United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Newton County, Missouri

How To Use This Soil Survey

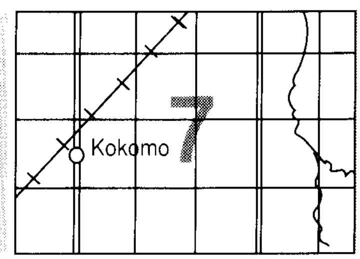
General Soil Map

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.

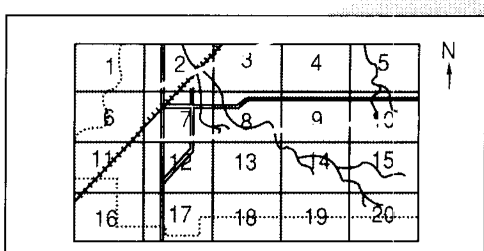
Detailed Soil Maps

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



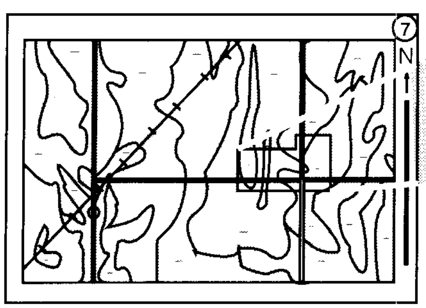
MAP SHEET

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.

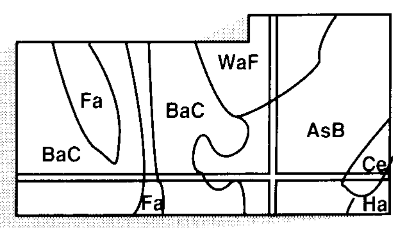


INDEX TO MAP SHEETS

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. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork. The Newton County Court, with some assistance from the Comprehensive Employment and Training Act (CETA), provided funds through the Newton County Soil and Water Conservation District for a soil scientist to assist with the fieldwork. Crowder Junior College provided office space for the survey party. The survey is part of the technical assistance furnished to the Newton 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.

Cover: Typical area of the Huntington-Secesh association. Clarksville soils are in the timbered area in the background.

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Soil Series

Issued September 1989

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Newton 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.

Paul F. Larson
State Conservationist
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Soil Survey of
Newton County, Missouri

By Max W. Aldrich, Soil Conservation Service

Fieldwork by Max W. Aldrich, Soil Conservation Service;
Ron McMurtrey, Newton County Soil and Water Conservation District;
and Dennis Meinert, Missouri Department of Natural Resources

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

NEWTON COUNTY is in the southwestern part of Missouri, on the western fringe of the Ozark region (fig. 1). It is bordered on the north by Jasper County, on the south by McDonald County, on the east by Lawrence and Barry Counties, and on the west by Kansas and Oklahoma. In 1980, Neosho, the county seat and largest town, had a population of 9,493. Other towns in the county and their populations are Seneca, 1,853; Grandby, 1,908; and Diamond, 766. Joplin is primarily in Jasper County, but 2,196 of its inhabitants reside in Newton County. Leawood, which is south of Joplin, has a population of 631.

The county is about 20 miles long and 31 miles wide. It has an area of 401,069 acres, or approximately 629 square miles.

This soil survey updates the survey of Newton County published in 1917 (*17*). It provides additional interpretive information and larger maps.

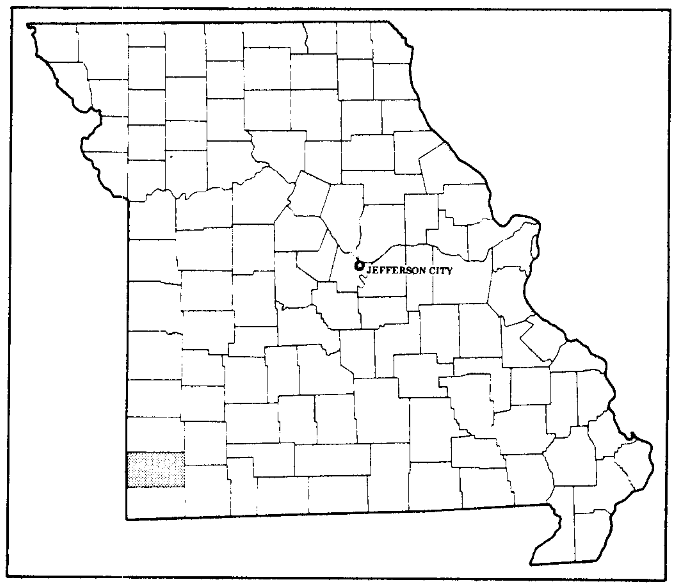

Figure 1.—Location of Newton County in Missouri.

General Nature of the County

This section gives general information about the county. It describes climate, relief and drainage, history, and farming.

Climate

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

Newton County, Missouri, is hot in summer and moderately cool in winter. Rainfall is fairly heavy and is well distributed throughout the year. Snow falls nearly every winter, but the snow cover lasts for only a few days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Neosho, Missouri, in the period 1952 to 1980. 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 39 degrees F, and the average daily minimum temperature is 26 degrees. The lowest temperature on record, which occurred at Neosho on January 8, 1979, is -16 degrees. In summer the average temperature is 77 degrees, and the average daily maximum temperature is 89 degrees. The highest recorded temperature, which occurred at Neosho on July 14, 1954, is 112 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 annual precipitation is 40.87 inches. Of this, nearly 25 inches, or about 60 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 4.97 inches at Neosho on May 21, 1957. Thunderstorms occur on about 60 days each year.

The average seasonal snowfall is 12.2 inches. The greatest snow depth at any one time during the period of record was 11 inches. On the average, 3 days of the year have at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is about 55 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, 13 miles per hour, in spring.

Relief and Drainage

William J. Caldwell, professor of geography, Missouri Southern State College, helped prepare this section.

The survey area is in the youthful stage of the present erosion cycle. Surface features are mainly a result of a gully type of water erosion. The landscape configurations differ from one another according to the geologic structure and the resistance of the bedrock to chemical and physical weathering.

Elevation ranges from 1,360 feet above sea level at the Barry County line, near Wheaton, to 830 feet at the bottom of Shoal Creek, where it enters Cherokee County, Kansas.

Most of the county is undulating to rolling. While undulating areas predominate on the major divides in the southwestern and western parts of the county, nearly level areas are more common in the eastern and northeastern parts, across the broad divides separating the major streams. Side slopes range from gently sloping in the northeastern part to steep and very steep along streams in the rest of the county. Bedrock escarpments are common along the banks of Shoal Creek and crop out in a few areas along the smaller streams.

All of the streams in the county drain into the Grand River drainage system. Shoal Creek, the largest stream, enters the county from the east and flows northwest, leaving the county south of Joplin. It crosses the Grand Falls Chert Formation 5 miles from the western border. The valley narrows to the width of the stream channel in a series of shoals culminating in a 20-foot drop at Grand Falls. After it crosses the Grand Falls Chert Formation, it again broadens into a wide valley.

Buffalo Creek drains the south-central part of the county, south of Neosho, and Indian Creek drains the southeastern part. Both of these creeks are characterized by a long series of high terraces, two and three steps above the stream channel, as much as 40 feet in elevation. The Lost Creek Watershed covers the southwestern part of the county. Flood-control dams and debris basins on this watershed protect the town of Seneca. The northeastern part of the county is drained by Jenkins, Jones, and Center Creeks.

The present drainage system and landforms have not prevailed throughout the geomorphic history of the county. Some soils are on landforms that are not likely to have formed under the present regime. Well rounded, well sorted gravel is at high elevations throughout the county. About 12 feet of sorted and stratified chert pebbles is exposed in a roadside pit along State Highway 86, at an altitude of 1,240 feet (*4*). These and other pebbles in the uplands show the effects of a greater amount of abrasive polishing and rounding than is characteristic of the pebbles in the present streams.

The well worn pebbles are in most of the upland soils, except for Clarksville and Nixa soils, which are subject to severe geological erosion. Some of the upland soils have these pebbles at a depth of more than 6 feet. The content of pebbles ranges from less than 1 percent to 90 percent within short distances and occurs in no uniform pattern. The pebbles form a wavy layer in the soils. The top of this layer is at a depth of 0 to more than 6 feet. Commonly, the fine-earth fraction around the pebbles is silt loam or silty clay loam.

The county has several mounds of well rounded boulders and pebbles. In some areas these mounds are more than a mile long. They are at the head of drainageways and appear to have occupied the perimeter around the top of the drainage system in the watershed. These areas apparently have been water worked. The boulders and pebbles have been transported only short distances. The mounds generally have two or more steps, each rarely more than 8 feet high. The top step broadens out, and the rounded pebbles on this part of the mounds are covered with fine-earth material a few inches to several feet thick.

In some areas the gravel transports free water laterally under 2 or more feet of soil to an entrenched drainageway, where it comes to the surface in seeps or wet-weather springs. Most of the smaller streams have stratified gravel at various depths. Much of the water is transported through the pebbles, generally at a depth of 2 to 6 feet. The strata in which the water flows have no fine-earth material. They range from a few inches to 3 feet in thickness.

History

Ron McMurtrey, soil scientist, Newton County Soil and Water Conservation District, helped prepare this section.

Prior to the settlement period, Indians roamed over the hunting grounds of the survey area but never took up permanent residence. The first settler in the survey area was Lunsford Oliver from Arkansas. In 1829, he located a claim along Shoal Creek (*10*). Settlers continued to come into the survey area during the next decade.

Newton County was organized by an act of the Missouri General Assembly on December 13, 1838. The county originally had an area of about 1,400 square miles. In 1849, however, about 500 square miles in the southern part was separated out as McDonald County.

In 1850, lead was discovered at what is now the town of Granby. After 1854, the Granby mines became famous for their rich deposits of lead.

When the Civil War began in 1861, Newton County had a population of nearly 10,000. In 1865, after the war, the population was only about 3,000 (*6*). Since the county was caught between the lines of two contending armies, it became the prey of marauders. Scenes of murder and pillage were common. In 1865, the posts of Neosho and Newtonia included nearly all the inhabitants of the county. A large number of people who left the county in 1861 never returned.

