capacity is high. The shrink-swell potential is moderate throughout the profile. The surface layer is firm and is difficult to till under most moisture conditions. It becomes cloddy and cannot be easily managed if tilled when too wet.

Most areas are used for hay and pasture or support trees and brush. This soil is unsuited to cultivated crops because of the steep and uneven slopes, the very low fertility, and compaction near the surface in some areas.

This soil is moderately well suited to birdsfoot trefoil, reed canarygrass, tall fescue, big bluestem, and indiangrass. The more shallow rooted species grow best in reshaped areas. Seedbed preparation may be difficult except under optimum moisture conditions. Establishing a good ground cover before the end of the growing season is important.

Trees can be grown in areas of this soil that have not been smoothed or leveled since the spoil was deposited. Black locust and eastern white pine are two of the more suitable species for planting. Water erosion and the equipment limitation are the main management concerns. Special techniques may be required for seeding or planting and for preventing excessive water erosion because of the steepness and irregularity of the slopes.

This soil is suitable for building site development if the site can be leveled and shaped. The cost of preparing the site may be significant. Separating site preparation and construction by 1 or 2 years allows the soil to settle. Proper design of footings and foundations is important. Using adequately reinforced concrete and backfilling with sand and gravel can minimize the damage caused by shrinking and swelling. Installing tile drains around the foundations and footings can help to prevent the damage caused by excessive wetness.

This soil generally is unsuitable as a site for septic tank absorption fields because of the moderately slow permeability. Properly constructed sewage lagoons can function adequately if a site that is large enough can be leveled.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material can minimize the road damage caused by low strength. Constructing adequate roadside ditches and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is VIe. The woodland ordination symbol is 5R.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 165,000 acres in the survey area, or 41.5 percent of the total acreage, meets the soil requirements for prime farmland. Most of this land is in the broad uplands and on terraces in the southwestern part of the county. The remainder is on the broader ridges and some of the bottom land and terraces throughout other parts of the county. About 120,000 acres of this prime farmland is used for cultivated crops. The crops grown on this land, mainly corn and soybeans, account for an estimated 81.5 percent of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help to prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Mike Painting, soil conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Approximately 46 percent of the 397,568 acres in Linn County is cropland. The principal cultivated crops are soybeans, corn, wheat, and grain sorghum. Much of the remainder of the county is used for pasture or hayland.

The major management needs on the cropland and pasture in the survey area are measures that control water erosion and flooding, reduce wetness, and help to maintain tilth. A combination of measures is needed in many areas.

Water erosion is a major problem on most of the upland soils in Linn County. It is a hazard in all cultivated areas where the slope is more than 2 percent. In the steeper areas where grassland has been converted to cropland, surface runoff increases the potential for severe erosion. These areas are better suited to pasture and hayland than to cultivated crops. The soils in the survey area that are best suited to row crops are those on bottom land and most stream terraces that are not frequently flooded and those in upland areas with a slope of less than 5 percent. Erosion-control measures may also be needed in these areas.

Loss of the surface layer through erosion reduces the productivity of the soils. The subsoil is gradually incorporated into the plow layer. As a result, tilth deteriorates and the available water capacity, the content of organic matter, and the seedling survival rate are reduced. The eroding sediments are deposited in streams, lakes, and ponds; the resulting sedimentation lowers water quality for municipal uses, for recreation, and for fish and wildlife. The sediments sometimes fill road ditches and cover rural roads. Cleaning and clearing these areas can be costly.

Control of erosion helps to maintain the productivity of the soils and minimizes the sedimentation of streams, lakes, and ponds. A number of conservation practices, used singularly or in combinations, can help to reduce soil loss. The practices provide a protective plant cover, reduce the runoff rate, and increase the rate of water infiltration.

Contour stripcropping is an important conservation practice on steep or complex slopes where the cost of constructing terraces is prohibitive. Strips are planted with grass sod or a close-grown crop that produces a high percentage of ground cover. This ground cover protects the soil from the impact of raindrops. Planting the grass strips on the contour reduces the velocity of the runoff water. Surface water moves through the grass strips slowly enough to allow the suspended soil particles to settle out. These grass strips are cut for hay and used for livestock feed.

Terraces aid in reducing the length of slopes and thus the runoff rate and the hazard of erosion. They are most practical and economical on long, smooth upland slopes of less than 8 percent. Terraces with tile outlets store runoff after a heavy rain, then allow the water to drain off slowly through the underground tile. Conventional broad-base terraces reduce the length of slopes. Because the gradient of the slopes is increased on the terraces, however, further erosion-control measures, such as crop residue management, are needed. Narrow-base terraces and terraces that have steep, grassed back slopes reduce both the length and the steepness of the slopes. The ones that have grassed back slopes are normally used on the steeper slopes, but a combination of terrace types can be used on an undulating landscape or a diversified topography. As with other conservation practices, it is often necessary to apply additional measures, such as no-till, minimum tillage, and crop rotations that include grasses and legumes, to minimize soil loss. Where a clayey subsoil is exposed during terracing, applications of a greater amount of lime and fertilizer may be required during the next few years or it may be necessary to plant a drilled crop, such as wheat, to increase the amount of organic residue in the plow layer. The practice of "topsoiling" involves scraping off topsoil, constructing the terrace with the subsoil material, then spreading the topsoil back over the terrace and the channel.

On some relatively stable landscapes in the western and south-central parts of the county, a cropping system that keeps a cover of plants or crop residue on the surface can minimize the hazard of erosion. Minimum tillage or no-till generally is sufficient on these landscapes. A crop rotation that includes grasses and legumes improves tilth, provides nitrogen for the following crop, and helps to control erosion.

Flood control is a management concern on bottom land and low terraces. Levees have been used extensively along the streams in some parts of the county to control flooding. Flood control has increased the amount of bottom land that meets the requirements for prime farmland.

Surface drainage is a management concern on several soils in the county, such as Chariton soils on stream terraces and Colo, Blackoar, Chequest, Humeston, Portage, Vesser, and Zook soils on bottom land. Drainage systems normally are not used on upland soils. Shallow ditches, called "W" ditches, and land grading commonly are used on the terraces and bottom land if the wet area is several acres or larger in size and a suitable outlet is available.

Soil management practices have an important influence on tilth. Good tilth enhances the germination of seeds and increases the rate of water infiltration in the soil.

The uneroded upland soils in the survey area that are used for crops have a silt loam or loam surface layer that is dark in color and moderate in organic matter content. Generally, tillage and compaction weaken the structure of silt loams, and intense rainfall causes the surface to crust. The crust is hard when dry. As a result, it reduces the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material can improve soil structure and tilth.

The eroded upland soils normally have a higher content of clay in the surface layer than the uneroded upland soils. This additional clay results in poorer tilth, a slower infiltration rate, and a greater amount of runoff. Effective conservation practices are needed on these eroded soils.

When terraces are built, a common practice is to construct the terrace berm almost entirely from topsoil. This practice leaves the terrace channel with a high clay content, poor tilth, low fertility, and the lowest productivity in the field. A more effective procedure is to move the topsoil into windrows or piles with a dozer or scraper, build the terrace berm with the clayey subsoil, and then spread the topsoil over both the berm and the terrace channel. This system will take longer and cost more, but productivity will be higher for the first several years after terracing.

In some years severely eroded soils and nearly level, poorly drained soils are wet until late in the spring. Tilling these soils when they are too wet will cause clodding. Because of the cloddiness, preparing a good seedbed is difficult. This problem can be minimized on soils that are not subject to erosion by tilling in the fall for the next spring's crop.

The soils in the county produce a large amount of row crops, but they are equally well suited to close-growing crops, such as wheat, legumes, cool-season grasses, and warm-season native grasses. Legumes, such as alfalfa, ladino clover, and red clover, can be grown for hay in pure stands or in combination with cool-season grasses, such as bromegrass, orchardgrass, timothy, tall fescue, and reed canarygrass. Birdsfoot trefoil yields quality forage for many years when it is properly managed. It is more drought resistant than red clover, is less sensitive to poor drainage than alfalfa, and does not cause bloating in livestock.

Good pasture management is a very important aspect of soil conservation. Overgrazing can increase the hazard of gully erosion and even of sheet erosion in places. Rotation grazing and restricted grazing during wet periods increase the rate of water infiltration, reduce the runoff rate, and minimize the hazard of erosion.

Maximum forage production can be obtained by a rotation system that includes both cool-season grasses and warm-season native grasses. This system allows livestock to be pastured on the cool-season grasses about 9 months per year. During the hot summer months, cool-season grasses are dormant and the warm-season grasses grow well. The quality of the midsummer pasture will make up for the limited number of months that the native grasses are productive. The management needs for establishing and grazing warm-season grasses, such as big bluestem, switchgrass, and indiangrass, are different from those for cool-season grasses. Prescribed burning may be needed to control undesirable vegetation and improve forage quality and quantity in areas of warm-season grasses. Burning generally is needed no more than once in 3 to 5 years. Before proper grazing management practices can be applied, fields of warm-season grasses should be separated from fields of cool-season grasses.

The upland soils that are poorly suited to row crop production because of the slope and the hazard of erosion are well suited to the production of grasses and legumes. Alfalfa stands are maintained for the longest period on the moderately well drained Purdin and Winnegan soils. The other legumes and the grasses grow well on any of the upland soils, except for the severely eroded soils, which tend to be droughty and low in fertility. The severely eroded soils require more intensive management to obtain an adequate stand or to produce an acceptable amount of forage.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and a harvesting method that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(20)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

Approximately 6 percent of the land area in Linn County is forested *(22)*.

An understanding of soils helps to explain how forest types develop and tree growth occurs. For example, white oak grows well on deep moist soils, and hickories, post oak, and chinkapin oak are more prevalent where the rooting depth is restricted or the moisture supply is limited. The soil serves as a reservoir for moisture, provides an anchor for roots, and supplies most of the available plant nutrients. The soil properties that directly or indirectly affect these growth requirements include reaction, fertility, drainage, texture, structure, and depth. Landscape position also is important.

Available water capacity is primarily influenced by texture, rooting depth, and content of stones, shale, and chert. Deep silt loams, such as Fatima silt loam, have a high available water capacity. The depth to bedrock reduces the amount of available water and restricts root development. These limitations reduce the productive potential of the site. Although little can be done to overcome these limitations, planting the species best suited to the soils helps to maximize woodland productivity.

The supply of plant nutrients in the soil also affects tree growth. The role of the mineral horizons is important. Many upland soils have a subsoil that is leached and thus contains few nutrients. Most soils on bottom land have a substratum that contains larger amounts of nutrients than is characteristic of the upland soils.

Decomposition of a layer of leaf litter recycles the nutrients that have accumulated in the forest ecosystem over long periods. Fire, excessive trampling by livestock, and erosion can result in loss of these nutrients. Forest management should include fire prevention and protection from overgrazing.

Among the site characteristics that affect tree growth are aspect and position on the landscape. These characteristics influence such factors as the amount of available sunlight, air drainage, soil temperature, and moisture relations. Because of these factors, north- and east-facing slopes generally are the best upland sites for tree growth.

The Lagonda-Armstrong-Grundy association, which is described under the heading "General Soil Map Units," has very few forested areas. The predominant natural vegetation was prairie grasses. Timber grew in drainageways and in the steeper areas of Armstrong soils, which are prairie-timber transition soils. Forest species typical of an oak-hickory forest were common on these soils.

The Armstrong-Purdin and Winnegan-Keswick associations support significant amounts of forest cover. The major timber type is white oak-northern red oak-hickory. Other common species are black oak, post oak, chinkapin oak, shingle oak, white ash, sugar maple, elm, and black walnut. Pure stands of white oak are on the Winnegan and Keswick soils on north- and east-facing slopes. With good management, these soils are capable of producing high-quality trees.

The Portage-Fatima-Vesser and Vesser-Blackoar-Fatima associations, which are on bottom land, support some forest species in narrow strips along the major rivers and tributaries and in areas that are frequently flooded or are too poorly drained for crop production. Typical species include cottonwood, silver maple, black willow, green ash, hackberry, pecan, American elm, and boxelder. Fatima soils are considered excellent for the production of black walnut. Portage and Chariton are examples of poorly drained soils that have potential for pecan production. These soils are highly productive and respond well to intensive forest management.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

Much of the county, especially the prairie areas represented by the Lagonda-Armstrong-Grundy association, could benefit from the establishment of farmstead or feedlot windbreaks. Farmstead windbreaks protect the farmstead area from blowing snow, reduce windchill, beautify the area, and reduce home heating costs by as much as 25 to 33 percent *(3)*. Windbreaks also protect livestock, fruit trees, and gardens and provide habitat for wildlife.

Field windbreaks are needed in areas of the Portage-Fatima-Vesser association and in several areas of the other associations where row crops are extensively grown. The windbreaks can significantly improve the yields on cropland. They tend to moderate the extremes of cold, dry, windy conditions, and hot, dry, windy conditions.

A planned windbreak system, alone or in combination with other management practices, can significantly reduce the hazard of soil blowing, which occurs most frequently when large fields are bare and dry. Soil blowing damages the fields by destroying drainage patterns and by removing productive soil layers and nutrients. Also, the abrasive action of windblown soil particles can damage new seedlings.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from a commercial nursery or from local offices of the Soil Conservation Service, the Missouri Department of Conservation, or the Cooperative Extension Service.

Recreation

Edward A. Gaskins, biologist, Soil Conservation Service, helped prepare this section.

In 1980, Linn County had 9,152 acres of recreational areas *(17)*. About 88 percent of this acreage was state owned. Ownership of the remaining 12 percent was divided among municipal, school, and other local entities. The facilities include water sports areas, golf courses, swimming areas, hunting and fishing areas, campgrounds, horseback and hiking trails, game courts, archery and shooting ranges, ball fields, picnic areas, playgrounds, horse arenas, and wildlife-viewing areas. The demand for recreational facilities in the county may increase slightly because of a projected small increase in population by 1990 *(7)*.

Fountain Grove Wildlife Area, which is more than 5,800 acres in size, is the largest state-owned public recreational area in the county. Mussel Fork Wildlife Area, which is 2,000 acres in size, is second largest, and Pershing State Park, with 1,836 acres, is third.

A 1974 inventory identified 12 private and semiprivate commercial recreation enterprises in the county *(11)*. These enterprises include a golf course, riding stables, a gun club, a drive-in theater, a historic site, a motorcross area, shooting preserves, a skeet range, and a waterfowl-shooting area.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Edward A. Gaskins, biologist, Soil Conservation Service, helped prepare this section.