After the war, the population increased significantly. By 1870, it was 12,821. The reopening of the lead mines and the advent of the railroad added greatly to the prosperity of the county. During the period from 1880 through World War I, the mining of lead, zinc, and tripoli and farming attracted many people to the county.

After the invention of the automobile, a county highway board was formed. It planned and constructed a good road system that connected all of the towns in the county. In 1941, Camp Crowder, a 60,000-acre military camp, was constructed south of Neosho. It was in existence until March 1946. The population of the county increased to 40,555 by 1980, in large part because many people are retiring in the county and local residents are finding jobs in the county.

Farming

Ron McMurtrey, soil scientist, Newton County Soil and Water Conservation District, helped prepare this section.

The early settlers in Newton County settled along the streams, where water was readily available and where the best soils on bottom land and terraces could be planted to cultivated crops. The crops were wheat, corn, oats, rye, tobacco, and buckwheat. An abundant supply of timber was available for fuel, dwellings and other buildings, fences, and other useful items. As the population rapidly increased, the local demand for food became greater. The result was a rapid expansion in the acreage used for cultivated crops. This acreage was not only on the bottom land but also in the uplands.

Around 1900, fruit growing and truck farming in the county began to attain more importance than grain or livestock farming. Strawberries were the most important of the fruit crops. From a meager beginning of 25 acres in 1895, the industry grew to a half-a-million dollar enterprise that employed more then 3,000 pickers during the harvesting season. The county shipped out as many as 400 railroad carloads of strawberries during the peak years of the 1930's (*5*). After these peak years, a series of continued spring droughts began to reduce crop yields and continued losses brought about the demise of the fruit and truck farming industry.

The tomato crop was also of local importance during this period. Many farmers grew patches of tomatoes that were sold locally to canning factories, which had been established as a direct result of the tomato crop (*5*).

The dairy business began in the 1870's. The county was soon dotted with fine dairy farms and creameries, which later processed whole milk (*7*).

The poultry business has grown into a major industry. From the practice of keeping a few chickens on each farm, the business has become very specialized, generating a multimillion dollar income each year.

The raising of beef cattle has always been a part of the agricultural activity in the county. It has evolved from the time when only a few beef cattle were kept on the farm to satisfy immediate family needs. It currently is the major part of the local agricultural economy. Diversified farming also is an important part. Wheat and soybeans are the chief cultivated crops.

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 descriptions, names, and delineations of the soils identified on the general soil map of this county do not fully agree or match with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

Soil Descriptions

1. Gerald-Creldon Association

Nearly level and very gently sloping, somewhat poorly drained and moderately well drained, silty soils on uplands

This association consists of soils on broad ridges of primary divides. The soils have a fragipan.

This association makes up 8 percent of the county. It is about 51 percent Gerald and similar soils, 45 percent Creldon and similar soils, and 4 percent minor soils (fig. 2).

Gerald soils are nearly level and somewhat poorly drained and are on broad ridgetops. Typically, the surface layer is very dark grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is grayish brown, very friable silt loam about 8 inches thick. The subsoil has a fragipan. The part of the subsoil above the fragipan is dark brown and dark yellowish brown, mottled, firm silty clay about 13 inches thick. The fragipan is about 20 inches thick. It is grayish brown, mottled, firm and brittle silty clay loam in the upper part and strong brown, mottled, firm and brittle extremely cherty silty clay loam in the lower part. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is grayish brown, mottled, firm extremely cherty silty clay.

Creldon soils are very gently sloping and moderately well drained and are on the sides and top of the broad ridges. Typically, the surface layer is very dark grayish brown, very friable silt loam about 6 inches thick. The subsurface layer is dark brown, very friable silt loam about 4 inches thick. The subsoil has a fragipan. The part of the subsoil above the fragipan is about 16 inches of dark yellowish brown, mottled, friable silty clay loam and dark brown and yellowish brown, mottled, firm silty clay. The fragipan is about 15 inches thick. It is yellowish red and brown, mottled, firm and brittle silty clay loam in the upper part and yellowish red and pale brown, mottled, firm and brittle extremely cherty silty clay loam in the lower part. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is dark red and red, mottled, very firm extremely cherty silty clay in the upper part and dark red, very firm very cherty clay in the lower part.

The minor soils in this association are the Cedargap, Keeno, and Secesh soils. Cedargap and Secesh soils are on low terraces and on flood plains. They do not have a fragipan. Keeno soils are cherty throughout. They are on short, steep breaks.

About 66 percent of this association is cropped. The rest is used mainly for tall fescue seed, hay, or pasture. Small grain, soybeans, and grain sorghum are the principal crops. The association is suited to grain crops and to grasses and legumes for hay and pasture. A low or moderate available water capacity, the hazard of erosion, a restricted rooting depth, and some seasonal wetness are the main concerns in managing the cropped areas. The seasonal wetness is the main concern in managing the areas used for cool-season pasture grasses.

This association is suitable for building site development and some kinds of onsite waste disposal. The major limitations are the wetness, restricted permeability, and a moderate shrink-swell potential.

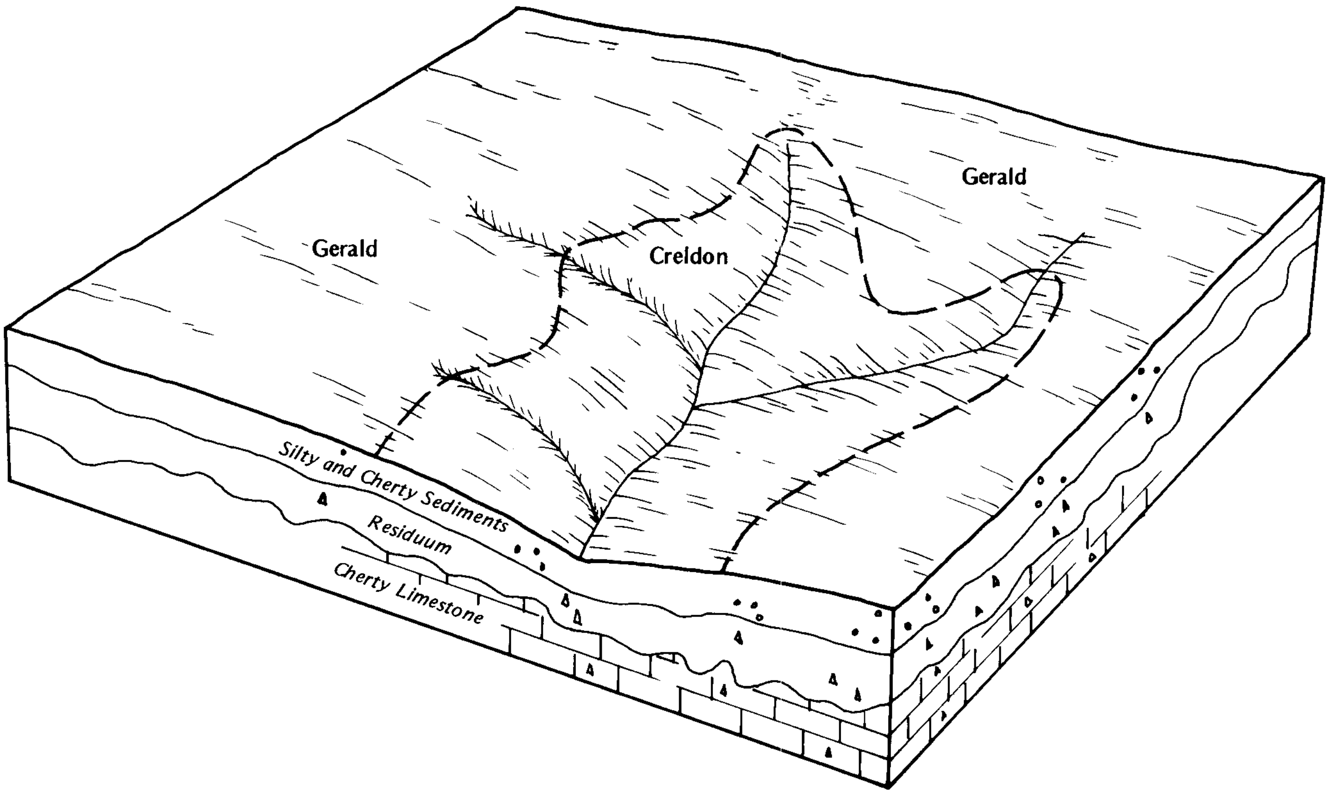

Figure 2.—Typical pattern of soils and parent material in the Gerald-Creldon association.

2. Hoberg-Keeno Association

Gently sloping and moderately sloping, moderately well drained, silty and cherty soils on uplands and terraces

This association consists of soils on moderately wide ridgetops and on side slopes of primary divides. The soils have a fragipan.

This association makes up about 14 percent of the county. It is about 55 percent Hoberg and similar soils, 32 percent Keeno soils, and 13 percent minor soils (fig. 3).

Hoberg soils are gently sloping and are on the top and sides of upland ridges and on terraces. Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsoil has a fragipan. The part of the subsoil above the fragipan is about 15 inches thick. It is dark brown, very friable silty clay loam in the upper part; strong brown, friable cherty silty clay in the next part; and strong brown, mottled, friable cherty silty clay loam in the lower part. The fragipan is pale brown and dark red, mottled, very firm and brittle extremely cherty silty clay loam about 22 inches thick. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is dark red, mottled, very firm extremely cherty silty clay.

Keeno soils are gently sloping and moderately sloping and are on side slopes, mounds, and sharp breaks in the uplands. Typically, the surface layer is black, very friable very cherty silt loam about 6 inches thick. The subsurface layer is very dark grayish brown and dark brown, very friable very cherty silt loam about 6 inches thick. The subsoil has a fragipan. The part of the subsoil above the fragipan is about 7 inches of brown, friable extremely cherty silty clay loam and 4 inches of grayish brown, mottled, friable extremely cherty silt loam. The fragipan is red, mottled, very firm and brittle extremely cherty silty clay loam about 11 inches thick. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is red, mottled, very firm extremely cherty silty clay.