Linn County is among the 11 counties in Missouri that make up the Northern Riverbreaks Zoogeographic Region *(10)*. Prior to cultivation, about 70 percent of this region was prairie and 30 percent was woodland. In 1983, about 33 percent of the acreage in the county was classified as grassland and no significant prairie areas remained. About 46 percent of the acreage was cropland, and 18 percent was wooded. Some of the problems affecting wildlife resources are the conversion of woodland to cropland, the enlargement of fields, the loss of wooded hedgerow cover between fields, and a grassland monoculture of tall fescue, which provides little plant diversity.

The vast majority of the wildlife habitat in the county is controlled by private landowners, and obtaining easy access for hunting is becoming more difficult as additional land is posted. The wildlife game species common in the county are primarily those that favor openland habitat.

The songbird population is good to excellent in each of the soil associations described under the heading "General Soil Map Units." The furbearer population is good. Raccoon, opossum, muskrat, coyote, mink, beaver, gray fox, and striped skunk are the principal furbearers in the county. A few marsh hawks and badgers remain in the county, even though their original grassland habitat has almost entirely disappeared.

More than 65 percent of all the associations in the county is used as cropland or grassland, which provides openland wildlife habitat. Small tracts of timber, waterways, hedgerows, fence rows, and other areas of woody or brushy cover within these associations provide the edge effect essential for the majority of openland wildlife species. These key habitat areas are fast disappearing in the parts of the county intensively used for agricultural purposes. The loss of woodland cover poses a serious threat to openland species.

The county's quail and rabbit population is good. The dove population also is good. It is enhanced by migratory flights during the hunting season in the fall. A few ring-necked pheasants are sighted each year, but the population is very small. The best pheasant habitat is in the northwestern part of the county.

About 35 percent of the Winnegan-Keswick association and 30 percent of the Vesser-Blackoar-Fatima association are wooded. These two associations provide the primary habitat for the woodland wildlife species in the county. Deer and turkey populations are good. The squirrel population is good throughout the county. The woodcock population is low, but migratory flights add to this number each year.

Wetland is by far the most scarce kind of wildlife habitat in the county. The Portage-Fatima-Vesser and Vesser-Blackoar-Fatima associations, which are on bottom land, provide nearly all of the wetland habitat in the survey area. Most of the remaining permanent wetland is in the southern half of the county, and hunting pressure is heavy in this area. Good populations of snow geese, blue geese, Canadian geese, and ducks use the bottom land during periods of high water. The remaining areas of permanent wetland are also used by these species. The wood duck population is good along selected streams.

The survey area has about 30 miles of perennial streams *(7)*. Locust Creek, the East and West Forks of Yellow Creek, and Mussel Fork provide public sport fisheries. They are inhabited by carp, suckers, flathead and channel catfish, and bluegill.

Impoundment fishing is available to the public at several lakes, ponds, and city reservoirs within the county. The Fountain Grove Wildlife Area and Pershing State Park offer a 30-acre lake, several 1- to 3-acre lakes, and numerous ponds for public fishing. City reservoirs at Marceline, Brookfield, and Linneus also provide fishing opportunities. The principal impoundment species are largemouth bass, channel catfish, bluegill, and crappie.

Recent estimates indicate that about 1,500 farm ponds and small lakes in the county have been stocked with fish. These ponds and lakes provide opportunities for limited public fishing.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, wheat, soybeans, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are tall fescue, orchardgrass, bromegrass, clover, alfalfa, indiangrass, switchgrass, trefoil, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, ragweed, beggarweed, foxtail, and partridge pea.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwoods and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, cherry, sweetgum, hawthorn, dogwood, hickory, blackberry, and maple. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Amur honeysuckle, autumn olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl-feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations.

For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, the shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), the shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 10). "Loam," for example, is soil that is

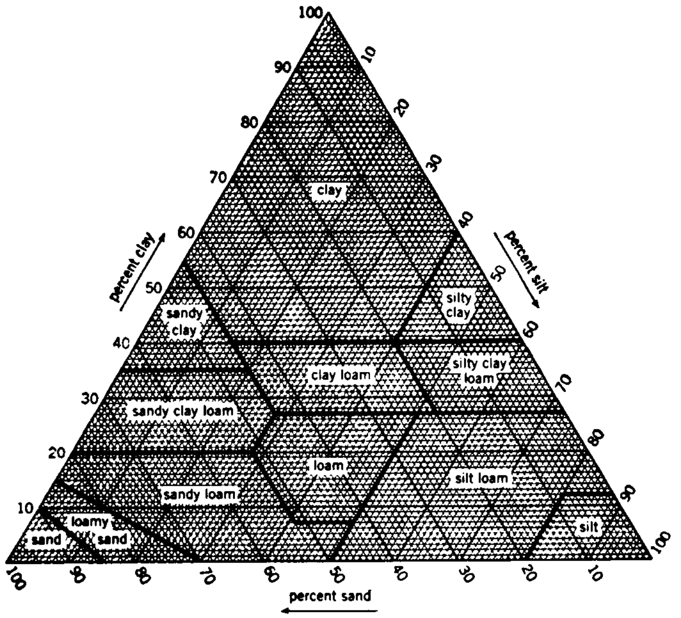

Figure 10.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance..In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content in each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous, loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(21)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aquollic* indicates that this subgroup is integrating to an Aquic suborder and Mollisol order. An example is Aquollic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, mesic Aquollic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (19)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (21)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Armstrong Series

The Armstrong series consists of deep, somewhat poorly drained soils on uplands. These soils formed in glacial till. Permeability is slow. Slopes range from 2 to 14 percent.

Typical pedon of Armstrong clay loam, 5 to 9 percent slopes, eroded, about 850 feet north and 1,600 feet east of the southwest corner of sec. 29, T. 59 N., R. 21 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; common fine pieces of brown (7.5YR 5/4) and strong brown (7.5YR 5/6) subsoil material; slightly acid; abrupt wavy boundary.

2Bt1—9 to 12 inches; dark brown (10YR 4/3) clay loam; common medium distinct yellowish brown (10YR 5/4) and few fine prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; common fine roots; few faint clay films on faces of peds; very dark grayish brown (10YR 3/2) organic coatings; medium acid; clear wavy boundary.

2Bt2—12 to 19 inches; brown (7.5YR 5/4) clay loam, common medium prominent dark grayish brown (10YR 4/2) and common fine prominent red (2.5YR 4/6) mottles; moderate very fine subangular blocky structure; firm; common fine roots; many distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

2Bt3—19 to 25 inches; mottled strong brown (7.5YR 5/6), light brownish gray (10YR 6/2), and yellowish red (5YR 4/6) clay; moderate very fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; strongly acid; gradual smooth boundary.

2Bt4—25 to 38 inches; dark yellowish brown (10YR 4/4) clay; common fine distinct light brownish gray (10YR 6/2) and few fine prominent reddish yellow (7.5YR 6/6) mottles; weak fine subangular blocky structure; very firm; few fine roots; common faint clay films on faces of peds; slightly acid; gradual smooth boundary.

2BC—38 to 50 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct light brownish gray (10YR 6/2) and few fine prominent strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; very firm; few faint clay films in root channels; few fine masses of carbonate; slight effervescence; mildly alkaline; gradual smooth boundary.

2C—50 to 60 inches; strong brown (7.5YR 5/6) clay loam; many coarse prominent light brownish gray (10YR 6/2) mottles; massive; very firm; few fine masses of calcium carbonate; slight effervescence; mildly alkaline.

The Ap horizon is loam or clay loam. The content of clay in the 2Bt horizon ranges from 38 to 50 percent.

Blackoar Series

The Blackoar series consists of deep, poorly drained soils on flood plains. These soils formed in silty alluvial sediments. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Blackoar silt loam, about 135 feet south and 2,450 feet east of the northwest corner of sec. 15, T. 60 N., R. 22 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; medium acid; abrupt wavy boundary.

A—6 to 13 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine subangular blocky structure; friable; common fine roots; medium acid; clear smooth boundary.

AB—13 to 17 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure; friable; few fine roots; common black (10YR 2/1) organic coatings; medium acid; clear smooth boundary.

Bg1—17 to 28 inches; dark gray (10YR 4/1) silt loam; moderate very fine subangular blocky structure; friable; few fine roots; common fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

Bg2—28 to 50 inches; gray (10YR 5/1) silt loam; many fine faint dark gray (10YR 4/1) and few fine distinct brown (10YR 4/3) mottles; weak fine subangular blocky structure; firm; few fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

Cg—50 to 60 inches; dark gray (10YR 4/1) silty clay loam; common medium faint gray (10YR 5/1) and few fine distinct brown (10YR 4/3) mottles; massive; firm; common fine concretions of iron and manganese oxide; medium acid.

The A horizon has chroma of 1 or 2. The C horizon has value of 4 or 5 and chroma of 1 or 2.

Chariton Series

The Chariton series consists of deep, poorly drained soils on stream terraces. These soils formed in loess and alluvial sediments. Permeability is slow. Slopes range from 0 to 2 percent.

Typical pedon of Chariton silt loam, about 1,975 feet west and 300 feet south of the northeast corner of sec. 12, T. 59 N., R. 21 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; common roots; slightly acid; abrupt wavy boundary.

E—9 to 15 inches; grayish brown (10YR 5/2) silt loam; common medium faint dark grayish brown (10YR 4/2) and few fine distinct very dark grayish brown (10YR 3/2) mottles; weak fine granular structure; friable; common roots; common fine concretions of iron and manganese oxide; medium acid; abrupt smooth boundary.

Bt1—15 to 25 inches; dark grayish brown (10YR 4/2) silty clay; few fine faint brown (10YR 5/3) mottles; common very dark grayish brown (10YR 3/2) organic stains on faces of peds; moderate very fine subangular blocky structure; firm; common roots; many distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt2—25 to 41 inches; grayish brown (10YR 5/2) silty clay; common medium faint dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; common black stains and few fine concretions of iron and manganese oxide; neutral; clear smooth boundary.

Bt3—41 to 58 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct brown (10YR 5/3) and few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; few roots; few faint clay films on vertical faces of peds; many black stains; neutral; clear smooth boundary.

C—58 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common coarse distinct dark yellowish brown (10YR 4/4) and few coarse faint brown (10YR 4/3) mottles; weak medium prismatic structure; firm; few black stains; common fine sand grains; neutral.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 or 5 and chroma of 1 or 2. The Bt horizon has chroma of 1 or 2.

Chequest Series

The Chequest series consists of deep, poorly drained soils on flood plains. These soils formed in alluvial sediments. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Chequest silty clay loam, about 2,650 feet south and 1,750 feet west of the northeast corner of sec. 35, T. 60 N., R. 21 W.

Ap—0 to 5 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; few roots; neutral; abrupt wavy boundary.

A—5 to 10 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; few roots; neutral; abrupt smooth boundary.

Bg1—10 to 21 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; firm; few roots; strongly acid; gradual smooth boundary.

Bg2—21 to 46 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct brown (10YR 4/3) mottles; few very dark gray (10YR 3/1) organic stains on faces of peds; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; firm; few roots; common fine concretions of iron and manganese oxide; strongly acid; gradual smooth boundary.

BCg—46 to 60 inches; gray (10YR 5/1) silty clay loam; common medium distinct brown (10YR 4/3) and few medium prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; firm; few roots; common fine concretions of iron and manganese oxide; medium acid.

The mollic epipedon is 10 to 18 inches thick. The A horizon has chroma of 1 or 2. The Bg horizon has hue of 10YR or 2.5Y and value of 4 to 6. It has mottles with hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 4.

Colo Series

The Colo series consists of deep, poorly drained soils on flood plains along small streams. These soils formed in silty alluvial sediments. Permeability is moderate. Slopes range from 0 to 5 percent.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, about 2,200 feet east and 90 feet north of the southwest corner of sec. 17, T. 60 N., R. 20 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; many roots; slightly acid; clear smooth boundary.

A1—7 to 14 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure parting to moderate very fine granular; friable; common roots; slightly acid; gradual smooth boundary.

A2—14 to 30 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; firm; few roots; medium acid; gradual smooth boundary.

Bg1—30 to 39 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; common fine distinct very dark grayish brown (10YR 3/2) mottles; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; firm; few fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

Bg2—39 to 52 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; common fine concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.

Cg—52 to 67 inches; dark gray (10YR 4/1) silty clay loam; few medium distinct dark yellowish brown (10YR 3/4) and common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure; firm; few fine concretions of iron and manganese oxide; slightly acid.

The mollic epipedon is 36 or more inches thick. The A horizon has chroma of 0 or 1. It typically is silty clay loam, but some pedons have overwash of silt loam. The upper part of the Bg horizon has the same color and texture as the A horizon. The lower part has value of 2 to 4 and chroma of 1 or 2.

Fatima Series

The Fatima series consists of deep, moderately well drained soils on flood plains. These soils formed in silty alluvial sediments. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Fatima silt loam, about 1,200 feet north and 720 feet west of the southeast corner of sec. 7, T. 60 N., R. 18 W.

A—0 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; many fine roots; neutral; clear wavy boundary.

Bw1—15 to 23 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.

Bw2—23 to 34 inches; brown (10YR 4/3) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; common fine roots; dark brown (10YR 3/3) coatings on faces of some peds; medium acid; diffuse smooth boundary.

C1—34 to 47 inches; brown (10YR 4/3) loam; common fine and medium distinct light brownish gray (10YR 6/2) and common medium faint dark brown (10YR 3/3) mottles; massive; friable; few fine roots; strongly acid; diffuse smooth boundary.

C2—47 to 66 inches; brown (10YR 4/3) loam; common coarse distinct light brownish gray (10YR 6/2), common medium faint dark brown (10YR 3/3), and few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; strongly acid.

The A horizon has chroma of 1 or 2. It typically is silt loam, but the range includes silty clay loam.

Gifford Series

The Gifford series consists of deep, poorly drained soils on stream terraces. These soils formed in loess and alluvial sediments. Permeability is very slow. Slopes range from 2 to 9 percent.

Typical pedon of Gifford silt loam, 2 to 5 percent slopes, about 1,425 feet west and 1,500 feet north of the southeast corner of sec. 4, T. 58 N., R. 19 W.

Ap1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; firm; few fine roots; medium acid; abrupt wavy boundary.

Ap2—4 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; common fine and medium faint brown (10YR 5/3) and yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; few fine roots; medium acid; abrupt wavy boundary.

Btg1—8 to 16 inches; grayish brown (10YR 5/2) silty clay; few fine prominent strong brown (7.5YR 4/6) and common fine prominent yellowish brown (10YR 5/6) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

Btg2—16 to 26 inches; grayish brown (10YR 5/2) silty clay; many medium faint brown (10YR 5/3) and few medium faint gray (10YR 5/1) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; few very fine sand grains; medium acid; gradual smooth boundary.

2Btg3—26 to 34 inches; gray (10YR 5/1) silty clay; common medium faint grayish brown (10YR 5/2) and few medium distinct brown (10YR 4/3) mottles; moderate fine subangular blocky structure; firm; few faint clay films on faces of peds; common fine sand grains; slightly acid; clear smooth boundary.

2BCg—34 to 49 inches; light brownish gray (10YR 6/2) silty clay loam; common coarse distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; about 15 percent sand grains; neutral.

2Cg—49 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common coarse distinct yellowish brown (10YR 5/4) mottles; massive; firm; about 15 percent sand grains; neutral.

The A or Ap horizon has chroma of 1 or 2. It typically is silt loam, but the range includes silty clay loam. The Btg horizon has value of 4 or 5 and chroma of 1 or 2. The 2Btg horizon has value of 5 or 6 and chroma of 1 or 2.

Gorin Series

The Gorin series consists of deep, somewhat poorly drained soils on uplands. These soils formed in loess and in the underlying pedisediments. Permeability is slow. Slopes range from 2 to 9 percent.

Typical pedon of Gorin silt loam, 2 to 5 percent slopes, about 1,500 feet south and 100 feet west of the northeast corner of sec. 14, T. 57 N., R. 21 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure parting to moderate very fine granular; friable; many fine roots; medium acid; abrupt smooth boundary.

E—6 to 11 inches; brown (10YR 5/3) silt loam; few fine faint brown (10YR 4/3) mottles; weak very fine subangular blocky structure; friable; common fine roots; few black stains; strongly acid; clear smooth boundary.

Bt1—11 to 16 inches; brown (10YR 4/3) silty clay loam; few fine faint grayish brown (10YR 5/2) mottles; moderate very fine subangular blocky structure; firm; common fine roots; common faint clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt2—16 to 25 inches; brown (10YR 4/3) silty clay loam; common fine faint grayish brown (10YR 5/2) and few fine faint dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure; firm; common fine roots; many distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt3—25 to 40 inches; grayish brown (10YR 5/2) silty clay; common fine prominent brown (7.5YR 4/4), common medium faint dark yellowish brown (10YR 4/3), and few fine faint dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; very strongly acid; gradual smooth boundary.

2Bt4—40 to 48 inches; mottled grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/4) silty clay loam; weak very fine subangular blocky structure; firm; few fine roots; common fine concretions of iron and manganese oxide; common faint clay films on faces of peds; common sand grains; very strongly acid; clear smooth boundary.

2C—48 to 60 inches; mottled grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/4) clay loam; massive; firm; few fine black stains and few fine concretions of iron and manganese oxide; strongly acid.

The E horizon has value of 4 or 5 and chroma of 2 or 3. The upper part of the Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silty clay. The lower part of the Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is silty clay loam or clay loam.

Gosport Series

The Gosport series consists of moderately deep, moderately well drained soils on uplands. These soils formed mainly in material weathered from interbedded shale and limestone. Permeability is very slow. Slopes range from 9 to 35 percent.

Typical pedon of Gosport silty clay loam, 9 to 35 percent slopes, eroded, about 250 feet south and 220 feet west of the northeast corner of sec. 23, T. 60 N., R. 22 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, brown (10YR 5/3) dry; moderate very fine subangular blocky structure parting to moderate fine granular; friable; many medium and fine roots; medium acid; abrupt wavy boundary.

Bw1—4 to 11 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct light brownish gray (2.5Y 6/2) and few medium faint dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; firm; common fine roots; very strongly acid; clear smooth boundary.

Bw2—11 to 19 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) and few fine faint yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; firm; common fine roots; very strongly acid; clear smooth boundary.

Bw3—19 to 26 inches; light olive brown (2.5Y 5/6) silty clay; common coarse distinct light brownish gray (2.5Y 6/2) and few fine faint olive yellow (2.5Y 6/6) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; very strongly acid; gradual wavy boundary.

Cr—26 to 60 inches; light olive brown (2.5Y 5/4), light olive gray (5Y 6/2), and olive (5Y 5/3) soft shale; platy rock structure.

The depth to weathered bedrock is 20 to 40 inches. The Ap horizon typically is silty clay loam, but the range includes silt loam. The Bw horizon has value of 5 or 6. The mottles in this horizon have hue of 10YR to 5Y.

Grundy Series

The Grundy series consists of deep, somewhat poorly drained soils on uplands. These soils formed in loess. Permeability is slow. Slopes range from 1 to 5 percent.

Typical pedon of Grundy silt loam, 1 to 5 percent slopes, 2,900 feet south and 600 feet east of the northwest corner of sec. 2, T. 57 N., R. 22 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine granular structure; friable; many fine roots; medium acid; abrupt wavy boundary.

A—7 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure; friable; medium acid; many fine roots; clear wavy boundary.

Bt—12 to 19 inches; dark grayish brown (10YR 4/2) silty clay; common fine distinct yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; common fine roots; many distinct clay films on faces of peds; few very dark gray (10YR 3/1) coatings on peds; medium acid; clear smooth boundary.

Btg1—19 to 29 inches; grayish brown (2.5Y 5/2) silty clay; common medium prominent yellowish brown (10YR 5/4) and few medium faint light brownish gray (2.5Y 6/2) mottles; weak fine subangular blocky structure; firm; few fine roots; many distinct clay films on vertical cleavage planes; very dark gray (10YR 3/1) silt loam in some vertical cracks; medium acid; clear smooth boundary.

Btg2—29 to 40 inches; grayish brown (2.5Y 5/2) silty clay; common medium prominent yellowish brown (10YR 5/4), few medium prominent dark yellowish brown (10YR 4/6), and few fine faint light brownish gray (2.5Y 6/2) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common faint clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg3—40 to 53 inches; grayish brown (2.5Y 5/2) silty clay loam; common coarse faint light brownish gray (2.5Y 6/2), few medium prominent yellowish brown (10YR 5/4), and few medium prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure; firm; few faint clay films on some vertical cleavage planes; slightly acid; clear smooth boundary.

Cg—53 to 68 inches; coarsely mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) silty clay loam; weak medium prismatic structure; firm; few distinct clay films in old root channels; slightly acid.

The mollic epipedon ranges from 11 to 18 inches in thickness . The A horizon has value of 2 or 3. The upper part of the Bt horizon has value of 3 or 4 and chroma of 1 or 2. The lower part has value of 4 or 5. The C horizon has value of 5 or 6.

Humeston Series

The Humeston series consists of deep, poorly drained soils on high flood plains. These soils formed in alluvial sediments. Permeability is very slow. Slopes range from 0 to 2 percent.

Typical pedon of Humeston silt loam, about 250 feet east and 2,280 feet south of the northwest corner of sec. 31, T. 59 N., R. 21 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.

A—7 to 14 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine subangular blocky structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.

E1—14 to 17 inches; dark gray (10YR 4/1) silt loam; weak very fine subangular blocky structure; friable; few very fine roots; medium acid; abrupt smooth boundary.

E2—17 to 21 inches; dark gray (10YR 4/1) silt loam; common medium faint very dark grayish brown (10YR 3/2) and common fine faint dark brown (10YR 4/3) mottles; weak thin platy structure; friable; few very fine roots; medium acid; clear smooth boundary.

E3—21 to 26 inches; dark gray (10YR 4/1) silt loam; common medium faint very dark grayish brown (10YR 3/2) and dark brown (10YR 4/3) mottles; moderate fine subangular blocky structure; firm; few fine roots; strongly acid; clear smooth boundary.

Btg1—26 to 36 inches; very dark gray (10YR 3/1) silty clay loam; common medium distinct dark grayish brown (10YR 4/2) and few fine prominent yellowish brown (10YR 5/8) mottles; moderate very fine subangular blocky structure; firm; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

Btg2—36 to 50 inches; very dark gray (10YR 3/1) silty clay loam; few fine distinct dark brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; firm; common faint clay films on faces of peds; slightly acid; gradual smooth boundary.

BCg—50 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) and few fine prominent yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; firm; few faint clay films on vertical cleavage planes; slightly acid.

The Ap or A horizon has value of 2 or 3. The E horizon has value of 4 or 5. The Btg horizon has value of 3 or 4.

Kennebec Series

The Kennebec series consists of deep, moderately well drained soils on flood plains and in small drainageways. These soils formed in silty alluvial sediments. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Kennebec silt loam, about 1,220 feet south and 100 feet east of the northwest corner of sec. 17, T. 59 N., R. 21 W.

A1—0 to 15 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; medium acid; clear wavy boundary.

A2—15 to 23 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; medium acid; gradual wavy boundary.

A3—23 to 45 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very thin and thin platy structure; friable; medium acid; clear smooth boundary.

C—45 to 70 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct dark yellowish brown (10YR 3/4) mottles; weak fine subangular blocky structure; friable; neutral.

The thickness of the mollic epipedon ranges from about 36 to 50 inches. The C horizon has value of 3 or 4 and chroma of 1 or 2.

Keswick Series

The Keswick series consists of deep, moderately well drained soils on uplands. These soils formed in glacial till. Permeability is slow. Slopes range from 5 to 14 percent.

Typical pedon of Keswick clay loam, 5 to 9 percent slopes, eroded, about 1,775 feet east and 80 feet south of the northwest corner of sec. 25, T. 60 N., R. 21 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; many medium faint grayish brown (10YR 5/2) and common medium faint brown (10YR 4/3) pieces; few fine concretions of iron and manganese oxide; medium acid; clear wavy boundary.

BE—6 to 9 inches; brown (7.5YR 5/4) clay loam; common fine prominent dark grayish brown (10YR 4/2) and many fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; common fine roots; few fine concretions of iron and manganese oxide; very strongly acid; clear wavy boundary.

2Bt1—9 to 17 inches; brown (7.5YR 5/4) clay; common medium prominent red (2.5YR 4/6) and common fine prominent grayish brown (10YR 5/2) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; gradual smooth boundary.

2Bt2—17 to 24 inches; strong brown (7.5YR 5/6) clay; common medium prominent light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

2Bt3—24 to 31 inches; yellowish brown (10YR 5/6) clay; few medium prominent light brownish gray (2.5Y 6/2) and few fine prominent light brownish gray (10YR 6/2) mottles; weak medium prismatic structure; firm; common faint clay films on faces of peds; many black stains and fine concretions of iron and manganese oxide; very strongly acid; abrupt wavy boundary.

2BC—31 to 49 inches; yellowish brown (10YR 5/4) clay loam; common fine prominent light brownish gray (2.5Y 6/2) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; common prominent clay films on vertical faces of peds; common black stains; slight effervescence; mildly alkaline; gradual smooth boundary.

2C—49 to 60 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; light brownish gray (2.5Y 6/2) streaks; weak medium prismatic structure; very firm; common black stains; common masses of calcium carbonate; mildly alkaline.

The 2Bt horizon has value of 5 or 6.

Kilwinning Series

The Kilwinning series consists of deep, poorly drained soils on uplands. These soils formed in loess. Permeability is very slow. Slopes range from 1 to 5 percent.

The Kilwinning soils in this county do not meet the COLE (coefficient of linear extensibility) requirement that is definitive for the series, but this difference does not significantly affect the use and management of the soils.

Typical pedon of Kilwinning silt loam, 1 to 5 percent slopes, about 480 feet west and 1,230 feet south of the northeast corner of sec. 32, T. 59 N., R. 21 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate very fine granular structure; friable; common fine roots; common fine pieces of brown (10YR 4/3) subsoil material; medium acid; abrupt wavy boundary.

Btg1—9 to 13 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) and few fine prominent strong brown (7.5YR 4/6) mottles; moderate very fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; very strongly acid; abrupt smooth boundary.

Btg2—13 to 20 inches; dark grayish brown (2.5Y 4/2) silty clay; many fine distinct brown (10YR 5/3) and yellowish brown (10YR 5/4) and few fine distinct gray (10YR 5/1) mottles; moderate very fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg3—20 to 28 inches; grayish brown (2.5Y 5/2) silty clay; common medium distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) and few medium prominent brown (7.5YR 4/4) mottles; moderate fine and very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; few fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Btg4—28 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6 and 4/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few faint clay films on faces of peds; few black stains; medium acid; gradual smooth boundary.

BCg—36 to 50 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent brown (10YR 5/3) and yellowish brown (10YR 5/4) and few fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; firm; slightly acid; gradual smooth boundary.

Cg—50 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium and coarse distinct brown (10YR 4/3) and dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure; friable; neutral.

The Ap horizon has chroma of 1 or 2. The upper part of the Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. The lower part has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silty clay.

Lagonda Series

The Lagonda series consists of deep, somewhat poorly drained soils on uplands. These soils formed in 20 to 36 inches of loess and in the underlying pedisediments. Permeability is slow. Slopes range from 2 to 9 percent.

The Lagonda soils in this county have a thinner dark surface layer than is definitive for the series, but this difference does not significantly affect the use and management of the soils.

Typical pedon of Lagonda silt loam, 2 to 5 percent slopes, eroded, 1,400 feet east and 550 feet south of the northwest corner of sec. 3, T. 57 N., R. 22 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; common fine roots; medium acid; abrupt wavy boundary.

Bt1—8 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate very fine subangular blocky structure; friable; common fine roots; common faint clay films on faces of peds; medium acid; gradual wavy boundary.

Bt2—12 to 20 inches; dark grayish brown (10YR 4/2) silty clay; common medium distinct yellowish brown (10YR 5/6) and few fine prominent yellowish red (5YR 5/6) mottles; moderate very fine subangular blocky structure; firm; common fine roots; common prominent very dark grayish brown (10YR 3/2) clay films on faces of peds; few very fine sand grains; medium acid; gradual smooth boundary.

2Btg1—20 to 31 inches; dark grayish brown (10YR 4/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4), few fine prominent strong brown (7.5YR 5/6), and common fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common prominent clay films on faces of peds; common fine sand grains; medium acid; clear smooth boundary.

2Btg2—31 to 39 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; few medium very dark gray (10YR 3/1) stains; about 10 percent sand grains; slightly acid; clear smooth boundary.