The minor soils in this association are the Cedargap, Eldorado, Gerald, Secesh, and Wanda soils. Cedargap, Eldorado, Secesh, and Wanda soils do not have a fragipan. Cedargap and Secesh soils are on flood plains and low terraces. Eldorado soils are on steep, short breaks. Wanda soils are on the lower side slopes. Gerald soils are somewhat poorly drained and are in the center of broad ridgetops.

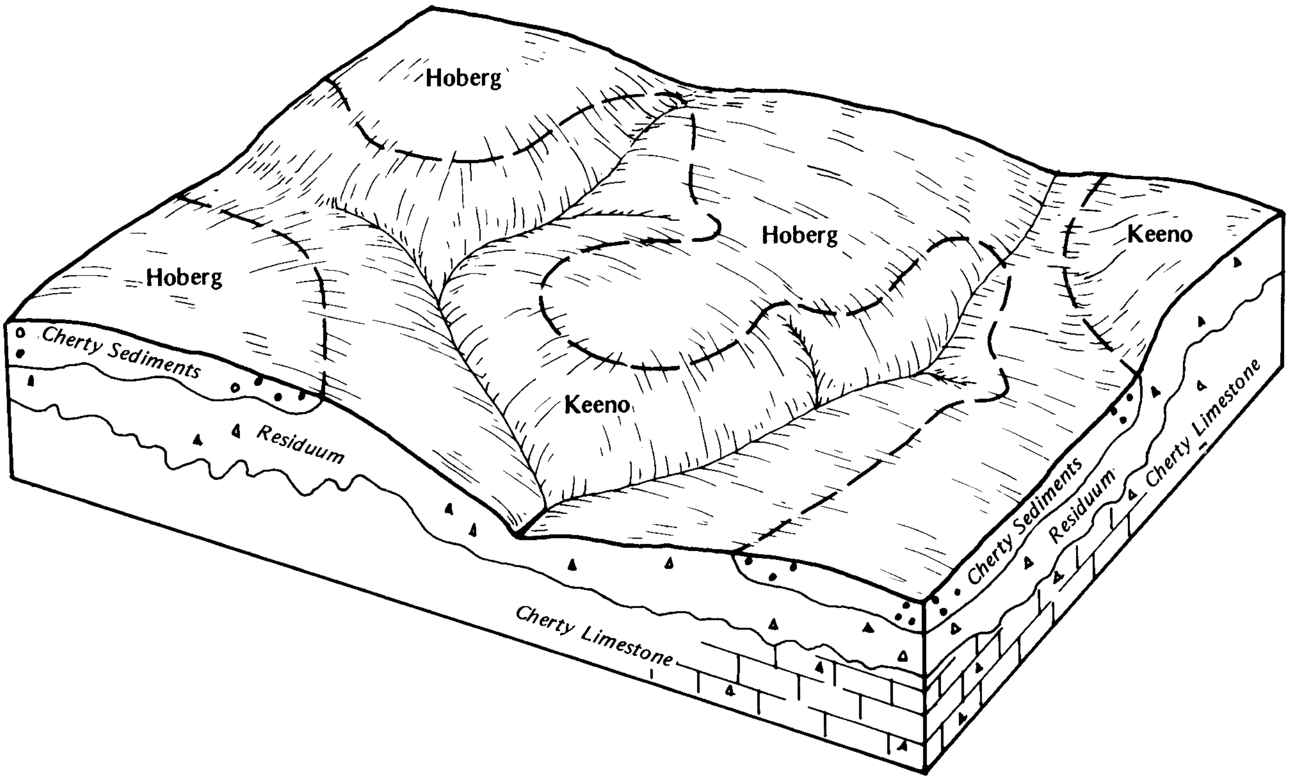

Figure 3.—Typical pattern of soils and parent material in the Hoberg-Keeno association.

About half of this association is used for pasture, hay, or tall fescue seed. The other half is cropped. The chief crops are small grain, soybeans, and grain sorghum. The chert fragments on and below the surface, a restricted rooting depth, wetness in spring, and a low available water capacity are the main concerns in managing the cropped areas.

This association generally is suited to building site development and to some kinds of onsite waste disposal. The major limitations are the wetness, restricted permeability in the fragipan, and the chert fragments.

3. Newtonia-Wanda Association

Very gently sloping and gently sloping, well drained, silty soils on uplands

This association consists of soils on broad divides and ridges. The drainage pattern extends in all directions from a central point.

This association makes up about 2 percent of the county. It is about 43 percent Newtonia soils, 38 percent Wanda and similar soils, and 19 percent minor soils.

Newtonia soils are very gently sloping and are on the higher parts of the broad divides. Typically, the surface layer is dark brown, very friable silt loam about 11 inches thick. The subsoil extends to a depth of about 60 inches or more. It is reddish brown, friable silty clay loam in the upper part; dark reddish brown and dark red, firm silty clay loam in the next part; and dark red, firm silty clay in the lower part.

Wanda soils are very gently sloping and gently sloping and are on the lower side slopes. Typically, the surface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark reddish brown, friable silty clay loam in the upper part; dark reddish brown and dark red, friable cherty silty clay loam in the next part; and red, firm very cherty silty clay in the lower part.

The minor soils in this association are the Bolivar, Carytown, and Creldon soils. Bolivar soils are moderately deep over sandstone. They are on mounds and breaks. Carytown soils are poorly drained and are in saddles near the head of drainageways. Creldon soils have a fragipan. They are on less sloping, slightly higher knobs near the outer edges of the association.

More than 75 percent of this association is intensively cropped. Small grain, soybeans, grain sorghum, and nursery plants are the major crops. The association is well suited to cultivated crops and nursery plants. If good management applied, row crops can be intensively grown in rotation with close-grown crops. The major management concern is erosion.

This association is well suited to pasture and hay. Alfalfa is the major hay crop. Tall fescue, orchardgrass, and bromegrass are the preferred grasses grown for hay and pasture.

This association is suitable for building site development and some kinds of onsite waste disposal. Restricted permeability and the shrink-swell potential are moderate limitations.

4. Huntington-Secesh Association

Nearly level and very gently sloping, well drained, silty soils on flood plains and low terraces

This association consists of soils on wide flood plains and terraces. It makes up about 13 percent of the county. It is about 27 percent Huntington soils, 25 percent Secesh soils, and 48 percent minor soils.

Huntington soils are nearly level and are on the flood plains along the major streams. Typically, the surface layer is very dark grayish brown, very friable silt loam about 10 inches thick. The subsoil to a depth of 60 inches or more is brown, dark yellowish brown, and yellowish brown, friable silt loam.

Secesh soils are nearly level and very gently sloping and are on the lower stream terraces. Typically, the surface layer is dark brown, very friable silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence downward, it is brown, very friable silt loam; brown, friable silty clay loam; reddish brown, friable cherty and extremely cherty silty clay loam; and dark brown, friable extremely cherty clay loam.

The minor soils in this association are the Cedargap, Claiborne, Dunning, Hepler, Peridge, and Waben soils. Cedargap soils have a dark, thick surface soil. They are on flood plains along secondary streams. Claiborne and Peridge soils have more clay in the subsoil than the major soils. They are on high terraces. The poorly drained Dunning and somewhat poorly drained Hepler soils are in slightly depressional areas adjacent to the uplands. Waben soils are cherty throughout. They are on the terraces along the narrow drainageways.

About 55 percent of this association is used for grasses and legumes for pasture and hay. About 40

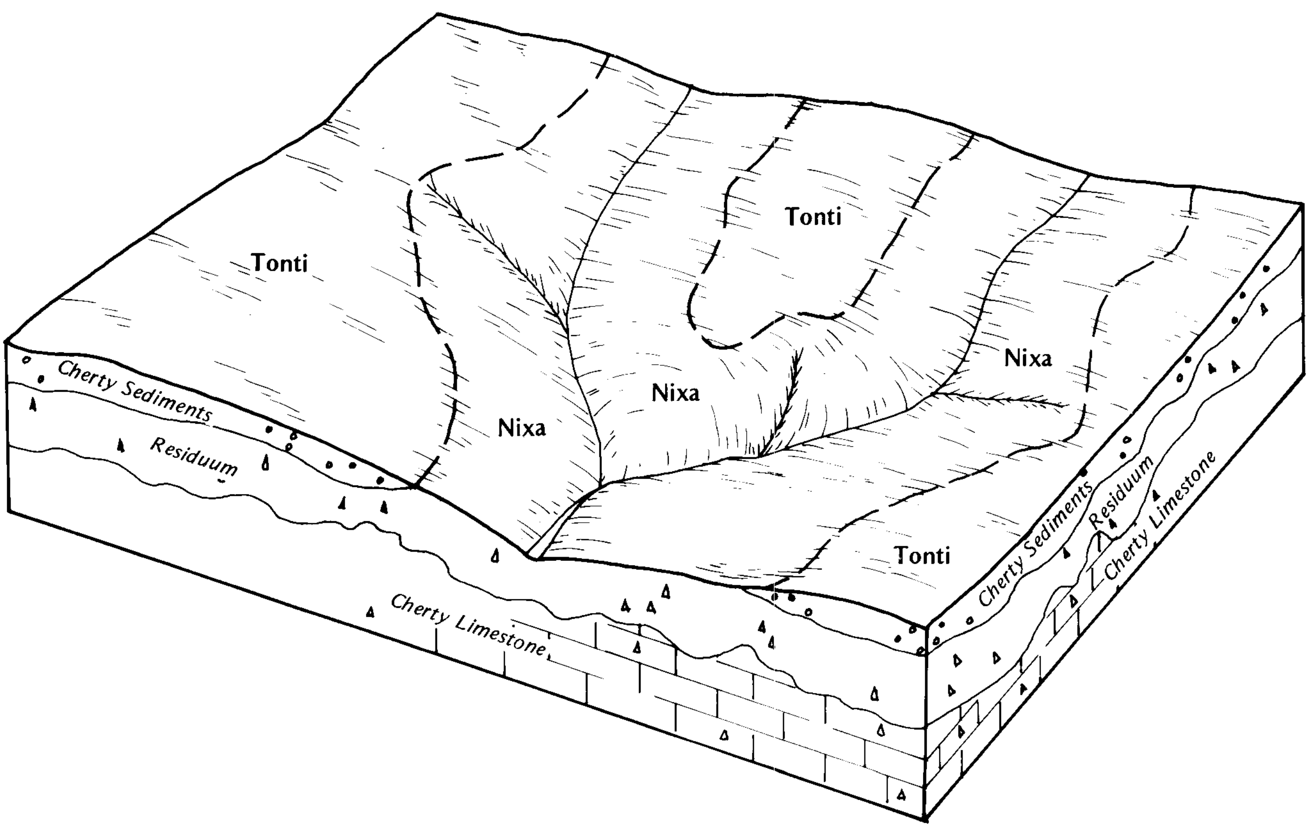

Figure 4.—Typical pattern of soils and parent material in the Nixa-Tonti association.

percent is cropland, and less than 5 percent is woodland.