2Btg3—39 to 60 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/4 and 5/6) clay loam; weak fine subangular blocky structure; very firm; few faint clay films on vertical cleavage planes; neutral.

Depth to the 2B horizon ranges from 20 to 36 inches. The A horizon has chroma of 1 or 2. The Bt horizon has value of 3 or 4 and chroma of 1 or 2. The 2Bt horizon has value of 4 to 6 and chroma of 1 or 2. It is silty clay loam or clay loam.

Landes Series

The Landes series consists of deep, moderately well drained soils on flood plains. These soils formed in loamy alluvial sediments. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Typical pedon of Landes loam, 225 feet west and 2,000 feet north of the southeast corner of sec. 7, T. 60 N., R. 20 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; moderate very fine granular structure; friable; common roots; slightly acid; abrupt wavy boundary.

A—8 to 17 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; common roots; slightly acid; clear smooth boundary.

Bw—17 to 40 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; friable; few roots; slightly acid; gradual smooth boundary.

C—40 to 72 inches; stratified brown (10YR 5/3) and light brownish gray (10YR 6/2) fine sandy loam and loamy fine sand; massive; very friable; slightly acid.

The A or Ap horizon has value of 2 or 3. The B horizon has value of 4 or 5 and chroma of 3 or 4. The C horizon is stratified silt loam to loamy sand. It has value of 4 to 6 and chroma of 3 or 4.

Lenzberg Series

The Lenzberg series consists of deep, well drained soils on upland mine spoils. These soils formed in material mixed by coal and limestone mining activities. This material is glacial till mixed with shale, limestone, and sandstone fragments from the underlying residuum. Permeability is moderately slow. Slopes range from 2 to 35 percent.

Typical pedon of Lenzberg silty clay loam, 2 to 35 percent slopes, about 840 feet west and 980 feet north of the southeast corner of sec. 35, T. 57 N., R. 18 W.

A—0 to 2 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (2.5Y 7/2) dry; moderate fine granular structure; friable; many fine roots; strong effervescence; moderately alkaline; abrupt wavy boundary.

C1—2 to 28 inches; grayish brown (2.5Y 5/2) and olive gray (5Y 5/2) silty clay loam; massive; firm; about 15 percent coarse fragments of limestone and sandstone rocks and channers; common light yellowish brown (2.5Y 6/4) and light olive brown (2.5Y 5/4) weathered shale fragments; strong effervescence; moderately alkaline; clear wavy boundary.

C2—28 to 62 inches; light olive gray (5Y 6/2) and olive gray (5Y 5/2) silty clay loam; massive; firm; about 10 percent coarse fragments of limestone channers and stones; few olive yellow (2.5Y 6/6) and olive gray (5Y 5/2) weathered shale fragments; strong effervescence; moderately alkaline; clear wavy boundary.

The A horizon typically has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. The C horizon has hue of 10YR to 5Y, value of 3 to 7, and chroma of 1 to 6. It is clay loam or silty clay loam.

Leonard Series

The Leonard series consists of deep, poorly drained soils on uplands. These soils formed in a thin layer of loess and pedisediments and in the underlying glacial till. Permeability is slow. Slopes range from about 2 to 5 percent.

Typical pedon of Leonard silt loam, 2 to 5 percent slopes, about 200 feet south and 2,200 feet east of the northwest corner of sec. 14, T. 57 N., R. 20 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine granular structure; friable; many fine roots; slightly acid; abrupt wavy boundary.

Btg1—7 to 11 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine faint brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; friable; common fine roots; many distinct very dark gray clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—11 to 21 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine prominent strong brown (7.5YR 4/6) and few fine prominent yellowish red (5YR 4/6) mottles; moderate very fine subangular blocky structure; firm; common fine roots; many distinct clay films on faces of peds; medium acid; clear smooth boundary.

Btg3—21 to 30 inches; grayish brown (2.5Y 5/2) silty clay; common fine prominent strong brown (7.5YR 4/6-5/6) mottles; weak very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; medium acid; gradual smooth boundary.

2Btg4—30 to 41 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct yellowish brown (10YR 5/4) mottles; weak very fine subangular blocky structure; firm; few faint clay films on faces of peds; common sand grains; slightly acid; gradual smooth boundary.

2Btg5—41 to 52 inches; grayish brown (2.5Y 5/2) silty clay; common medium prominent strong brown (7.5YR 5/6) mottles; weak very fine subangular blocky structure; firm; few distinct very dark gray clay films in old root channels; common sand grains; few pebbles; mildly alkaline; clear smooth boundary.

2C—52 to 60 inches; coarsely mottled light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) silty clay; massive; firm; common sand grains; few pebbles; mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It typically is silt loam, but the range includes silty clay loam.

The upper part of the Bt horizon has value of 4 or 5 and chroma of 1 or 2. It has mottles with value of 4 or 5 and chroma of 2 to 6. It is silty clay or silty clay loam. The lower part of the Bt horizon and the upper part of the 2Bt horizon have hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. They are silty clay, silty clay loam, or clay. The lower part of the 2Bt horizon and the C horizon typically are mottled and have value of 4 to 6 and chroma of 1 to 6. They are silty clay, silty clay loam, or clay loam.

Olmitz Series

The Olmitz series consists of deep, moderately well drained soils on alluvial fans, foot slopes, and uplands.

These soils formed in glacial sediments or local alluvium. Permeability is moderate. Slopes range from 2 to 6 percent.

Typical pedon of Olmitz loam, 2 to 6 percent slopes, about 1,260 feet north and 190 feet west of the southeast corner of sec. 34, T. 60 N., R. 21 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; few fine roots; medium acid; abrupt wavy boundary.

A1—5 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; common medium faint dark brown (10YR 3/3) mottles; weak very fine subangular blocky structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

A2—10 to 26 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; few fine faint very dark grayish brown (10YR 3/2) mottles; weak very fine subangular blocky structure; friable; few fine roots; medium acid; gradual smooth boundary.

Bw1—26 to 41 inches; brown (10YR 4/3) clay loam; few very dark gray (10YR 3/1) organic coatings; moderate very fine subangular blocky structure; friable; few fine roots; medium acid; gradual smooth boundary.

Bw2—41 to 49 inches; brown (10YR 4/3) clay loam; common very dark grayish brown (10YR 3/2) organic coatings; weak fine subangular blocky structure; firm; few roots; medium acid; gradual smooth boundary.

Bw3—49 to 60 inches; brown (10YR 4/3) clay loam; few dark brown (10YR 3/3) organic coatings; few very dark grayish brown (10YR 3/2) organic coatings in root channels; moderate fine prismatic structure; firm; medium acid.

The mollic epipedon is 24 to 36 inches thick. The A horizon has value of 2 or 3 and chroma of 1 to 3.

Portage Series

The Portage series consists of deep, very poorly drained soils on flood plains. These soils formed in clayey alluvial sediments. Permeability is very slow. Slopes are 0 to 1 percent.

Typical pedon of Portage silty clay, about 300 feet south and 100 feet west of the northeast corner of sec. 34, T. 57 N., R. 21 W.

Ap—0 to 5 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate very fine granular and subangular blocky structure; friable; common fine roots; neutral; abrupt wavy boundary.

A—5 to 12 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; few fine faint dark grayish brown (10YR 4/2) mottles; moderate very fine subangular blocky structure; firm; few fine roots; strongly acid; clear wavy boundary.

Bg1—12 to 24 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; few medium faint dark grayish brown (10YR 4/2) and few fine distinct brown (10YR 4/3) mottles; moderate medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; strongly acid; clear wavy boundary.

Bg2—24 to 43 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; few fine faint dark grayish brown (10YR 4/2) and common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure; very firm; few fine roots; strongly acid; gradual wavy boundary.

Cg—43 to 60 inches; dark gray (10YR 4/1) clay; common fine faint dark grayish brown (10YR 4/2) and common fine distinct brown (10YR 4/3) mottles; massive; very firm; medium acid.

The A horizon has hue of 10YR or 2.5Y and value of 2 or 3. The Bg horizon has color and texture similar to those of the lower part of the A horizon. The Cg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2.

Purdin Series

The Purdin series consists of deep, moderately well drained soils on uplands. These soils formed in glacial till. Permeability is slow. Slopes range from 9 to 20 percent.

Typical pedon of Purdin loam, 9 to 14 percent slopes, eroded, about 1,120 feet north and 65 feet east of the center of sec. 5, T. 60 N., R. 21 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; many fine roots; slightly acid; abrupt wavy boundary.

Bt1—7 to 13 inches; dark yellowish brown (10YR 4/4) clay loam; moderate very fine subangular blocky structure; firm; common fine roots; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—13 to 18 inches; dark yellowish brown (10YR 4/4) clay loam; common medium faint yellowish brown (10YR 5/4) mottles; moderate fine and very fine subangular blocky structure; firm; common fine roots; many distinct clay films on faces of peds; strongly acid; clear smooth boundary.

Bt3—18 to 25 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common prominent clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; gradual smooth boundary.

Bt4—25 to 37 inches; yellowish brown (10YR 5/6) clay loam; many medium and coarse prominent light brownish gray (10YR 6/2), common medium faint dark yellowish brown (10YR 4/6), and few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; few faint clay films on vertical faces of peds; common fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

BC—37 to 50 inches; yellowish brown (10YR 5/6) clay loam; many medium and coarse prominent light brownish gray (10YR 6/2), few medium distinct yellowish brown (10YR 5/4), and few medium faint dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; very firm; few fine roots; few soft masses of calcium carbonate; common soft black oxides; strong effervescence; moderately alkaline; gradual smooth boundary.

C—50 to 72 inches; mottled yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/6), and light brownish gray (10YR 6/2) clay loam; weak medium prismatic structure; very firm; common soft masses of calcium carbonate; few soft black oxides; strong effervescence; moderately alkaline.

The A or Ap horizon is loam or clay loam. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 to 6. It is clay loam or clay. The content of clay in the control section ranges from 35 to 45 percent.

Vesser Series

The Vesser series consists of deep, poorly drained soils on high flood plains. These soils formed in silty alluvial sediments. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Vesser silt loam, 3,490 feet west and 2,800 feet north of the southeast corner of sec. 14, T. 57 N., R. 22 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; few medium to very fine roots; medium acid; abrupt wavy boundary.

A—8 to 13 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; few medium to very fine roots; common fine distinct dark yellowish brown (10YR 3/4) stains; medium acid; clear smooth boundary.

E1—13 to 19 inches; gray (10YR 5/1) silt loam; weak fine granular structure; friable; strongly acid; gradual smooth boundary.

E2—19 to 27 inches; dark gray (10YR 4/1) silt loam; few fine prominent brown (7.5YR 5/4) mottles; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Btg1—27 to 41 inches; very dark gray (10YR 3/1) silty clay loam; few fine prominent brown (7.5YR 5/4) mottles; moderate fine subangular blocky structure; firm; faint light brownish gray (10YR 6/2) silt coatings; common faint clay films on faces of peds; medium acid; diffuse smooth boundary.

2Btg2—41 to 64 inches; very dark gray (10YR 3/1) silty clay loam; common fine faint dark brown (10YR 3/3) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; firm; slightly acid.

The E horizon has chroma of 1 or 2. The Btg horizon has value of 3 to 5 and chroma of 1 or 2.

Winnegan Series

The Winnegan series consists of deep, moderately well drained soils on uplands. These soils formed in glacial till. Permeability is slow. Slopes range from 9 to 35 percent.

Typical pedon of Winnegan loam, 20 to 35 percent slopes, about 950 feet north and 280 feet west of the southeast corner of sec. 17, T. 60 N., R. 20 W.

Oi—1 inch to 0; oak and hickory leaves and twigs.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate very fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

E—2 to 6 inches; brown (10YR 5/3) loam; few fine faint light brownish gray (10YR 6/2) mottles; weak fine granular structure; friable; common fine roots; strongly acid; abrupt smooth boundary.

BE—6 to 10 inches; yellowish brown (10YR 5/4) loam;

moderate very fine subangular blocky structure; firm; common fine and medium roots; very strongly acid; clear smooth boundary.

Bt1—10 to 20 inches; yellowish brown (10YR 5/4) clay loam; moderate fine and very fine subangular blocky structure; firm; common fine and medium roots; common prominent clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—20 to 26 inches; yellowish brown (10YR 5/6) clay loam; common medium prominent light brownish gray (10YR 6/2) and few medium distinct yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; firm; few fine and medium roots; common prominent dark clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—26 to 31 inches; yellowish brown (10YR 5/6) clay loam; few medium prominent light brownish gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; firm; few fine and medium roots; many prominent clay films on faces of peds; few black stains; slightly acid; clear wavy boundary.

BC—31 to 38 inches; dark yellowish brown (10YR 4/4) clay loam; common coarse distinct light brownish gray (10YR 6/2), common fine distinct dark yellowish brown (10YR 4/6), and common fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few fine roots; common soft masses of calcium carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C—38 to 60 inches; dark yellowish brown (10YR 4/4) clay loam; many coarse distinct light brownish gray (10YR 6/2), common medium distinct dark yellowish brown (10YR 4/6), and few medium faint yellowish brown (10YR 5/4) mottles; weak medium prismatic structure; very firm; few fine roots; many soft masses of calcium carbonate; strong effervescence; moderately alkaline.

The A or Ap horizon has value of 3 to 5 and chroma of 1 to 3. The E horizon, if it occurs, has value of 4 to 6 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR and value of 4 or 5. The content of clay in the control section ranges from 35 to 45 percent. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6.

Zook Series

The Zook series consists of deep, poorly drained soils on flood plains. These soils formed in alluvial sediments. Permeability is slow. Slopes range from 0 to 2 percent.

Typical pedon of Zook silty clay loam, about 3,790 feet south and 900 feet west of the northeast corner of sec. 14, T. 60 N., R. 21 W.

Ap1—0 to 5 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine granular structure; firm; many fine roots; medium acid; abrupt wavy boundary.

Ap2—5 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; firm; many fine roots; medium acid; abrupt wavy boundary.

A1—8 to 18 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine subangular blocky structure; firm; common fine roots; medium acid; clear smooth boundary.

A2—18 to 33 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; moderate very fine subangular blocky structure; firm; few fine roots; medium acid; gradual smooth boundary.

A3—33 to 45 inches; very dark gray (10YR 3/1) silty clay, very dark gray (10YR 3/1) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; firm; few fine roots; few fine concretions of iron and manganese oxide; slightly acid; clear wavy boundary.

Bg—45 to 60 inches; dark gray (10YR 4/1) silty clay; few medium distinct dark yellowish brown (10YR 4/4) mottles; moderate fine prismatic structure parting to weak fine subangular blocky; firm; few fine concretions of iron and manganese oxide; neutral.

The mollic epipedon ranges from 36 to 60 inches in thickness. The A horizon has hue of 10YR or 2.5Y.

Formation of the Soils

Soil formation is the result of the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over some measurable period of time. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material accumulated; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material *(5)*.

Parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Climate and plant and animal life are active factors of soil formation. They act on the earthy parent material and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. Finally, time is needed for the transformation of the parent material into a soil. Generally, a long time is required for the development of distinct soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others. The interaction of these factors can cause soils to vary considerably over a rather small area.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineral composition of the soil. The soils in Linn County formed in loess, glacial till, alluvium, Pennsylvanian-age residual material, or a combination of these *(9)*.

The last great continental ice sheet began to melt approximately 30,000 years ago. During the next 12,000 to 18,000 years, streams with headwaters farther north overflowed each summer with muddy water from the melting ice *(12)*. In the winter the water levels dropped, and the westerly winds picked up silt from the drying mudflats and deposited it in the uplands of the Midwest. This wind-deposited, silty material is called loess. Its primary source in the survey area was the flood plains along the Missouri River, but undoubtedly smaller amounts also came from the flood plains along the Grand and Thompson Rivers and perhaps others. At one time the loess covered all of the uplands and higher terraces in Linn County, but all or most of it has eroded from the moderately sloping and steeper side slopes and some of the narrow, rounded ridgetops. The thickest remaining loess deposits are on broad upland ridges and nearly level stream terraces. Grundy and Kilwinning soils formed in loess on uplands. Chariton soils formed in loess on high terraces.

At least two large ice sheets covered northern Missouri during the time period between about 750,000 and 350,000 years ago *(13, 16)*. In Linn County glacial till was deposited in thick layers on uplands by meltwater from each of these large retreating ice sheets. Although some of it has been removed by erosion in the more sloping areas, the till remains on almost all of the uplands in the county. It is covered by loess in the more nearly level areas, but it is at the surface in the more sloping areas. It is probable that much of the glacial till from the first ice sheet was removed by erosion and that the till was reworked by the second ice sheet throughout much of the county. Thus, nearly all of the glacial till on the surface and directly below the loess cap probably was deposited by the second ice sheet. Armstrong, Purdin, Keswick, and Winnegan soils formed in the glacial till. Gorin, Leonard, and Lagonda soils formed in a thin mantle of loess and in the underlying pedisediments.

In a few of the upland areas in the county, primarily those adjacent to Locust Creek, all of the loess and glacial till has eroded from the surface. Gosport soils formed in material weathered from the underlying interbedded shale and limestone in these areas.

Alluvium is soil material that was transported by water and deposited on the nearly level flood plains along streams. Most of the alluvium came from the adjacent uplands. Texture of the material ranges from clay and silt to very fine sand. Chequest, Portage, and

Zook are examples of soils that formed in silty and clayey alluvium. Soils that formed in relatively silty alluvial material include Blackoar, Kennebec, and Fatima soils. Landes soils formed in loamy alluvial material. Humeston and Vesser soils formed in alluvium on high flood plains or second bottoms. Gifford soils formed in alluvium on the side slope escarpments of high stream terraces and Chariton soils in alluvium on the nearly level tops of the high stream terraces.

Olmitz soils are on a few parts of some alluvial fans, foot slopes, and uplands adjacent to the flood plain along Locust Creek. In some places they formed in local alluvium that was moved only short distances. In other places they formed in locally transported glacial sediments.

Climate

Climate has been an important factor in the formation of soils in Linn County. It largely determines the rate of weathering in soils, and it also influences the type of vegetation that grows on the soils. The county has a subhumid midcontinental climate that has changed little, except for minor fluctuations, in the past 8,000 years. Seasonal temperature changes are distinct, and rainfall distribution is predictable. Precipitation has been sufficient to leach bases, lower natural fertility, and increase acidity in the upper several feet of soils that are a few hundred years old or older. The climate has favored the growth of the mixed prairie and forest vegetation that was present when the first settlers arrived in the survey area.

In the last million years, variations in climate have drastically affected the soils in the survey area. The climate was considerably colder and possibly wetter when the ice sheets covered northern Missouri. There have been several soil-forming periods since the last ice sheet left northern Missouri at least 350,000 years ago. Geologic evidence indicates that the climate was colder than the present climate during some soil-forming periods and warmer during other soil-forming periods.

Living Organisms

Plants, burrowing animals, insects, bacteria, and fungi have important effects on soil formation *(15)*. Among the soil properties affected are the content of organic matter and its distribution in the soil profile, plant nutrients, structure, and porosity.

Soils that formed under forest vegetation have an accumulation of organic matter on and near the surface. When these soils are cleared for farming, this organic material is mixed into the plow layer and is oxidized in a relatively short period. Therefore, cultivated soils in forested areas characteristically have a gray or light brown surface layer and a very low organic matter content. Gorin, Keswick, Winnegan, and Gosport are examples of upland soils that formed under forest vegetation.

In soils that formed under prairie vegetation, the organic matter is distributed throughout the upper several feet of the profile. Cultivation of these soils lowers the organic matter content somewhat in the plow layer. The organic matter content of a cultivated prairie soil remains much higher in and below the plow layer than does that of a cultivated soil in a forested area. Therefore, the prairie soils have a darker surface layer than the forested soils. Grundy, Lagonda, and Kilwinning are examples of upland soils that formed under prairie vegetation.

Many of the soils in Linn County formed under a mixture of prairie and forest vegetation. After cultivation, these soils have more organic matter in the plow layer than forested soils but less than prairie soils. Also, the organic matter extends farther into the profile than it does in the forested soils, but not so far as it does in the prairie soils. It is possible that the vegetation alternated between trees and prairie grasses. The vegetation changes could have been triggered by natural events, such as prairie fires, or by minor climatic changes. It is also possible that the vegetation consisted of scattered trees and an understory of prairie grasses and that this pattern remained virtually unchanged over a long period. Armstrong and Purdin are examples of soils that formed under both prairie and forest vegetation.

Worms, insects, burrowing animals, and large animals disturb and otherwise affect the soil. Bacteria and fungi have a greater effect on soil formation than do animals. The rate of decomposition of organic material in the soil is directly related to the population of soil organisms. The kinds of organisms in a given area and their activity are determined by the differences in vegetation and the amount of organic material in the soil.

Human activities have affected soil formation in Linn County during the past 150 years. The processes of soil formation have been altered by the conversion of woodland and grassland to cropland. Intensive cultivation and the use of chemicals and fertilizers have lowered the organic matter content of the soils and reduced the population of worms, burrowing animals, bacteria, and fungi. Cultivation has resulted in deterioration of tilth in the plow layer and of soil structure and in many places has increased the runoff rate and the hazard of erosion. In many upland areas, erosion has removed all or part of the original surface layer and has lowered the fertility level and productivity of the soils.

Relief

Relief refers to the general unevenness of the land surface. It includes the difference in elevation from the ridgetops to the valley floors and the nature of the slopes in between. It affects soil formation mostly through its influence on drainage, infiltration, runoff, and geologic erosion.

The amount of water entering and passing through the soil depends on the steepness of the slope, the permeability of the soil, and the amount and intensity of rainfall. As the slope becomes steeper, less water passes through the soil and the amount of runoff becomes greater. On gently sloping and nearly level soils, runoff is slow and most of the water passes through the profile. Such soils are characterized by maximum profile development. Chariton soils are an example.

Geologic erosion is the erosion which occurs independently of human activities. Its rate depends primarily on the slope; the aspect, or direction in which a slope faces; the kind of material at the surface; and the type of vegetation. Geologic erosion occurs more rapidly on grass-covered slopes than it does on forested slopes. Soils on steep, south- and west-facing slopes receive more direct sunrays and thus are more droughty during the summer months than soils on north- and east-facing slopes. The droughtiness reduces the extent of the vegetative cover and thus increases the hazard of erosion. Soils that have a silty or loamy surface layer erode more rapidly than clayey soils.

The youngest upland soils are on both the most stable and the least stable landscapes. The most stable landscapes are the loess-covered ridgetops and high terraces. The loess is less than 20,000 years old. Chariton, Gorin, Grundy, Kilwinning, and Lagonda soils are in these areas. The steepest upland areas are the least stable parts of the county. The loess and glacial till have been removed from these areas by geologic erosion. Thus, the soils formed in material weathered from interbedded shale and limestone. Gosport soils are an example.

The landscape in many of the uplands in Linn County lacked the stability that was needed to retain the loess cover, but it did retain remnants of the Sangamon paleosol, which was exhumed by geologic erosion. Armstrong and Keswick soils formed in these remnants.

Time

Time is an important factor of soil formation in that it allows climate, living organisms, and relief to exert their influence on the parent material. The degree of profile development in a soil reflects the length of time that the parent material has been in place and has been subject to weathering. Young soils show little evidence of profile development, or horizon differentiation. Mature soils, which show the effects of clay movement and leaching, have distinct horizons.

Kansan glacial till was deposited in a thick blanket over northern Missouri when the last ice sheet melted about 350,000 years ago. The soil-forming period that followed is called the Yarmouth interglacial episode *(12)*. The soils that formed during this period are called Yarmouth paleosols. A paleosol is a soil that formed on an old landscape, such as the one that existed 350,000 years ago. Geologic erosion subsequently removed the Yarmouth paleosol from all but the more stable parts of the upland landscape. About 120,000 years ago, another soil-forming period began. This period is called the Sangamon interglacial episode, and the associated soils are called Sangamon paleosols *(12)*. The Sangamon paleosols formed in the Yarmouth paleosols or in the Kansan glacial till where the Yarmouth paleosols had been removed by geologic erosion.

The Sangamon interglacial episode, which may have ended as recently as 30,000 years ago, was followed by the Peorian episode, during which the surface of the landscape was blanketed with loess. Peorian loess remains on the most stable parts of the landscape, but geologic erosion has removed it from the less stable parts.

The youngest soils in the survey area are the alluvial soils, which are less than 100 years old to a few hundred years old. Examples are Blackoar, Chequest, Colo, Landes, Kennebec, Fatima, Portage, and Zook soils. The Humeston and Vesser soils on second bottoms and the Olmitz soils on foot slopes, terraces, and uplands formed in somewhat older sediments.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediments of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt 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."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-84 at Brookfield, Missouri)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	35.7	16.2	26.0	63	-15	7	1.56	0.39	2.48	3	5.9
February----	42.7	22.0	32.4	68	-9	16	1.31	.55	1.94	4	3.8
March-------	52.9	30.6	41.8	82	-3	56	2.82	1.41	4.03	6	4.4
April-------	67.1	43.0	55.1	87	22	198	3.82	1.90	5.48	7	.4
May---------	76.6	53.1	64.9	91	32	467	4.82	3.17	6.32	8	.0
June--------	85.3	62.3	73.8	98	46	714	4.77	2.11	7.03	7	.0
July--------	90.3	66.8	78.6	103	51	887	4.36	1.74	6.56	6	.0
August------	88.8	64.6	76.7	102	49	828	3.78	1.62	5.61	6	.0
September---	81.1	56.3	68.7	97	36	561	4.44	1.81	6.65	6	.0
October-----	70.3	45.4	57.9	90	24	270	3.63	1.46	5.44	6	.0
November----	54.5	33.3	43.9	77	9	32	1.94	.48	3.09	3	.7
December----	40.8	22.7	31.8	67	-7	13	1.93	.79	2.89	4	4.4
Yearly:											
Average---	65.5	43.0	54.3	---	---	---	---	---	---	---	---
Extreme---	---	---	---	105	-15	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,049	39.18	31.17	46.61	66	19.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-84 at Brookfield, Missouri)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 11	Apr. 18	May 3
2 years in 10 later than--	Apr. 7	Apr. 14	Apr. 28
5 years in 10 later than--	Mar. 29	Apr. 6	Apr. 19
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 23	Oct. 16	Oct. 3
2 years in 10 earlier than--	Oct. 28	Oct. 20	Oct. 8
5 years in 10 earlier than--	Nov. 6	Oct. 29	Oct. 18

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-84 at Brookfield, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	200	187	162
8 years in 10	207	193	169
5 years in 10	221	205	182
2 years in 10	235	217	194
1 year in 10	242	224	201