This association is well suited to cultivated crops and to pasture and hay. If good management is applied, row crops can be grown intensively in rotation with close-grown crops. The main concerns in managing the cropped areas are flooding, the hazard of erosion on the terraces, and scouring on the flood plains. Alfalfa and red clover are the preferred legumes in the areas used as hayland. Tall fescue, orchardgrass, and bromegrass have been the preferred grasses.

The Huntington soils generally are unsuited to building site development and onsite waste disposal because of the flooding. The Secesh soils are suited to these uses if dwellings are constructed on raised fill material or are otherwise protected against flooding.

5. Nixa-Tonti Association

Gently sloping and moderately sloping, moderately well drained, cherty and silty soils on uplands

This association consists of soils on broad ridges of secondary divides. The soils have a fragipan.

This association makes up about 34 percent of the county. It is about 53 percent Nixa soils, 38 percent Tonti and similar soils, and 9 percent minor soils (fig. 4).

Nixa soils are gently sloping and moderately sloping and generally are on side slopes below the Tonti soils. Typically, the surface layer is very dark grayish brown, friable very cherty silt loam about 2 inches thick. The subsurface layer is brown, friable very cherty silt loam about 10 inches thick. The subsoil has a fragipan. The part of the subsoil above the fragipan is light yellowish brown, mottled, friable very cherty silt loam about 14 inches thick. The fragipan is strong brown, mottled, firm and brittle very cherty silty clay loam about 10 inches thick. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is dark red, mottled, firm very cherty silty clay in the upper part and mottled dark red and grayish brown, firm extremely cherty clay in the lower part.

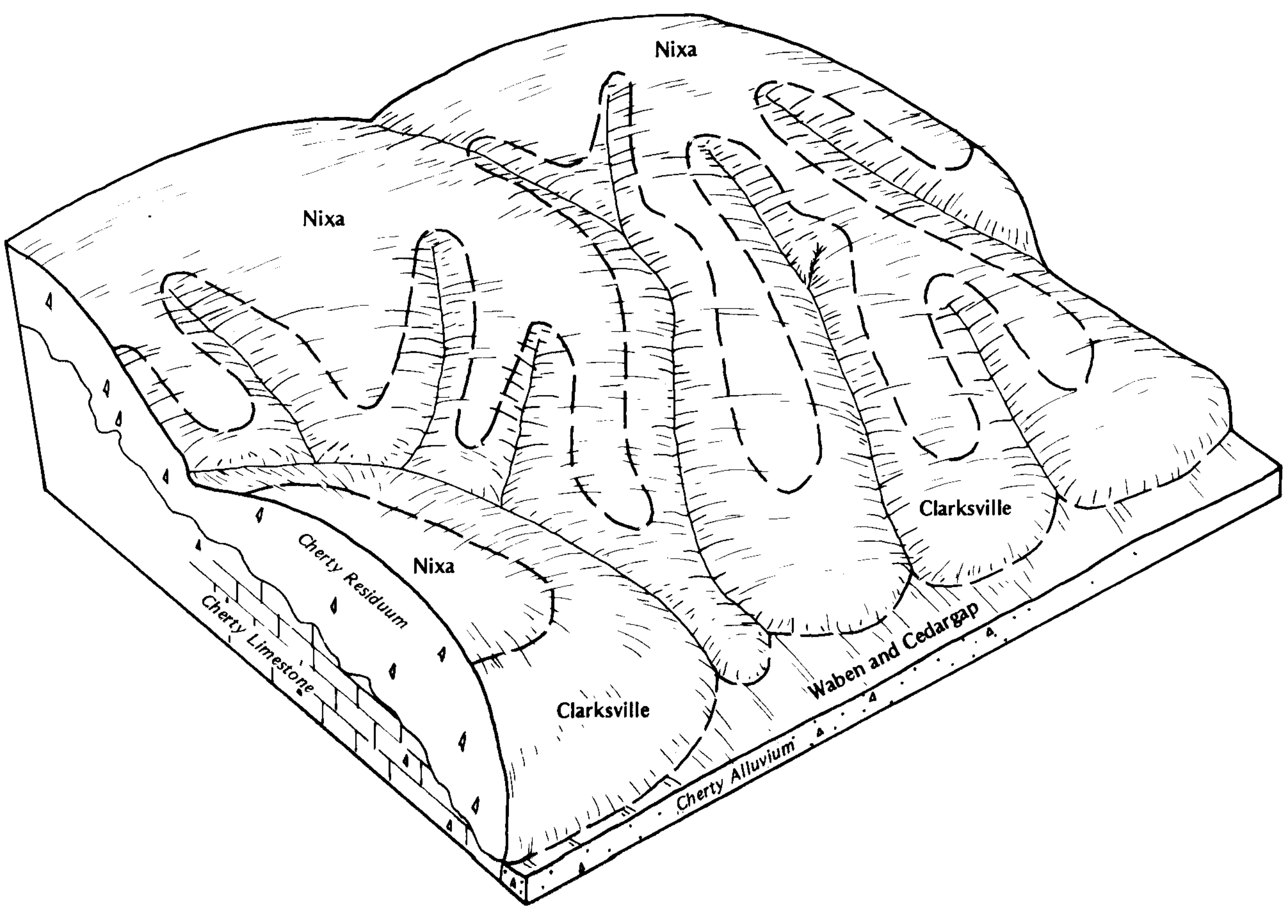

Figure 5.—Typical pattern of soils and parent material in the Nixa-Clarksville association.

Tonti soils are gently sloping and are on the top of ridges. Typically, the surface layer is brown, very friable silt loam about 7 inches thick. The subsoil has a fragipan. The part of the subsoil above the fragipan is about 18 inches thick. It is yellowish brown, very friable silt loam in the upper part and yellowish red, friable cherty silty clay loam in the lower part. The fragipan is about 19 inches thick. It is reddish brown, mottled, firm and brittle cherty silt loam in the upper part and mottled light brownish gray and red, very firm and brittle very cherty silt loam in the lower part. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is dark red, mottled, firm extremely cherty silty clay.

The minor soils in this association are the Bado, Cedargap, Clarksville, Needleye, and Secesh soils. Bado soils are poorly drained and are in small depressions on ridgetops. Cedargap, Clarksville, and Secesh soils do not have a fragipan. Cedargap and Secesh soils are on narrow flood plains and terraces, and Clarksville soils are on the lower, steeper slopes and breaks. Needleye soils have less chert than the major soils and are grayer. They are on the less sloping parts of ridgetops.

Most of this association is used for pasture, hay, or tall fescue seed. Some of the gently sloping areas are used for small grain or for occasionally grown row crops. The association is suited to cool-season and warm-season grasses, to legumes, and to small grain. The management concerns are a low organic matter content, the chert fragments in the surface layer, a restricted rooting depth, a perched water table during winter and spring, and a low available water capacity.

This association generally is suited to building site development and to some kinds of onsite waste disposal. Restricted permeability, the wetness, the slope, and the chert fragments are the main management concerns.

6. Nixa-Clarksville Association

Gently sloping to very steep, moderately well drained and somewhat excessively drained, cherty soils on uplands

This association consists of soils on long and narrow, continuous ridges and short side slopes highly dissected by V-shaped drainageways and narrow flood plains. It makes up about 29 percent of the county. It is about 49 percent Nixa soils, 42 percent Clarksville soils, and 9 percent minor soils (fig. 5).

Nixa soils are gently sloping and moderately sloping, are moderately well drained, and are on ridgetops and the upper side slopes. Typically, the surface layer is very dark grayish brown, very friable very cherty silt loam about 7 inches thick. The subsurface layer is pale brown, very friable very cherty silt loam about 4 inches thick. The subsoil has a fragipan. The part of the subsoil above the fragipan is pale brown and light yellowish brown, friable very cherty silt loam about 13 inches thick. The fragipan is strong brown, mottled, firm and brittle extremely cherty silty clay loam about 13 inches thick. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is dark red, mottled, firm extremely cherty clay.

Clarksville soils are moderately steep to very steep, are somewhat excessively drained, and are on the steeper side slopes dissected by small drainageways. Typically, the surface layer is dark grayish brown and grayish brown, very friable very cherty silt loam about 5 inches thick. The subsurface layer is light yellowish brown, very friable very cherty silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. It is light yellowish brown and reddish yellow, very friable extremely cherty silt loam in the upper part; red and strong brown, friable extremely cherty silty clay loam in the next part; and red, dark red, and yellowish red, friable extremely cherty silty clay loam and silty clay in the lower part.

The minor soils in this association are the Cedargap, Tonti, and Waben soils. Cedargap and Waben soils have less clay than the major soils. They are on terraces and flood plains. Tonti soils have less chert than the major soils. They are on the broader ridges above the Nixa soils.

About two-thirds of this association is used for timber. The association supports the majority of the timber in the county. It is suited to trees. Some of the trees are logged during winter and spring. The main management concerns are seedling mortality and windthrow on the Nixa soils and the equipment limitation and seedling mortality on the Clarksville soils.

About one-third of this association is cleared of trees and supports cool-season grasses used for pasture or hay. The chief kinds of livestock in these areas are feeder calves, dairy cows, poultry, and some feeder pigs. Hay is harvested in some of the smoother areas during the more productive years. The slope, the chert fragments, and droughtiness are the main management concerns.