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1B2	Armstrong loam, 2 to 5 percent slopes, eroded	35,500	8.9
1C2	Armstrong clay loam, 5 to 9 percent slopes, eroded	101,500	25.5
1C3	Armstrong clay loam, 5 to 9 percent slopes, severely eroded	2,800	0.7
1D2	Armstrong clay loam, 9 to 14 percent slopes, eroded	3,200	0.8
1D3	Armstrong clay loam, 9 to 14 percent slopes, severely eroded	520	0.1
2D2	Purdin loam, 9 to 14 percent slopes, eroded	40,750	10.3
2D3	Purdin clay loam, 9 to 14 percent slopes, severely eroded	6,000	1.5
2E2	Purdin clay loam, 14 to 20 percent slopes, eroded	9,600	2.4
2E3	Purdin clay loam, 14 to 20 percent slopes, severely eroded	1,350	0.3
3B	Kilwinning silt loam, 1 to 5 percent slopes	10,100	2.5
4D2	Winnegan clay loam, 9 to 14 percent slopes, eroded	4,000	1.0
4D3	Winnegan clay loam, 9 to 14 percent slopes, severely eroded	560	0.1
4E2	Winnegan clay loam, 14 to 20 percent slopes, eroded	7,000	1.8
4E3	Winnegan clay loam, 14 to 20 percent slopes, severely eroded	1,050	0.3
4F	Winnegan loam, 20 to 35 percent slopes	7,200	1.8
5B2	Leonard silt loam, 2 to 5 percent slopes, eroded	9,000	2.3
7B	Grundy silt loam, 1 to 5 percent slopes	9,500	2.4
9B2	Lagonda silt loam, 2 to 5 percent slopes, eroded	35,500	8.9
9C2	Lagonda silt loam, 5 to 9 percent slopes, eroded	1,800	0.5
10F2	Gosport silty clay loam, 9 to 35 percent slopes, eroded	2,550	0.6
12C2	Keswick clay loam, 5 to 9 percent slopes, eroded	6,800	1.7
12D2	Keswick clay loam, 9 to 14 percent slopes, eroded	1,200	0.3
14B	Gorin silt loam, 2 to 5 percent slopes	310	0.1
14C2	Gorin silt loam, 5 to 9 percent slopes, eroded	970	0.2
22B	Olmitz loam, 2 to 6 percent slopes	360	0.1
25	Chariton silt loam	1,950	0.5
27B	Gifford silt loam, 2 to 5 percent slopes	3,550	0.9
27C2	Gifford silt loam, 5 to 9 percent slopes, eroded	950	0.2
29	Humeston silt loam	3,800	1.0
31A	Colo silty clay loam, 0 to 2 percent slopes	5,000	1.3
31B	Colo silty clay loam, 2 to 5 percent slopes	1,800	0.5
35	Blackoar silt loam	17,500	4.4
36	Chequest silty clay loam	9,000	2.3
37	Zook silty clay loam	4,700	1.2
38	Landes loam	820	0.2
39	Kennebec silt loam	1,550	0.4
40	Portage silty clay	12,700	3.2
41	Vesser silt loam	16,100	4.0
43	Fatima silt loam	17,600	4.4
90	Udorthents, nearly level	103	*
94F	Lenzburg silty clay loam, 2 to 35 percent slopes	225	0.1
	Water	1,100	0.3
	Total	397,568	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
1B2	Armstrong loam, 2 to 5 percent slopes, eroded
3B	Kilwinning silt loam, 1 to 5 percent slopes (where drained)
5B2	Leonard silt loam, 2 to 5 percent slopes, eroded (where drained)
7B	Grundy silt loam, 1 to 5 percent slopes
9B2	Lagonda silt loam, 2 to 5 percent slopes, eroded
14B	Gorin silt loam, 2 to 5 percent slopes
22B	Olmitz loam, 2 to 6 percent slopes
25	Chariton silt loam (where drained)
27B	Gifford silt loam, 2 to 5 percent slopes (where drained)
29	Humeston silt loam (where drained)
31A	Colo silty clay loam, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
31B	Colo silty clay loam, 2 to 5 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
35	Blackoar silt loam (where drained and either protected from flooding or not frequently flooded during the growing season)
36	Chequest silty clay loam (where drained and either protected from flooding or not frequently flooded during the growing season)
37	Zook silty clay loam (where drained and either protected from flooding or not frequently flooded during the growing season)
38	Landes loam (where protected from flooding or not frequently flooded during the growing season)
39	Kennebec silt loam (where protected from flooding or not frequently flooded during the growing season)
40	Portage silty clay (where drained and either protected from flooding or not frequently flooded during the growing season)
41	Vesser silt loam (where drained)
43	Fatima silt loam (where protected from flooding or not frequently flooded during the growing season)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-alfalfa hay	Orchard-grass	Switchgrass
		Bu	Bu	Bu	Bu	Tons	AUM*	AUM*
1B2------------- Armstrong	IIIe	92	33	79	37	3.4	6.8	6.8
1C2------------- Armstrong	IIIe	83	31	73	34	3.1	6.2	6.2
1C3------------- Armstrong	IVe	70	25	60	27	2.6	5.2	5.2
1D2------------- Armstrong	IVe	72	26	61	28	2.6	5.2	5.2
1D3------------- Armstrong	VIe	---	---	---	---	2.5	5.0	5.0
2D2------------- Purdin	IVe	89	33	78	37	3.4	6.8	6.8
2D3------------- Purdin	VIe	---	---	---	---	3.1	6.2	6.2
2E2------------- Purdin	VIe	---	---	---	---	2.9	5.8	5.8
2E3------------- Purdin	VIIe	---	---	---	---	2.4	4.8	4.8
3B-------------- Kilwinning	IIe	91	35	80	37	3.5	7.0	7.0
4D2------------- Winnegan	IVe	81	30	71	33	3.0	6.0	6.0
4D3------------- Winnegan	VIe	---	---	---	---	2.8	5.6	5.6
4E2------------- Winnegan	VIe	---	---	---	---	2.8	5.6	5.6
4E3------------- Winnegan	VIIe	---	---	---	---	2.2	4.4	4.4
4F-------------- Winnegan	VIIe	---	---	---	---	2.8	5.6	5.6
5B2------------- Leonard	IIIe	81	30	71	33	3.0	6.0	6.0
7B-------------- Grundy	IIe	110	40	92	40	3.8	7.6	7.6
9B2------------- Lagonda	IIIe	96	36	84	39	3.6	7.2	7.2
9C2------------- Lagonda	IIIe	89	33	77	36	3.3	6.6	6.6

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchardgrass-alfalfa hay	Orchardgrass	Switchgrass
		Bu	Bu	Bu	Bu	Tons	AUM*	AUM*
10F2----------- Gosport	VIIe	---	---	---	---	---	2.5	5.0
12C2----------- Keswick	IIIe	83	30	73	34	3.1	6.2	6.2
12D2----------- Keswick	IVe	72	26	61	28	2.6	5.2	5.2
14B------------ Gorin	IIe	89	33	79	37	3.2	6.4	6.4
14C2----------- Gorin	IIIe	78	29	68	31	2.8	5.6	5.6
22B------------ Olmitz	IIe	112	41	97	46	4.2	8.4	8.4
25------------- Chariton	IIw	96	36	85	39	3.6	7.2	7.2
27B------------ Gifford	IIe	84	31	75	35	3.1	6.2	6.2
27C2----------- Gifford	IIIe	72	24	63	28	2.6	5.2	5.2
29------------- Humeston	IIIw	94	35	83	38	3.5	7.0	7.0
31A, 31B-------- Colo	IIIw	98	36	85	---	---	7.0	7.0
35------------- Blackoar	IIIw	96	35	86	40	---	7.6	7.6
36------------- Chequest	IIw	81	30	71	---	---	6.0	6.0
37------------- Zook	IIw	81	30	71	---	---	6.0	6.0
38------------- Landes	IIIw	81	30	71	---	---	6.0	6.0
39------------- Kennebec	IIw	110	40	92	---	---	7.8	7.8
40------------- Portage	IIIw	69	26	61	---	---	5.1	5.1
41------------- Vesser	IIw	102	37	89	40	3.8	7.6	7.6
43------------- Fatima	IIw	106	38	92	---	3.9	7.8	7.8
90------------- Udorthents	IVe	---	---	---	27	2.6	5.2	5.2

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-alfalfa hay	Orchard-grass	Switchgrass
		Bu	Bu	Bu	Bu	Tons	AUM*	AUM*
94F-------------- Lenzburg	VIe	---	---	---	---	2.5	5.0	5.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity*: Common trees	Potential productivity*: Site index	Potential productivity*: Volume	Trees to plant
1B2, 1C2, 1C3, 1D2, 1D3: Armstrong	3C	Slight	Moderate	Moderate	Severe	White oak Northern red oak	55 55	38 38	Eastern white pine, northern red oak, sugar maple.
2D2, 2D3: Purdin	3A	Slight	Slight	Slight	Slight	White oak Post oak Blackjack oak Black oak	60 --- --- ---	43 --- --- ---	White oak, white ash, black oak, northern red oak.
2E2, 2E3: Purdin	3R	Moderate	Moderate	Slight	Slight	White oak Post oak Blackjack oak Black oak	60 --- --- ---	43 --- --- ---	White oak, white ash, black oak, northern red oak.
4D2, 4D3: Winnegan	3A	Slight	Slight	Slight	Slight	White oak Post oak Blackjack oak Black oak	60 --- --- ---	43 --- --- ---	White oak, white ash, black oak, northern red oak.
4E2, 4E3, 4F: Winnegan	3R	Moderate	Moderate	Slight	Slight	White oak Post oak Blackjack oak Black oak	60 --- --- ---	43 --- --- ---	White oak, white ash, black oak, northern red oak.
10F2: Gosport	2R	Moderate	Moderate	Slight	Moderate	White oak	45	30	Northern red oak, white oak, black oak, white ash.
12C2, 12D2: Keswick	3C	Slight	Moderate	Moderate	Severe	White oak Northern red oak	55 55	38 38	Northern red oak, white oak, black oak.
14B, 14C2: Gorin	3C	Slight	Moderate	Moderate	Severe	White oak	55	38	White oak, white ash, pin oak, black oak.
35: Blackoar	4W	Slight	Severe	Moderate	Moderate	Pin oak Eastern cottonwood Green ash	80 95 ---	62 116 ---	Pin oak, eastern cottonwood, pecan.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity*			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume	
36--------------- Chequest	7W	Slight	Severe	Slight	Slight	Eastern cottonwood-- Silver maple--------	90 80	103 34	Eastern cottonwood, silver maple, pin oak, American sycamore, green ash.
38--------------- Landes	10A	Slight	Slight	Slight	Slight	Eastern cottonwood-- American sycamore--- Green ash-----------	105 --- ---	141 --- ---	Black walnut, eastern cottonwood, American sycamore, green ash, eastern white pine.
39--------------- Kennebec	3A	Slight	Slight	Slight	Slight	Bur oak------------- Black walnut-------- Hackberry----------- Green ash----------- Eastern cottonwood--	63 79 --- --- ---	46 --- --- --- ---	Black walnut, bur oak, hackberry, green ash, eastern cottonwood, American sycamore.
40--------------- Portage	6W	Slight	Severe	Severe	Severe	Eastern cottonwood-- Silver maple-------- Pin oak-------------	85 80 75	91 34 57	Eastern cottonwood, pin oak, pecan, green ash, sweetgum, silver maple, baldcypress.
43--------------- Fatima	5A	Slight	Slight	Slight	Slight	Pin oak------------- Black walnut-------- Bur oak-------------	86 --- ---	68 --- ---	Pin oak, pecan, eastern cottonwood, American sycamore, black oak, black walnut.

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands. Site index is the height attained in 50 years.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1B2, 1C2, 1C3, 1D2, 1D3 Armstrong	Lilac	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, American cranberrybush, Amur honeysuckle.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
2D2, 2D3, 2E2, 2E3 Purdin	Lilac	American cranberrybush, Amur honeysuckle, Amur privet, arrowwood, Washington hawthorn, eastern redcedar.	Austrian pine, green ash, Osageorange.	Pin oak, eastern white pine.	---
3B Kilwinning	Lilac	Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, Washington hawthorn, eastern redcedar.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
4D2, 4D3, 4E2, 4E3, 4F Winnegan	Lilac	American cranberrybush, Amur honeysuckle, Amur privet, arrowwood, Washington hawthorn, eastern redcedar.	Austrian pine, green ash, Osageorange.	Pin oak, eastern white pine.	---
5B2 Leonard	Lilac	Amur honeysuckle, Amur privet, eastern redcedar, American cranberrybush, Washington hawthorn, arrowwood.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
7B Grundy	---	Washington hawthorn, eastern redcedar, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood.	Austrian pine, Osageorange, green ash.	Pin oak, eastern white pine.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
9B2, 9C2: Lagonda	Lilac	Amur honeysuckle, Washington hawthorn, Amur privet, arrowwood, eastern redcedar, American cranberrybush.	Austrian pine, Osageorange, green ash.	Pin oak, eastern white pine.	---
10F2: Gosport	Lilac	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
12C2, 12D2: Keswick	Lilac	Eastern redcedar, American cranberrybush, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
14B, 14C2: Gorin	Lilac	Amur honeysuckle, Washington hawthorn, eastern redcedar, Amur privet, arrowwood, American cranberrybush.	Green ash, Austrian pine, Osageorange.	Pin oak, eastern white pine.	---
22B: Olmitz	---	Amur honeysuckle, Amur privet, silky dogwood, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
25: Chariton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
27B, 27C2: Gifford	Lilac	Amur honeysuckle, Amur privet, eastern redcedar, arrowwood, Washington hawthorn, American cranberrybush.	Green ash, Austrian pine, Osageorange.	Pin oak, eastern white pine.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
29. Humeston	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
31A, 31B. Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, blue spruce, white fir, northern whitecedar, Washington hawthorn.	Eastern white pine	Pin oak.
35. Blackoar	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
36. Chequest	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
37. Zook	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Norway spruce, northern whitecedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
38. Landes	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
39. Kennebec	---	Amur maple, Amur honeysuckle, lilac, autumn olive.	Eastern redcedar	Austrian pine, hackberry, pin oak, green ash, honeylocust.	Eastern white pine, eastern cottonwood.
40. Portage	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Austrian pine, Washington hawthorn, northern whitecedar, blue spruce, Norway spruce, white fir.	Eastern white pine	Pin oak.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
41----------------- Vesser	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
43----------------- Fatima	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
90. Udorthents					
94F--------------- Lenzburg	Siberian peashrub	Eastern redcedar, jack pine, Russian olive, Washington hawthorn, Osageorange.	Honeylocust, northern catalpa.	---	---