This association is suitable for building site development and some kinds of onsite waste disposal. The slope of the Clarksville soils and restricted permeability in the fragipan of the Nixa soils are the main limitations.

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, Bolivar very fine sandy loam, 2 to 5 percent slopes, is a phase of the Bolivar series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Rock outcrop-Clarksville complex, 2 to 50 percent slopes, is an example.

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.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The Quarries in the Orthents-Quarries complex is an example.

The descriptions, names, and delineations of the soils identified on the detailed soil maps of this county do not fully agree or match with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

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

1B—Newtonia silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on the tops and sides of broad ridges. Individual areas are nearly as wide as they are long. They range from about 5 to several hundred acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 11 inches thick. The subsoil extends to a depth of 60 inches or more. It is reddish brown, friable silty clay loam in the upper part; dark reddish brown and dark red, firm silty clay loam in the next part; and dark red, firm silty clay in the lower part. In some places the surface layer is brown or reddish brown. In other places the dark brown surface layer is less than 10 inches thick. In some areas the subsoil is cherty.

Permeability is moderate. Runoff is slow or medium. Available water capacity is high. Organic matter content is moderate, and natural fertility is medium. The shrink-swell potential is moderate. The response to soil amendments is very good.

This soil is cropped intensively. In most areas it is double cropped. Mixtures of alfalfa and red clover are included in long crop rotations. A large acreage is used for nursery stock. The soil is suited to cultivated crops. Erosion is a hazard. It restricts the choice of crops unless moderate conservation practices are applied.

Contour farming, grassed waterways, and field terraces help to control erosion where a high percentage of intensively cultivated row crops are grown. Erosion also can be controlled by a system of conservation tillage that leaves a protective amount of crop residue on the surface and by a conservation cropping system of row crops, small grain, and meadow crops grown in rotation. Crop residue management helps to maintain the organic matter content and tilth and increases the rate of water infiltration.

This soil is well suited to the commonly grown legumes, such as alfalfa and red clover; warm-season grasses, such as bermudagrass and Caucasian bluestem; and cool-season grasses, such as tall fescue and orchardgrass. A cover of grasses and legumes helps to control erosion. Erosion is a hazard in newly seeded areas. Timely seedbed preparation can ensure a good ground cover.

The amount of livestock water may be limited because ponds in areas of this soil have a high seepage rate. Embankments for farm ponds, lakes, and lagoons are difficult to pack and seal. Chemical additives and a blanket of suitable soil material can reduce the seepage rate. In some areas deep wells provide livestock water.

This soil is suited to building site development and to most kinds of onsite waste disposal. The moderate shrink-swell potential is the main limitation affecting the design of dwellings. Properly designing footings, foundations, and basement walls and constructing them with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling. Septic tank absorption fields generally function adequately if they are properly constructed. Seepage is a hazard on sites for sewage lagoons. Sealing the lagoon helps to prevent seepage and the contamination of ground water. Community sewers should be used if they are available.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or some other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate side ditches minimize the damage caused by shrinking and swelling and by frost action.

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

2B—Wanda silt loam, 1 to 5 percent slopes. This deep, very gently sloping and gently sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are broad and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark reddish brown, friable silty clay loam in the upper part; dark reddish brown and dark red, friable cherty silty clay loam in the next part; and red, firm very cherty silty clay in the lower part. In some places the surface layer is brown or reddish brown silty clay loam. In other places the dark surface layer is less than 10 inches thick. In some areas the subsoil does not have chert. In other areas slopes are more than 5 percent.

Included with this soil in mapping are areas of Creldon and Eldorado soils, which make up about 10 percent of the unit. Creldon soils have a fragipan. They are in positions on the landscape similar to those of the Wanda soil. Eldorado soils are moderately sloping and are extremely cherty. They are lower on the landscape than the Wanda soil.

Permeability is moderate in the Wanda soil. Runoff is medium. Available water capacity is high. Organic matter content is moderate, and natural fertility is medium. The shrink-swell potential is moderate. The response to soil amendments is very good.

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to small grain and grain sorghum. Erosion is a hazard. It restricts the choice of crops unless moderate conservation practices are applied. Grassed waterways and field terraces help to control erosion where a high percentage of intensively cultivated row crops are grown. Erosion also can be controlled by a conservation cropping system that includes close-growing pasture or hay crops, contour farming, and a system of conservation tillage that leaves a protective amount of crop residue on the surface. Crop residue management helps to maintain the organic matter content and tilth and increases the rate of water infiltration.

This soil is well suited to the commonly grown legumes, such as alfalfa and red clover; warm-season grasses, such as bermudagrass and Caucasian bluestem; and cool-season grasses, such as tall fescue and orchardgrass. A cover of grasses and legumes helps to control erosion. Erosion is a hazard in newly seeded areas. Timely seedbed preparation can ensure a good ground cover.

The amount of livestock water may be limited because ponds in areas of this soil have a high seepage rate. Embankments for farm ponds, lakes, and lagoons are difficult to pack and seal. Chemical additives and a blanket of suitable soil material can reduce the seepage rate. In some areas deep wells provide livestock water.

This soil is suited to building site development and to most kinds of onsite waste disposal. The moderate shrink-swell potential is the main limitation affecting the design of dwellings. Properly designing footings, foundations, and basement walls and constructing them with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling. Septic tank absorption fields function adequately if they are properly constructed. Seepage is a hazard on sites for sewage lagoons. Sealing the lagoon helps to prevent seepage and the contamination of ground water. Community sewers should be used if they are available.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or some other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate side ditches minimize the damage caused by shrinking and swelling and by frost action.

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

3C—Eldorado cherty silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on convex side slopes and the tops of ridges in the uplands. Individual areas are elongated and range from about 5 to more than 40 acres in size.

Typically, the surface layer is dark brown, very friable cherty silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark brown, friable very cherty silty clay loam in the upper part; dark reddish brown, reddish yellow, and yellowish red, friable extremely cherty silty clay loam in the next part; and red, firm cherty silty clay loam and cherty silty clay in the lower part. In places the content of clay in the upper part of the subsoil averages more than 35 percent.

Included with this soil in mapping are areas of Hoberg and Keeno soils, which make up about 10 percent of the unit. Hoberg soils have a surface layer of silt loam and have a fragipan. They are on ridgetops. Keeno soils have a fragipan. They are on side slopes. Also included are small stony areas.

Permeability is moderate in the Eldorado soil. Runoff is medium. Available water capacity is low. Organic matter content is moderate, and natural fertility is medium. The shrink-swell potential is moderate. The response to soil amendments is good.

Most areas are used for pasture or hay. Some small areas are used for cultivated crops. This soil is suitable for some row crops grown on a limited basis. The main management concerns are erosion, the low available water capacity, and the content of chert in the surface layer. Erosion can be controlled by a cropping sequence that includes several years of pasture and hay crops and by grassed waterways, a system of conservation tillage that leaves a protective amount of crop residue on the surface, and contour farming.

This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; warm-season grasses, such as bermudagrass and Caucasian bluestem; and cool-season grasses, such as tall fescue and orchardgrass. Erosion, droughtiness, the high content of chert, and the low available water capacity are management concerns. An adequate ground cover helps to control erosion. Droughtiness and overgrazing during summer increase the susceptibility of the grasses to summer kill. Achieving an adequate grazing rotation is sometimes quite difficult because of a shortage of adequate water for livestock. The chert can hinder tillage and haying. Using a heavy roller in the spring to push the chert down to the surface level causes a moderate amount of compaction and may reduce the infiltration rate if the practice is repeated for several years.

On sites for farm ponds, lakes, lagoons, and other water impoundments, seepage is a hazard. It generally can be controlled by applications of soda ash, polyphosphate, silty material, or an expanding type of clay.

This soil is suited to building site development and to some kinds of onsite waste disposal. The moderate shrink-swell potential and coarse chert fragments on the surface are the main limitations affecting the design of dwellings. Properly designing footings, foundations, and basement walls and constructing them with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling. The soil generally is not suitable as a site for sewage lagoons because of the chert. Sewage should be piped to suitable adjacent areas, if available, or to community sewers. Although the soil is cherty and is moderately permeable, septic tank absorption fields can function satisfactorily if they are enlarged and are properly designed and constructed.

This soil is suited to local roads and streets. No major hazards or limitations affect construction.

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

6B—Creldon silt loam, 1 to 3 percent slopes. This deep, very gently sloping, moderately well drained soil is on the tops and sides of broad ridges in the uplands. Individual areas are irregular in shape and range from 10 to more than 300 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 6 inches thick. The subsurface layer is dark brown, very friable silt loam about 4 inches thick. The upper part of the subsoil is about 16 inches of dark yellowish brown, friable silty clay loam and dark brown and yellowish brown, mottled, firm silty clay. The next part is a firm and brittle fragipan about 15 inches thick (fig. 6). It is yellowish red and brown, mottled, silty clay loam and yellowish red and pale brown, mottled extremely cherty silty clay loam. The lower part to a depth of 60 inches or more is dark red and red, mottled, very firm extremely cherty silty clay and dark red, very firm very cherty clay. In places the part of the subsoil above the fragipan is cherty silty clay loam.