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1B2 Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
1C2, 1C3 Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
1D2, 1D3 Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
2D2, 2D3 Purdin	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Slight	Moderate: slope.
2E2, 2E3 Purdin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
3B Kilwinning	Severe: percs slowly, wetness.	Severe: percs slowly.	Severe: percs slowly, wetness.	Moderate: wetness.	Moderate: wetness.
4D2, 4D3 Winnegan	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Slight	Moderate: slope.
4E2, 4E3 Winnegan	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
4F Winnegan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
5B2 Leonard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
7B Grundy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
9B2 Lagonda	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
9C2 Lagonda	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness.
10F2 Gosport	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
12C2 Keswick	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
12D2 Keswick	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
14B Gorin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
14C2 Gorin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight	Slight.
22B Olmitz	Slight	Slight	Moderate: slope.	Slight	Slight.
25 Chariton	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
27B Gifford	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
27C2 Gifford	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: slope, wetness, percs slowly.	Severe: wetness.	Severe: wetness.
29 Humeston	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
31A, 31B Colo	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
35 Blackoar	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
36 Chequest	Severe: wetness, flooding.	Moderate: flooding, wetness, percs slowly.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
37 Zook	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
38 Landes	Severe: flooding.	Moderate: flooding.	Slight	Moderate: flooding.	Severe: flooding.
39 Kennebec	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
40 Portage	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: ponding, flooding, too clayey.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
41-------------------- Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
43-------------------- Fatima	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
90. Udorthents					
94F------------------- Lenzburg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1B2----------------- Armstrong	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Very poor.
1C2, 1C3, 1D2, 1D3- Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
2D2, 2D3----------- Purdin	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
2E2, 2E3----------- Purdin	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
3B----------------- Kilwinning	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
4D2, 4D3----------- Winnegan	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
4E2, 4E3----------- Winnegan	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
4F----------------- Winnegan	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
5B2---------------- Leonard	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
7B----------------- Grundy	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
9B2, 9C2----------- Lagonda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
10F2--------------- Gosport	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
12C2, 12D2--------- Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
14B, 14C2---------- Gorin	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
22B---------------- Olmitz	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
25----------------- Chariton	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
27B, 27C2---------- Gifford	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
29----------------- Humeston	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
31A, 31B----------- Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
35----------------- Blackoar	Good	Good	Good	Fair	Fair	Good	Fair	Good	Fair	Fair.
36----------------- Chequest	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
37----------------- Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
38----------------- Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
39----------------- Kennebec	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
40----------------- Portage	Poor	Poor	Poor	Poor	Poor	Poor	Good	Very poor.	Very poor.	Poor.
41----------------- Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
43----------------- Fatima	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
90. Udorthents										
94F---------------- Lenzburg	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1B2, 1C2, 1C3----- Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength.	Moderate: wetness.
1D2, 1D3---------- Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness, slope.	Severe: shrink-swell, low strength.	Moderate: slope, wetness.
2D2, 2D3---------- Purdin	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
2E2, 2E3---------- Purdin	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
3B---------------- Kilwinning	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.	Moderate: wetness.
4D2, 4D3---------- Winnegan	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
4E2, 4E3, 4F------ Winnegan	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
5B2--------------- Leonard	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
7B---------------- Grundy	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
9B2, 9C2---------- Lagonda	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
10F2-------------- Gosport	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
12C2-------------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
12D2-------------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
14B, 14C2--------- Gorin	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell.	Severe: low strength, frost action, shrink-swell.	Slight.
22B--------------- Olmitz	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
25---------------- Chariton	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, frost action.	Severe: wetness.
27B, 27C2--------- Gifford	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
29---------------- Humeston	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, wetness, low strength.	Severe: wetness.
31A, 31B---------- Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
35---------------- Blackoar	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
36---------------- Chequest	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, shrink-swell.	Severe: flooding.
37---------------- Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding.
38---------------- Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
39---------------- Kennebec	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Severe: flooding.
40---------------- Portage	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, flooding, too clayey.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
41----------------- Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
43----------------- Fatima	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
90. Udorthents						
94F---------------- Lenzburg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1B2------------------ Armstrong	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
1C2, 1C3, 1D2, 1D3-- Armstrong	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
2D2, 2D3------------ Purdin	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
2E2, 2E3------------ Purdin	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness, slope, too clayey.	Severe: wetness, slope.	Poor: too clayey, slope.
3B------------------- Kilwinning	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
4D2, 4D3------------ Winnegan	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey, slope, wetness.
4E2, 4E3, 4F-------- Winnegan	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness, slope.	Severe: wetness, slope.	Poor: slope.
5B2------------------ Leonard	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
7B------------------- Grundy	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
9B2------------------ Lagonda	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
9C2------------------ Lagonda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
10F2----------------- Gosport	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, slope, too clayey.	Severe: slope.	Poor: area reclaim, hard to pack, slope.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12C2, 12D2 Keswick	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
14B Gorin	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: thin layer.
14C2 Gorin	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: thin layer.
22B Olmitz	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
25 Chariton	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
27B Gifford	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
27C2 Gifford	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
29 Humeston	Severe: wetness, percs slowly, flooding.	Severe: flooding.	Severe: wetness, too clayey, flooding.	Severe: wetness, flooding.	Poor: wetness, too clayey, hard to pack.
31A, 31B Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
35 Blackoar	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
36 Chequest	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: wetness, hard to pack, too clayey.
37 Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
38 Landes	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: seepage, too sandy.
39 Kennebec	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
40------------------- Portage	Severe: flooding, ponding, percs slowly.	Severe: flooding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
41------------------- Vesser	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
43------------------- Fatima	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
90. Udorthents					
94F------------------ Lenzburg	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1B2, 1C2, 1C3, 1D2, 1D3 Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
2D2, 2D3 Purdin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
2E2, 2E3 Purdin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
3B Kilwinning	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
4D2, 4D3 Winnegan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
4E2, 4E3 Winnegan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
4F Winnegan	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
5B2 Leonard	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
7B Grundy	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
9B2, 9C2 Lagonda	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
10F2 Gosport	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
12C2, 12D2 Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
14B, 14C2 Gorin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
22B Olmitz	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
25 Chariton	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
27B, 27C2-------------- Gifford	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
29-------------------- Humeston	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
31A, 31B-------------- Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
35-------------------- Blackoar	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
36-------------------- Chequest	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
37-------------------- Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
38-------------------- Landes	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: small stones, thin layer.
39-------------------- Kennebec	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
40-------------------- Portage	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
41-------------------- Vesser	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
43-------------------- Fatima	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
90. Udorthents				
94F------------------- Lenzburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1B2, 1C2, 1C3 Armstrong	Moderate: slope.	Moderate: wetness, hard to pack.	Slope, percs slowly, frost action.	Slope, wetness, percs slowly.	Percs slowly, wetness.	Percs slowly, wetness.
1D2, 1D3 Armstrong	Severe: slope.	Moderate: wetness, hard to pack.	Slope, percs slowly, frost action.	Slope, wetness, percs slowly.	Slope, percs slowly, wetness.	Percs slowly, slope, wetness.
2D2, 2D3, 2E2, 2E3 Purdin	Severe: slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, wetness, percs slowly.	Slope, percs slowly.
3B Kilwinning	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly, wetness.
4D2, 4D3, 4E2, 4E3, 4F Winnegan	Severe: slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, wetness.	Slope, percs slowly.
5B2 Leonard	Moderate: slope.	Severe: wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
7B Grundy	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
9B2, 9C2 Lagonda	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
10F2 Gosport	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
12C2 Keswick	Moderate: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
12D2 Keswick	Severe: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
14B, 14C2 Gorin	Moderate: slope.	Moderate: thin layer, piping, wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
22B Olmitz	Moderate: seepage, slope.	Slight	Deep to water	Slope	Favorable	Favorable.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
25 Chariton	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
27B, 27C2 Gifford	Moderate: slope.	Severe: wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
29 Humeston	Moderate: seepage.	Severe: wetness.	Percs slowly, frost action, flooding.	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly, wetness.
31A Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
31B Colo	Moderate: seepage, slope.	Severe: wetness.	Flooding, frost action, slope.	Slope, wetness, flooding.	Wetness	Wetness.
35 Blackoar	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
36 Chequest	Slight	Severe: wetness.	Flooding, frost action.	Flooding, wetness.	Wetness, erodes easily.	Wetness, erodes easily.
37 Zook	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
38 Landes	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable	Too sandy	Favorable.
39 Kennebec	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
40 Portage	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
41 Vesser	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
43 Fatima	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
90. Udorthents						
94F Lenzburg	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1B2 Armstrong	0-7	Loam	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	7-49	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	49-60	Clay loam	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1C2 Armstrong	0-9	Clay loam	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	9-50	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	50-60	Clay loam	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1C3 Armstrong	0-3	Clay loam	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	3-30	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	30-60	Clay loam	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1D2 Armstrong	0-8	Clay loam	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	8-44	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	44-60	Clay loam	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1D3 Armstrong	0-5	Clay loam	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	5-48	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	48-60	Clay loam	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
2D2 Purdin	0-7	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	80-95	60-80	20-30	5-15
	7-13	Clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	60-75	35-45	15-25
	13-37	Clay loam, clay	CL	A-6, A-7	0	95-100	95-100	85-95	65-85	35-50	15-25
	37-50	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	15-25
	50-72	Clay loam, loam	CL	A-6	0	95-100	95-100	80-95	60-80	30-40	11-20
2D3 Purdin	0-5	Clay loam	CL	A-6	0	95-100	95-100	70-85	60-75	30-40	11-20
	5-13	Clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	60-75	35-45	15-25
	13-29	Clay loam, clay	CL	A-6, A-7	0	95-100	95-100	85-95	65-85	35-50	15-25
	29-60	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	15-25
2E2 Purdin	0-5	Clay loam	CL	A-6	0	95-100	95-100	70-85	60-75	30-40	11-20
	5-11	Clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	60-75	35-45	15-25
	11-31	Clay loam, clay	CL	A-6, A-7	0	95-100	95-100	85-95	65-85	35-50	15-25
	31-60	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	15-25
2E3 Purdin	0-7	Clay loam	CL	A-6	0	95-100	95-100	70-85	60-75	30-40	11-20
	7-31	Clay loam, clay	CL	A-6, A-7	0	95-100	95-100	85-95	65-85	35-50	15-25
	31-60	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	15-25
3B Kilwinning	0-9	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	9-36	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	55-70	35-45
	36-50	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-55	20-30
	50-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	80-100	25-35	11-20
4D2, 4D3, 4E2, 4E3 Winnegan	0-4	Clay loam	CL	A-6	0	95-100	95-100	80-90	65-80	25-40	11-20
	4-26	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	20-30
	26-43	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	20-30
	43-60	Clay loam, loam	CL	A-6	0	95-100	95-100	85-95	60-80	25-40	10-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
4F---------------- Winnegan	0-6	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	95-100	80-90	60-80	20-30	5-15
	6-10	Loam, clay loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	80-90	60-80	20-30	5-15
	10-31	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	20-30
	31-38	Clay loam, clay	CL	A-7	0	95-100	95-100	85-95	65-85	40-50	20-30
	38-60	Clay loam, loam	CL	A-6	0	95-100	95-100	85-95	60-80	25-40	10-20
5B2--------------- Leonard	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	95-100	90-100	85-100	25-40	5-15
	7-21	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	20-30
	21-41	Silty clay, clay, silty clay loam.	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	41-60	Silty clay, clay loam, silty clay loam.	CL, CH	A-7	0	95-100	95-100	80-95	75-90	45-60	25-35
7B---------------- Grundy	0-12	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-20
	12-40	Silty clay-------	CH	A-7	0	100	100	95-100	90-100	50-70	30-45
	40-68	Silty clay loam	CH, CL	A-7	0	100	100	90-100	90-100	40-55	25-35
9B2, 9C2---------- Lagonda	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	20-40	5-15
	8-39	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	40-70	25-40
	39-60	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	95-100	90-100	80-95	75-90	45-60	25-40
10F2-------------- Gosport	0-4	Silty clay loam	ML, MH	A-7	0	100	90-100	90-100	85-100	41-55	11-20
	4-26	Clay, silty clay, silty clay loam.	CH	A-7	0	100	90-100	90-100	85-100	50-65	35-50
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
12C2, 12D2-------- Keswick	0-6	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-100	75-90	60-80	35-50	15-25
	6-31	Clay loam, clay	CH, CL	A-7	0-5	90-100	80-100	70-90	55-80	40-70	20-40
	31-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
14B--------------- Gorin	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-18
	11-16	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-30
	16-40	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	40-60	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	80-95	70-90	30-50	12-30
14C2-------------- Gorin	0-4	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-18
	4-10	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-30
	10-16	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	16-54	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	80-95	70-90	30-50	12-30
	54-60	Clay-------------	CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	30-45
22B--------------- Olmitz	0-10	Loam-------------	CL	A-6	0	100	90-100	85-95	60-80	30-40	11-20
	10-26	Loam, clay loam	CL	A-6	0	100	90-100	85-95	60-80	30-40	11-20
	26-60	Clay loam--------	CL	A-6, A-7	0	100	90-100	85-95	60-80	35-45	15-25
25---------------- Chariton	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	15-41	Silty clay-------	CH	A-7	0	100	100	95-100	90-95	55-75	40-50
	41-60	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	45-55	25-35

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
27B, 27C2-------- Gifford	0-8	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	85-95	30-40	10-20
	8-34	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	50-65	30-40
	34-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	100	85-100	75-90	35-45	20-25
29--------------- Humeston	0-14	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	14-26	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	26-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35
31A, 31B--------- Colo	0-14	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	14-39	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	39-67	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
35--------------- Blackoar	0-17	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-18
	17-50	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-18
	50-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
36--------------- Chequest	0-10	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-50	15-25
	10-60	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	90-100	45-60	20-30
37--------------- Zook	0-18	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
	18-45	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
	45-60	Silty clay loam, silty clay, silt loam.	CH, CL	A-7, A-6	0	100	100	95-100	95-100	35-80	10-50
38--------------- Landes	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	90-100	85-95	50-75	25-35	5-15
	8-40	Fine sandy loam, loam, loamy fine sand.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	85-100	70-95	20-70	<25	NP-10
	40-72	Stratified sand to silt loam.	SM, ML, SP-SM, SC	A-2, A-4	0	100	95-100	60-95	10-70	<30	NP-10
39--------------- Kennebec	0-45	Silt loam--------	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	45-70	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	90-100	25-40	5-15
40--------------- Portage	0-5	Silty clay-------	CH	A-7	0	100	100	95-100	90-100	55-80	30-50
	5-43	Clay-------------	CH	A-7	0	100	100	100	95-100	65-85	35-55
	43-60	Clay-------------	CH	A-7	0	100	100	100	95-100	65-85	35-55
41--------------- Vesser	0-13	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	13-27	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	27-64	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
43--------------- Fatima	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	5-18
	15-34	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	30-40	12-18
	34-66	Silt loam, loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	5-18
90. Udorthents											
94F-------------- Lenzburg	0-2	Silty clay loam	CL	A-6, A-7	2-10	80-100	75-100	65-95	55-85	35-50	15-25
	2-62	Silty clay loam, clay loam.	CL	A-6, A-7	2-10	80-95	75-90	70-90	55-85	25-45	10-25