Included with this soil in mapping are small areas of Gerald and Keeno soils. Gerald soils are somewhat poorly drained and are nearly level. They are on the tops of broad ridges. Keeno soils have more chert throughout than the Creldon soil. They are on isolated knolls or

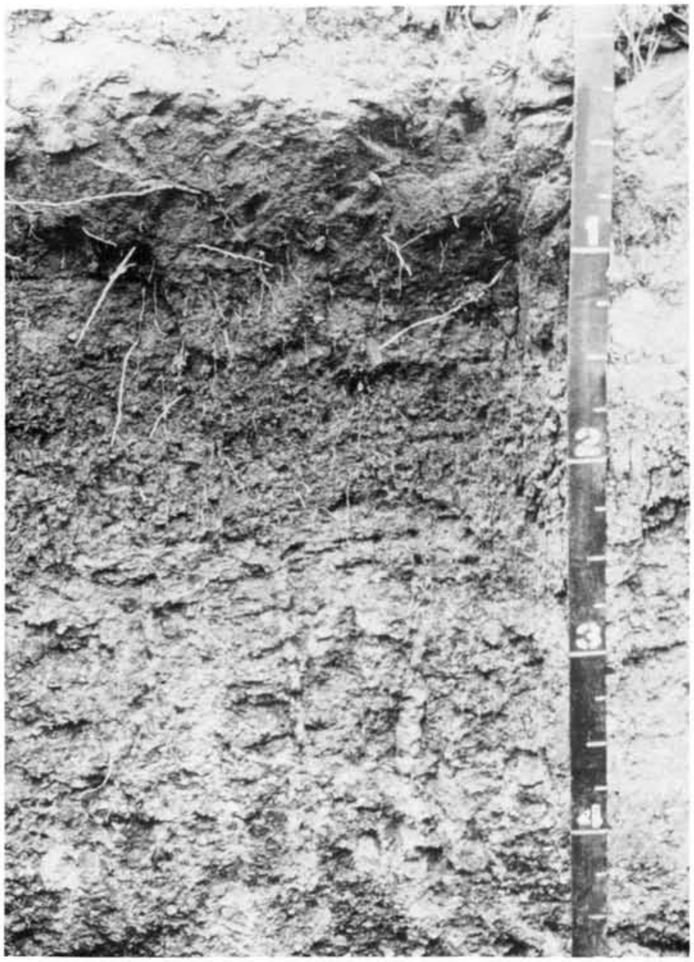

Figure 6.—Profile of Creldon silt loam, 1 to 3 percent slopes. The depth to a fragipan is 18 to 27 inches. Depth is marked in feet.

breaks. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow above the fragipan in the Creldon soil, very slow in the fragipan, and moderate below the fragipan. Runoff is medium. Available water capacity is moderate. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 18 to 27 inches. Organic matter content is moderate, and natural fertility is medium. The response to soil amendments is good. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content.

More than half of the acreage is used for cultivated crops. Some areas are used as pasture or hayland. This soil is suited to small grain, soybeans, and grain sorghum. Erosion is a hazard. An insufficient supply of soil moisture commonly limits the growth of row crops during midsummer. Contour farming, grassed waterways, and field terraces help to control erosion. Erosion also can be controlled by a system of conservation tillage that leaves a protective amount of crop residue on the surface and by a conservation cropping system that includes pasture and hay crops in the rotation. Crop residue management helps to maintain the organic matter content and tilth and increases the rate of water infiltration. The soil is suitable for irrigation, but the supply of adequate water is limited.

This soil is well suited to legumes, such as lespedeza and hop clover in pasture mixtures; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as Caucasian bluestem. It is moderately suited to bermudagrass and to alfalfa and red clover for hay. A cover of grasses and legumes helps to control erosion. The rooting depth is only moderate, and an insufficient supply of soil moisture commonly is a problem during most midsummer months. Erosion is a hazard in newly seeded areas. It can be controlled by timely tillage and a quickly established ground cover.

On sites for farm ponds, lakes, lagoons, and other water impoundments that require excavations to a depth of 4 feet or more, seepage is a hazard. It generally can be controlled by keeping the excavation shallow, by extending the excavation over an area that is larger than normal, and by establishing high berms around the impoundment. If depth is a factor, applications of soda ash and polyphosphate or a blanket of silty material and an expanding type of clay can reduce the seepage rate.

This soil is suited to some kinds of onsite waste disposal. The seasonal wetness and the very slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. The mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Sewage lagoons generally function adequately if they are properly constructed. The bottom of the lagoon should not be below the bottom of the fragipan.

This soil is suited to building site development. Properly designing footings, foundations, and basement walls and constructing them with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings and basement walls helps to prevent the damage caused by excessive wetness. Grading, land shaping, and establishing ditches can improve surface drainage in some areas.

Low strength, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Properly constructed side ditches remove excess water and minimize the damage caused by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

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

8B—Captina silt loam, 1 to 3 percent slopes. This deep, very gently sloping, moderately well drained soil is on the tops of broad ridges in the uplands. Individual areas range from 5 to more than 80 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The upper part of the subsoil is about 18 inches of yellowish brown, friable silt loam and strong brown, firm silty clay loam. The next part is a multicolored, mottled, firm and brittle fragipan about 30 inches thick. It is silty clay loam and very cherty silty clay loam. The lower part to a depth of 60 inches or more is dark red and yellowish brown, firm very cherty silty clay. In places the part of the subsoil above the fragipan has coarse fragments.

Included with this soil in mapping are small areas of Nixa soils, which make up about 10 percent of the unit. These soils are moderately sloping and are cherty throughout. They are on breaks and in the lower areas.

Permeability is moderate above and below the fragipan in the Captina soil and slow in the fragipan. Runoff is medium. Available water capacity is moderate. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 18 to 27 inches. Organic matter content is moderately low, and natural fertility is medium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content. It tends to crust or puddle if left fallow. The response to soil amendments is good.

Most areas are used as pasture or hayland. Some are used for cultivated crops. A few are used as woodland. This soil is suited to small grain and grain sorghum. Erosion and seasonal wetness are management concerns. An insufficient supply of soil moisture commonly limits the growth of row crops during midsummer. Contour farming, grassed waterways, and field terraces help to control erosion. Erosion also can be controlled by a system of conservation tillage that leaves a protective amount of crop residue on the surface and by a conservation cropping system that includes pasture and hay crops in the rotation. Crop residue management, cover crops, and green manure crops help to maintain the organic matter content and tilth and increase the rate of water infiltration.

This soil is well suited to legumes, such as lespedeza and hop clover in pasture mixtures; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as Caucasian bluestem. It is moderately suited to bermudagrass and to alfalfa and red clover for hay. A cover of grasses and legumes helps to control erosion. The rooting depth is only moderate, and an insufficient supply of soil moisture commonly is a problem during most midsummer months. Erosion is a hazard in newly seeded areas. It can be controlled by timely tillage and a quickly established ground cover.

On sites for farm ponds, lakes, lagoons, and other water impoundments that require excavations to a depth of 4 feet or more, seepage is a hazard. It generally can be controlled by keeping the excavation shallow, by extending the excavation over an area that is larger than normal, and by establishing high berms around the impoundment. If depth is a factor, applications of soda ash, polyphosphate, silty material, or an expanding type of clay can reduce the seepage rate.

This soil is suited to trees. Stands of hardwoods are common. Windthrow hazard is a management concern. 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 and to some kinds of onsite waste disposal. The seasonal wetness and the very slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Sewage lagoons generally function adequately if they are properly constructed. The bottom of the lagoon should not be below the bottom of the fragipan. Installing tile drains around footings and basement walls helps to prevent the damage to buildings caused by excessive wetness. Grading, land shaping, and establishing ditches can improve surface drainage in some areas.

Low strength, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Properly constructed side ditches remove excess water and minimize the damage caused by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

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

9B—Needleye silt loam, 1 to 3 percent slopes. This deep, very gently sloping, moderately well drained soil is on the crest of broad ridges in the uplands. Individual areas range from 5 to more than 80 acres in size.

Typically, the surface layer is grayish brown and dark grayish brown, very friable silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence downward, it is yellowish brown and light yellowish brown, friable silt loam; brownish yellow, light yellowish brown, light brownish gray, and grayish brown, mottled, friable silty clay loam; a fragipan of multicolored, mottled, firm and brittle extremely cherty silt loam and very cherty silty clay loam; strong brown, mottled, firm very cherty silty clay; and dark red, mottled, very firm very cherty clay. In places the part of the subsoil above the fragipan does not have grayish brown mottles.

Included with this soil in mapping are small areas of Bado, Nixa, and Tonti soils. Bado soils are poorly drained. They are in nearly level or depressional areas on uplands. Nixa soils are cherty throughout. They are on knobs and short breaks. Tonti soils have more sand and fine chert fragments in the lower part of the subsoil than the Needleye soil. They are in positions on the landscape similar to those of the Needleye soil. Included soils make up about 5 to 15 percent of the unit.

Permeability is moderately slow above the fragipan in the Needleye soil, very slow in the fragipan, and moderate below the fragipan. Runoff is medium. Available water capacity is moderate. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 18 to 27 inches. Organic matter content is moderately low, and natural fertility is low. The surface layer is very friable and can be easily tilled throughout a fairly wide range of moisture content. It tends to crust or puddle if left fallow. The response to soil amendments is good.

Most areas are used as pasture or hayland. Some are cropped. This soil is suited to small grain and grain sorghum. Erosion and seasonal wetness are management concerns. An insufficient supply of soil moisture commonly limits the growth of row crops during midsummer. Contour farming, grassed waterways, and field terraces help to control erosion. Erosion also can be controlled by a system of conservation tillage that leaves a protective amount of crop residue on the surface and by a conservation cropping system that includes pasture and hay crops in the rotation. Crop residue management, cover crops, and green manure crops help to maintain the organic matter content and tilth and increase the rate of water infiltration.

This soil is well suited to legumes, such as lespedeza and hop clover in pasture mixtures; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as Caucasian bluestem. It is moderately suited to bermudagrass and to alfalfa and red clover for hay. A cover of grasses and legumes helps to control erosion. The rooting depth is only moderate, and an insufficient supply of soil moisture commonly is a problem during most midsummer months. Erosion is a hazard in newly seeded areas. It can be controlled by timely tillage and a quickly established ground cover.

On sites for farm ponds, lakes, lagoons, and other water impoundments that require excavations to a depth of 4 feet or more, seepage is a hazard. It generally can be controlled by keeping the excavation shallow, by extending the excavation over an area that is larger than normal, and by establishing high berms around the impoundment. If depth is a factor, applications of soda ash, polyphosphate, silty material, or an expanding type of clay can reduce the seepage rate.

This soil is suited to trees. Stands of native hardwoods are common. Windthrow and seedling mortality are management concerns. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Planting container-grown nursery stock increases the seedling survival rate.

This soil is suited to some kinds of onsite waste disposal. The seasonal wetness and very slow permeability are limitations affecting the design of septic tank absorption fields. These fields generally function adequately if they are properly constructed and if the thickness of the soil material over the fragipan is increased by a properly constructed mound of fill material. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Sewage lagoons generally function adequately if they are properly constructed. The bottom of the lagoon should not be below the bottom of the fragipan. Community sewers should be used if they are available.

This soil is suited to building site development. Properly designing footings, foundations, and basement walls and constructing them with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings and basement walls helps to prevent the damage caused by excessive wetness. Grading, land shaping, and establishing ditches can improve surface drainage in some areas.

Low strength, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Properly constructed side ditches remove excess water and minimize the damage caused by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

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

10—Bado silt loam. This deep, nearly level, poorly drained soil is on flats and in slight depressions on the top of broad upland ridges. Individual areas range from 5 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown and grayish brown, very friable silt loam about 4 inches thick. The subsurface layer is grayish brown, very friable silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence downward, it is dark grayish brown, mottled, firm silty clay loam; dark grayish brown, mottled, very firm silty clay; mottled dark gray and gray, very firm silty clay; a fragipan of multicolored, mottled, very firm and brittle extremely cherty silty clay loam; and dark red, mottled, very firm extremely cherty silty clay. In places the surface layer is very dark grayish brown silt loam about 8 inches thick.

Included with this soil in mapping are areas of the moderately well drained, very gently sloping Captina and Needleye soils. These soils are on the breaks or lower slopes near the perimeter of the mapped areas. They make up about 5 to 10 percent of the unit.

Permeability is slow above the fragipan in the Bado soil, very slow in the fragipan, and moderate below the fragipan. Runoff is very slow. Available water capacity is moderate. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 20 to 32 inches. Organic matter content and natural fertility are low. The shrink-swell potential is moderate or high in the part of the subsoil above the fragipan. The surface layer is very friable and can be easily tilled throughout a fairly wide range of moisture content. It tends to crust or puddle if left fallow.

Most areas are used for hay, pasture, or native timber (fig. 7). A few small areas are used for cultivated crops. This soil is well suited to warm-season grasses, such as Caucasian bluestem and indiangrass. It is moderately suited to cool-season grasses and legumes, such as tall fescue and ladino clover. It is not suited to deep-rooted plants. The main concerns in managing pasture are the limited rooting depth and the seasonal wetness. The pasture can be improved by applications of fertilizer, rotation grazing, and timely deferment of grazing. Grazing during wet periods should be avoided.

This soil is suited to small grain and grain sorghum. The seasonal wetness is a management concern. Also, an insufficient supply of moisture commonly limits the growth of row crops during midsummer. Properly managing crop residue and including cover crops and green manure crops in the cropping sequence increase the rate of water infiltration and the organic matter content and improve tilth. Grading, land smoothing, establishing surface ditches, and installing drainage tile improve drainage.

Many areas support native hardwoods, dominantly water-tolerant, drought-resistant, slow-growing species, such as post oak and blackjack oak. The equipment limitations, the windthrow hazard, and seedling mortality are management concerns. Equipment should be used only during periods when the soil is dry or frozen. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Ridging the soil and planting container-grown nursery stock on the ridges increase the seedling survival rate.

This soil is suited to building site development and some kinds of onsite sewage disposal. The wetness and the shrink-swell potential are limitations affecting the design of dwellings. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings and basement walls helps to prevent the damage caused by excessive wetness. Properly constructed sewage lagoons function adequately on this soil, but septic tank absorption fields generally do not function properly because of the wetness. Community sewers should be used if they are available.

The wetness, the high shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. Grading the roads so that they shed water, constructing adequate side ditches, and installing culverts minimize the damage caused by wetness, shrinking and swelling, and frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

21B—Claiborne-Peridge silt loams, 2 to 5 percent slopes. These deep, gently sloping, well drained soils are on stream terraces and toe slopes, generally adjacent to the uplands. Individual areas generally are narrow and elongated and are 5 to 100 acres in size. They are about 50 percent Claiborne soil and 35 percent Peridge soil.

Typically, the surface layer of the Claiborne soil is dark brown, very friable silt loam about 9 inches thick. The subsoil extends to a depth of about 60 inches or more. It is dark brown and dark yellowish brown, friable silt loam in the upper part; yellowish red, friable cherty silty clay loam in the next part; and yellowish red, mottled, friable cherty silty clay loam in the lower part. In some places the dark brown surface layer is more than 10 inches thick. In other places this layer is cherty. In some areas the content of chert in the subsoil is more than 25 percent. In other areas slopes are more than 5 percent.

Typically, the surface layer of the Peridge soil is dark brown, very friable silt loam about 10 inches thick. The subsoil extends to a depth of about 60 inches or more. It is dark brown, very friable silt loam in the upper part; strong brown and yellowish red, very friable and friable silty clay loam in the next part; and yellowish red, friable cherty and very cherty silty clay loam in the lower part.

Included with these soils in mapping are areas of Captina and Waben soils, which make up about 15 percent of the unit. Captina soils have a fragipan. They are on the convex parts of broad areas. Waben soils have more gravel in the surface layer than the Claiborne and Peridge soils. They are in the lower areas near the small drainageways. Also included, near the center of the broad, concave areas, are soils having a subsoil that is clayey and is grayer than that of the Claiborne and Peridge soils.

The Claiborne and Peridge soils are moderately permeable. Runoff is medium on the Claiborne soil and medium or slow on the Peridge soil. Available water capacity is high in the Peridge soil and moderate in the Claiborne soil. Organic matter content is moderately low in both soils, and natural fertility is medium. The shrink-swell potential is moderate in the Claiborne soil. The response to soil amendments is very good on both soils.

Figure 7.—Tall fescue in an area of Bado silt loam used for hay and pasture. Post oak and blackjack oak are in the background.

Most areas are used for pasture or hay crops, such as tall fescue, alfalfa, or other grass-legume mixtures. Alfalfa and tall fescue are the dominant species harvested for hay. A few small areas are used for row crops. These soils are well suited to most of the commonly grown legumes, such as alfalfa and red clover; warm-season grasses, such as bermudagrass and Caucasian bluestem; and cool-season grasses, such as tall fescue and orchardgrass. No serious problems affect the use of these soils for hay and pasture. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

Embankments for farm ponds or lakes are difficult to pack and seal. Ponds and other impoundments commonly fail to hold water because of seepage. Chemical additives or a blanket of suitable soil material can reduce the seepage rate. In some areas deep wells provide livestock water.

These soils are suited to small grain and grain sorghum. Erosion is the main management concern. An insufficient supply of moisture in the Claiborne soil commonly limits the growth of row crops during midsummer. A system of conservation tillage that leaves a protective amount of crop residue on the surface and a cropping sequence that includes close-growing pasture and hay crops help to control erosion.

These soils are suited to trees. No major problems affect planting or harvesting.

These soils are suited to building site development and to some kinds of onsite waste disposal. The shrink-swell potential of the Claiborne soil is a limitation on sites for dwellings. Properly designing footings, foundations, and basement walls and constructing them with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling. Septic tank absorption fields generally function adequately if they are properly constructed. Some leveling is needed on sites for sewage lagoons. Sealing the bottom of the lagoon helps to prevent seepage and the contamination of ground water.

Low strength, the shrink-swell potential, and frost action limit the use of these soils as sites for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate side ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. The woodland ordination symbol is 4A.

23B—Bolivar very fine sandy loam, 2 to 5 percent slopes. This moderately deep, gently sloping, well drained soil is on convex ridgetops, side slopes, and foot slopes. Individual areas are irregular in shape and range from 5 to more than 40 acres in size.

Typically, the surface layer is brown, very friable very fine sandy loam about 6 inches thick. The subsoil is about 30 inches thick. It is brown and strong brown, very friable loam in the upper part; strong brown, friable clay loam and yellowish brown and brownish yellow, mottled, friable clay loam in the next part; and light yellowish brown and brownish yellow, mottled, firm clay in the lower part. Light gray, soft shale and sandstone bedrock is at a depth of about 36 inches. In some areas the soil has a dark surface layer 7 or more inches thick.

Included with this soil in mapping are areas of soils that have a fragipan at a depth of about 26 inches. These soils make up as much as 10 percent of the mapped areas. Also included are some areas of soils that are shallow over bedrock and have a surface layer that is darker than that of the Bolivar soil.

Permeability is moderate in the Bolivar soil. Runoff is medium. Available water capacity is low. The root zone is limited by the interbedded sandstone and shale bedrock at a depth of 20 to 40 inches. Organic matter content and natural fertility are low. The surface layer can be worked throughout a wide range of moisture content. The response to soil amendments is good.

Most areas are used as pasture, hayland, or woodland. A few small areas are used for cultivated crops. This soil is well suited to warm-season grasses, such as Caucasian bluestem, and is moderately suited to bermudagrass. It is well suited to tall fescue and lespedeza. A cover of grasses and legumes helps to control erosion. The rooting depth is only moderate, and an insufficient supply of soil moisture commonly is a problem during most midsummer months. Erosion is a hazard in newly seeded areas. It can be controlled by timely tillage and a quickly established ground cover.

This soil is suited to small grain and grain sorghum. A high susceptibility to erosion and the moderately deep root zone are management concerns. Also, an insufficient supply of soil moisture commonly limits the growth of row crops in midsummer. If the soil is intensively cropped, special conservation practices are needed. Erosion commonly is controlled by a conservation cropping system that includes close-growing pasture or hay crops and by contour farming, terraces, and a system of conservation tillage that leaves a protective amount of crop residue on the surface. Some type of grade stabilization structure generally is needed where grassed waterways are established. Crop residue management, cover crops, and green manure crops help to maintain the organic matter content and good tilth and increase the rate of water infiltration.

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

This soil is suited to building site development and to some kinds of onsite waste disposal. The moderate depth to bedrock is a limitation on sites for sanitary facilities. Fill material is needed on sites for sewage lagoons. Septic tank absorption fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the laterals. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Community sewers should be used if they are available. On sites for buildings, properly designing foundations and footings and constructing them with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling.

Low strength and the shrink-swell potential limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate side ditches, and installing culverts minimize the damage caused by shrinking and swelling.