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
1B2--------------- Armstrong	0-7	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6	2-3
	7-49	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	49-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
1C2--------------- Armstrong	0-9	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	3	4	1-2
	9-50	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	50-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
1C3--------------- Armstrong	0-3	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	2	4	1-2
	3-30	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	30-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
1D2--------------- Armstrong	0-8	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	3	4	.5-1
	8-44	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	44-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
1D3--------------- Armstrong	0-5	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	2	4	.5-1
	5-48	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	48-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
2D2--------------- Purdin	0-7	20-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-7.3	Low----------	0.32	3	6	2-3
	7-13	30-40	1.35-1.55	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.32			
	13-37	35-45	1.35-1.55	0.06-0.2	0.10-0.16	4.5-6.5	High---------	0.32			
	37-50	35-45	1.35-1.55	0.06-0.2	0.10-0.16	7.4-8.4	High---------	0.32			
	50-72	24-35	1.40-1.60	0.2-0.6	0.12-0.17	7.4-8.4	Moderate-----	0.32			
2D3--------------- Purdin	0-5	27-35	1.20-1.40	0.2-0.6	0.16-0.18	4.5-7.3	Moderate-----	0.32	2	6	.5-2
	5-13	30-40	1.35-1.55	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.32			
	13-29	35-45	1.35-1.55	0.06-0.2	0.10-0.16	4.5-6.5	High---------	0.32			
	29-60	35-45	1.35-1.55	0.06-0.2	0.10-0.16	7.4-8.4	High---------	0.32			
2E2--------------- Purdin	0-5	27-35	1.20-1.40	0.2-0.6	0.16-0.18	4.5-7.3	Moderate-----	0.32	3	6	.5-2
	5-11	30-40	1.35-1.55	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.32			
	11-31	35-45	1.35-1.55	0.06-0.2	0.10-0.16	4.5-6.5	High---------	0.32			
	31-60	35-45	1.35-1.55	0.06-0.2	0.10-0.16	7.4-8.4	High---------	0.32			
2E3--------------- Purdin	0-7	27-35	1.20-1.40	0.2-0.6	0.16-0.18	4.5-7.3	Moderate-----	0.32	2	6	.5-2
	7-31	35-45	1.35-1.55	0.06-0.2	0.10-0.16	4.5-6.5	High---------	0.32			
	31-60	35-45	1.35-1.55	0.06-0.2	0.10-0.16	7.4-8.4	High---------	0.32			
3B---------------- Kilwinning	0-9	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	3	6	2-4
	9-36	35-55	1.30-1.40	<0.06	0.11-0.13	4.5-6.0	High---------	0.37			
	36-50	35-55	1.30-1.40	0.06-0.2	0.18-0.20	5.6-7.3	Moderate-----	0.37			
	50-60	25-35	1.30-1.40	0.6-2.0	0.20-0.22	6.6-7.8	Low----------	0.37			
4D2, 4D3, 4E2, 4E3-------------- Winnegan	0-4	27-35	1.20-1.40	0.2-0.6	0.17-0.19	4.5-7.3	Moderate-----	0.32	3-2	6	.5-1
	4-26	35-45	1.35-1.55	0.06-0.2	0.09-0.15	4.5-6.5	High---------	0.32			
	26-43	35-45	1.35-1.55	0.06-0.2	0.09-0.15	7.4-8.4	High---------	0.32			
	43-60	20-35	1.40-1.60	0.2-0.6	0.09-0.15	7.4-8.4	Moderate-----	0.32			
4F---------------- Winnegan	0-6	18-27	1.20-1.40	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.32	3	6	.5-1
	6-10	20-30	1.25-1.45	0.2-0.6	0.15-0.19	4.5-6.5	Moderate-----	0.32			
	10-31	35-45	1.35-1.55	0.06-0.2	0.09-0.15	4.5-6.5	High---------	0.32			
	31-38	35-45	1.35-1.55	0.06-0.2	0.09-0.15	7.4-8.4	High---------	0.32			
	38-60	20-35	1.40-1.60	0.2-0.6	0.09-0.15	7.4-8.4	Moderate-----	0.32			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
5B2: Leonard	0-7	20-27	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.37	3	6	1-3
	7-21	35-45	1.30-1.45	0.06-0.2	0.11-0.13	4.5-6.5	High	0.37			
	21-41	35-45	1.20-1.35	0.06-0.2	0.10-0.12	4.5-6.5	High	0.37			
	41-60	32-45	1.25-1.40	0.06-0.2	0.11-0.14	6.6-7.8	High	0.37			
7B: Grundy	0-12	12-35	1.35-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	0.37	3	6	2-4
	12-40	40-50	1.30-1.40	0.06-0.2	0.11-0.13	5.1-7.3	High	0.37			
	40-68	28-35	1.35-1.40	0.06-0.2	0.18-0.20	5.6-7.3	High	0.37			
9B2, 9C2: Lagonda	0-8	12-27	1.35-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Moderate	0.37	3	6	2-4
	8-39	32-50	1.30-1.40	0.06-0.2	0.13-0.18	5.6-7.3	High	0.37			
	39-60	35-45	1.30-1.40	0.06-0.2	0.10-0.18	6.6-7.8	High	0.37			
10F2: Gosport	0-4	27-34	1.30-1.40	0.2-0.6	0.14-0.16	5.1-7.3	Moderate	0.43	3	7	1-2
	4-26	36-60	1.50-1.60	<0.06	0.12-0.14	3.6-5.5	High	0.32			
	26-60	---	---	---	---	---	-------------	----			
12C2, 12D2: Keswick	0-6	27-40	1.45-1.50	0.2-0.6	0.17-0.19	4.5-7.3	Moderate	0.37	3	4	.5-1
	6-31	35-60	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High	0.37			
	31-60	30-40	1.60-1.75	0.2-0.6	0.12-0.16	4.5-7.8	Moderate	0.37			
14B: Gorin	0-11	12-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Moderate	0.43	3	6	.5-2
	11-16	27-42	1.30-1.45	0.06-0.6	0.18-0.20	4.5-6.0	Moderate	0.32			
	16-40	35-60	1.30-1.40	0.06-0.2	0.11-0.16	4.5-6.0	High	0.32			
	40-60	27-40	1.30-1.45	0.2-0.6	0.18-0.20	4.5-6.0	Moderate	0.32			
14C2: Gorin	0-4	12-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Moderate	0.43	3	6	.5-2
	4-10	27-42	1.30-1.45	0.06-0.6	0.18-0.20	4.5-6.0	Moderate	0.32			
	10-16	35-60	1.30-1.40	0.06-0.2	0.11-0.16	4.5-6.0	High	0.32			
	16-54	27-40	1.30-1.45	0.2-0.6	0.18-0.20	4.5-6.0	Moderate	0.32			
	54-60	40-60	1.30-1.40	<0.06	0.10-0.12	4.5-6.0	High	0.32			
22B: Olmitz	0-10	24-30	1.40-1.45	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.28	5	6	3-4
	10-26	24-30	1.40-1.45	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.28			
	26-60	28-34	1.45-1.55	0.6-2.0	0.15-0.17	5.1-6.5	Moderate	0.28			
25: Chariton	0-15	18-27	1.35-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	3	6	1-4
	15-41	48-60	1.35-1.45	0.06-0.2	0.11-0.13	5.1-7.3	High	0.28			
	41-60	32-40	1.35-1.45	0.2-0.6	0.18-0.20	6.1-7.8	Moderate	0.43			
27B, 27C2: Gifford	0-8	20-35	1.30-1.45	0.6-2.0	0.22-0.24	5.1-6.5	Low	0.43	3	6	1-4
	8-34	45-60	1.30-1.45	<0.06	0.11-0.14	5.1-7.3	High	0.32			
	34-60	25-35	1.35-1.50	0.06-0.2	0.18-0.20	5.6-7.3	Moderate	0.43			
29: Humeston	0-14	24-27	1.35-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Low	0.32	4	6	2-4
	14-26	20-26	1.30-1.35	0.2-2.0	0.20-0.22	4.5-6.0	Moderate	0.32			
	26-60	30-48	1.35-1.50	<0.06	0.13-0.15	4.5-6.5	High	0.32			
31A, 31B: Colo	0-14	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.28	5	7	5-7
	14-39	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.28			
	39-67	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	0.28			
35: Blackoar	0-17	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.28	5	6	2-4
	17-50	18-27	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.43			
	50-60	18-30	1.35-1.45	0.6-2.0	0.18-0.22	5.6-7.3	Low	0.43			
36: Chequest	0-10	30-35	1.30-1.35	0.2-0.6	0.18-0.20	5.1-7.3	High	0.28	5	7	2-4
	10-60	35-42	1.35-1.45	0.2-0.6	0.14-0.18	5.1-6.0	High	0.43			
37: Zook	0-18	32-38	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High	0.28	5	7	5-7
	18-45	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High	0.28			
	45-60	20-45	1.30-1.45	0.06-0.6	0.11-0.22	5.6-7.8	High	0.28			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
38---------------- Landes	0-8	8-22	1.20-1.40	0.6-2.0	0.20-0.22	6.1-8.4	Low-----------	0.28	4	5	1-2
	8-40	5-18	1.45-1.70	2.0-6.0	0.10-0.15	6.1-8.4	Low-----------	0.20			
	40-72	5-18	1.60-1.70	6.0-20	0.05-0.15	6.1-8.4	Low-----------	0.20			
39---------------- Kennebec	0-45	22-27	1.25-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Moderate------	0.32	5	6	5-6
	45-70	24-28	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate------	0.43			
40---------------- Portage	0-5	45-75	1.25-1.45	<0.06	0.12-0.14	5.1-7.3	Very high----	0.37	5	4	2-4
	5-43	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-5.5	Very high----	0.37			
	43-60	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-6.0	Very high----	0.37			
41---------------- Vesser	0-13	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate------	0.32	5	6	2-4
	13-27	18-22	1.35-1.40	0.6-2.0	0.18-0.22	5.1-6.0	Moderate------	0.43			
	27-64	30-35	1.40-1.45	0.6-2.0	0.17-0.21	5.1-6.5	Moderate------	0.43			
43---------------- Fatima	0-15	15-27	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.3	Low-----------	0.28	5	6	2-4
	15-34	18-27	1.35-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28			
	34-66	18-27	1.35-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.28			
90. Udorthents											
94F--------------- Lenzburg	0-2	27-35	1.30-1.60	0.6-2.0	0.17-0.22	6.6-8.4	Moderate------	0.37	5	4L	.5-2
	2-62	27-35	1.30-1.60	0.2-0.6	0.15-0.18	7.4-8.4	Moderate------	0.37			

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1B2, 1C2, 1C3, 1D2, 1D3 Armstrong	C	None	---	---	1.0-3.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
2D2, 2D3, 2E2, 2E3 Purdin	C	None	---	---	2.0-3.5	Perched	Nov-Apr	>60	---	Moderate	High	High.
3B Kilwinning	D	None	---	---	1.0-2.0	Perched	Nov-Apr	>60	---	Moderate	High	Moderate.
4D2, 4D3, 4E2, 4E3, 4F Winnegan	C	None	---	---	2.0-3.5	Perched	Nov-Apr	>60	---	Moderate	High	High.
5B2 Leonard	D	None	---	---	0.5-2.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
7B Grundy	C	None	---	---	1.0-3.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
9B2, 9C2 Lagonda	C	None	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High	High	Low.
10F2 Gosport	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	High.
12C2, 12D2 Keswick	C	None	---	---	1.0-3.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
14B, 14C2 Gorin	C	None	---	---	2.0-4.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
22B Olmitz	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
25 Chariton	C	Rare	---	---	0-1.5	Perched	Nov-Apr	>60	---	High	High	Moderate.
27B, 27C2 Gifford	D	Rare	---	---	0.5-2.0	Perched	Nov-Apr	>60	---	Moderate	High	Moderate.
29 Humeston	C/D	Occasional	Very brief	Nov-Apr	0-1.0	Apparent	Nov-Apr	>60	---	High	High	Moderate.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
31A, 31B---------- Colo	B/D	Frequent----	Very brief to brief.	Nov-Apr	1.0-3.0	Apparent	Nov-Apr	>60	---	High-----	High-----	Moderate.
35---------------- Blackoar	B/D	Frequent----	Brief-----	Nov-Apr	0-1.0	Apparent	Nov-Apr	>60	---	High-----	High-----	Low.
36---------------- Chequest	C	Frequent----	Brief to long.	Nov-Apr	1.0-3.0	Apparent	Nov-Apr	>60	---	High-----	High-----	Moderate.
37---------------- Zook	C/D	Frequent----	Brief-----	Nov-Apr	0-3.0	Apparent	Nov-Apr	>60	---	High-----	High-----	Moderate.
38---------------- Landes	B	Frequent----	Brief-----	Nov-Apr	4.0-6.0	Apparent	Nov-Apr	>60	---	Moderate	Low------	Low.
39---------------- Kennebec	B	Frequent----	Brief-----	Nov-Apr	3.0-5.0	Apparent	Nov-Apr	>60	---	High-----	Moderate	Low.
40---------------- Portage	D	Frequent----	Brief-----	Nov-Apr	+.5-1.0	Apparent	Nov-Apr	>60	---	Moderate	High-----	High.
41---------------- Vesser	C	Occasional	Brief-----	Nov-Apr	1.0-3.0	Apparent	Nov-Apr	>60	---	High-----	High-----	Moderate.
43---------------- Fatima	B	Frequent----	Brief-----	Nov-Apr	3.0-5.0	Apparent	Nov-Apr	>60	---	High-----	Moderate	Low.
90. Udorthents												
94F--------------- Lenzburg	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

TABLE 18.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Armstrong	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Blackoar	Fine-silty, mixed, mesic Fluvaquentic Haplaquolls
Chariton	Fine, montmorillonitic, mesic Mollic Albaqualfs
Chequest	Fine, montmorillonitic, mesic Typic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Fatima	Fine-silty, mixed, mesic Fluvaquentic Hapludolls
Gifford	Fine, montmorillonitic, mesic Vertic Ochraqualfs
Gorin	Fine, montmorillonitic, mesic Aquic Hapludalfs
Gosport	Fine, illitic, mesic Typic Dystrochrepts
Grundy	Fine, montmorillonitic, mesic Aquic Argiudolls
Humeston	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Kennebec	Fine-silty, mixed, mesic Cumulic Hapludolls
Keswick	Fine, montmorillonitic, mesic Aquic Hapludalfs
*Kilwinning	Fine, montmorillonitic, mesic Vertic Ochraqualfs
*Lagonda	Fine, montmorillonitic, mesic Aquic Argiudolls
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Lenzburg	Fine-loamy, mixed (calcareous), mesic Typic Udorthents
Leonard	Fine, montmorillonitic, mesic, sloping Vertic Ochraqualfs
Olmitz	Fine-loamy, mixed, mesic Cumulic Hapludolls
Portage	Very fine, montmorillonitic, mesic Vertic Haplaquolls
Purdin	Fine, mixed, mesic Mollic Hapludalfs
Udorthents	Fine-loamy, mixed, mesic Udorthents
Vesser	Fine-silty, mixed, mesic Argiaquic Argialbolls
Winnegan	Fine, mixed, mesic Typic Hapludalfs
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

Erratum

Map unit 10F2, Gosport silty clay loam, 9 to 35 percent slopes, eroded, is represented by the map symbol 10F on the detailed soil maps.

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