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

25—Gerald silt loam. This deep, nearly level, somewhat poorly drained soil is on broad ridgetops in the uplands. Individual areas range from about 10 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is grayish brown, very friable silt loam about 8 inches thick. The upper part of the subsoil is dark brown and dark yellowish brown, mottled, firm silty clay about 13 inches thick. The next part is a mottled, firm and brittle fragipan about 20 inches thick. It is grayish brown silty clay loam and strong brown extremely cherty silty clay loam. The lower part to a depth of 60 inches or more is grayish brown, mottled, firm extremely cherty silty clay. In some areas the surface layer is dark grayish brown. In other areas the subsoil is less gray.

Included with this soil in mapping are areas of the very gently sloping Creldon soils, which make up about 5 percent of the unit. These soils have less clay in the subsoil than the Gerald soil. They are near the perimeters of the mapped areas. Also included are a few soils that do not have fragipans.

Permeability is very slow in the fragipan of the Gerald soil and moderate below the fragipan. Runoff is slow. Available water capacity is low. A perched water table is above the fragipan during winter and spring in most years. The shrink-swell potential is high in the part of the subsoil above the fragipan. The root zone is restricted by the fragipan at a depth of 20 to 30 inches. Organic matter content is moderately low, and natural fertility is medium. The response to soil amendments is good.

Most areas are used for cultivated crops or for pasture and hay. This soil is suited to soybeans, grain sorghum, and small grain. The seasonal wetness and the susceptibility of the long slopes to erosion are management concerns. During wet periods planting and harvesting generally are more likely to be delayed on this soil than on the adjacent soils. Land grading and shallow surface ditches improve drainage. A conservation cropping system of row crops and pasture and hay crops can be applied year after year without excessive erosion. A system of conservation tillage that leaves a protective amount of crop residue on the surface, terraces, or cross-slope field ditches help to control erosion on the long slopes. Crop residue management, cover crops, and green manure crops help to maintain the organic matter content and good tilth and increase the rate of water infiltration. An insufficient supply of soil moisture commonly limits the growth of row crops in midsummer.

This soil is well suited to some warm-season grasses, such as Caucasian bluestem and indiangrass, and is moderately suited to cool-season grasses and legumes, such as tall fescue and ladino clover. It is not suited to deep-rooted plants. The limited rooting depth and the seasonal wetness are management concerns. The pasture can be improved by applications of fertilizer, rotation grazing, and timely deferment of grazing. Grazing during wet periods should be avoided.

This soil is suited to building site development and some kinds of onsite waste disposal. The wetness and the shrink-swell potential are limitations affecting the design of dwellings. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings and basement walls helps to prevent the damage caused by excessive wetness. Properly constructed sewage lagoons function adequately on this soil, but septic tank absorption fields generally do not function properly because of the wetness. Community sewers should be used if they are available.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate side ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action.

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

26—Carytown silt loam. This deep, nearly level, poorly drained soil is in plane or depressional areas on uplands. Individual areas are narrow and irregular in shape and range from about 5 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown and very dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is dark gray, very friable silt loam about 4 inches thick. The subsoil is about 27 inches thick. It is very dark gray, very firm silty clay in the upper part and dark grayish brown, extremely firm clay in the lower part. The substratum to a depth of 60 inches or more is gray, very firm silty clay.

Included with this soil in mapping are small areas of Gerald and Hepler soils. These soils have less sodium in the subsoil than the Carytown soils. They are in landscape positions similar to those of the Carytown soil. Also included are some areas of severely eroded soils that have a surface layer of silty clay. Included soils make up about 5 to 10 percent of the unit.

The Carytown soil is very slowly permeable. Runoff is slow. Available water capacity is moderate. A perched water table is within a depth of 1 foot from December through April in most years. Organic matter content is moderately low, and natural fertility is medium or low. The content of sodium is high in the lower part of the subsoil and in the substratum. The shrink-swell potential is high.

About half of the acreage is used for cultivated crops. Some areas are used as pasture or hayland. This soil is suited to small grain, soybeans, and grain sorghum. Erosion and the seasonal wetness are the major management concerns. Also, an insufficient supply of soil moisture commonly limits the growth of row crops in midsummer. Long slopes that have a gradient of more than 1 percent are susceptible to erosion. Tilling the soil under optimum moisture conditions and properly managing crop residue help to maintain good tilth and increase the organic matter content and the rate of water infiltration. Land grading and shallow surface ditches improve drainage. Seepage and runoff from adjacent areas can be intercepted by diversion terraces. Field terraces help to control erosion on the long slopes. Cross-slope field ditches help to divert water and thus reduce the wetness in low or depressional areas.

This soil is moderately suited to alsike clover, ladino clover, tall fescue, and warm-season grasses, such as bermudagrass and big bluestem. It is well suited to switchgrass. The wetness in winter and spring is the main management concern. Grazing when the soil is wet causes poor tilth, compaction, and excessive runoff. The condition of the pasture and forage production can be improved by applications of fertilizer, rotation grazing, and timely deferment of grazing. Grazing during wet periods should be avoided.

The equipment limitation, seedling mortality, and windthrow are management concerns if this soil is used for timber. Equipment should be used only during periods when the soil is dry or frozen. Ridging the soil and planting container-grown nursery stock on the ridges 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 building site development. The wetness and the high shrink-swell potential are limitations affecting the designing of dwellings. Land grading and shallow surface ditches improve drainage. Diversion ditches can intercept seepage and runoff from the higher adjacent slopes. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling. Installing tile drains around the footings and foundations helps to prevent the damage caused by excessive wetness. Because of high corrosivity, metals exposed to the soil should be coated with a sealer, such as asphalt.

If properly constructed, sewage lagoons function adequately on this soil. Septic tank absorption fields do not function properly, however, because of the wetness and the very slow permeability. Community sewer systems should be used if they are available.

The wetness, the shrink-swell potential, and low strength limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water, constructing adequate side ditches, and installing culverts minimize the damage caused by wetness and by shrinking and swelling. Constructing the roads on raised, well compacted fill material also minimizes this damage. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

27C—Bolivar loam, 3 to 9 percent slopes, stony. This moderately deep, gently sloping and moderately sloping, well drained soil is on side slopes and the tops of ridges in the uplands. Sandstone fragments cover 15 to 30 percent of the surface. They are 15 to 24 inches long, 8 to 20 inches wide, and 4 to 12 inches thick. They are a few inches to 3 or more feet apart. Individual areas are irregular in shape and range from 5 to more than 40 acres in size.

Typically, the surface layer is very dark grayish brown, very friable loam about 5 inches thick. The subsoil is about 22 inches thick. It is dark yellowish brown and brown, friable flaggy loam in the upper part and dark yellowish brown flaggy sandy clay loam in the lower part. Soft, weathered, fractured sandstone bedrock is at a depth of about 27 inches. Cracks in the bedrock are filled with light brownish gray and yellowish brown, friable sandy clay loam. Hard sandstone bedrock is at a depth of about 40 inches. Some areas do not have stones on the surface.

Included with this soil in mapping are areas of flaggy and cherty soils that are more than 40 inches deep over hard bedrock. Also included are areas of soils that have boulders on the surface and do not have a subsoil and a few areas of soils having a dark surface layer that is more than 10 inches thick. Included soils make up as much as 15 percent of the mapped areas.

Permeability is moderate in the Bolivar soil. Runoff is medium. Available water capacity is low. Organic matter content and natural fertility also are low. The root zone is limited by the interbedded sandstone and shale bedrock at a depth of 20 to 40 inches.

Most areas of this soil are used as woodland. Blackjack oak and post oak are the dominant species. Isolated black oak and white oak and a few clumps of hickory are in scattered areas. A few areas have been cleared of trees and stones and are seeded to pasture grasses, generally tall fescue. Most areas are too rough and too stony for the use of conventional machinery. Some areas are used as wildlife habitat.

The pasture species on this soil are mainly native plants. Tall fescue, orchardgrass, and lespedeza are grown in scattered areas. Only a small acreage is managed as pasture because the mapped areas are irregularly shaped, fencing is difficult, and the stones prevent the use of conventional farm equipment. Livestock tend to use the pastured areas of this soil for shade and shelter.

This soil generally is suited to trees. Because of low production, however, intensive timber management is not warranted. Timber production is limited mainly to firewood. A few isolated trees are used for sawtimber. If trees are planted or the existing timber is harvested, the surface stones moderately limit the use of equipment. In most areas logs should be yarded to specially located skid trails or logging roads.

This soil is suited to woodland wildlife habitat. The plant cover is fair, but forage for animals is scarce. Food plots are needed in or near areas of this soil.

This soil generally is not used for building site development or onsite waste disposal because of the limited depth to bedrock and the sandstone fragments throughout the profile. Some areas have been developed for urban uses. Each project has been specially designed for a particular site.

The land capability classification is VIs. The woodland ordination symbol is 3X.

30C—Keeno very cherty silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on side slopes, knolls, and sharp breaks in the uplands. Individual areas are irregular in shape and range from about 5 to several hundred acres in size.

Typically, the surface layer is black, very friable very cherty silt loam about 6 inches thick. The subsurface layer also is very friable very cherty silt loam about 6 inches thick. It is very dark grayish brown and dark brown. The subsoil extends to a depth of 60 inches or more. In sequence downward, it is brown, friable extremely cherty silty clay loam; grayish brown, mottled, friable extremely cherty silt loam; a fragipan of red, mottled, very firm and brittle extremely cherty silty clay loam; and red, mottled, very firm extremely cherty silty clay (fig. 8).

Included with this soil in mapping are areas of Hoberg, Creldon, and Eldorado soils. Hoberg and Creldon soils have fewer chert fragments in the surface layer and the upper part of the subsoil than the Keeno soil. They are on the tops and sides of ridges. Eldorado soils do not have a fragipan. They are on side slopes and breaks. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate above and below the fragipan in the Keeno soil and slow in the fragipan. Runoff is medium. Available water capacity is low. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 18 to 27 inches. Organic matter content is moderate, and natural fertility is medium. The response to soil amendments is good.

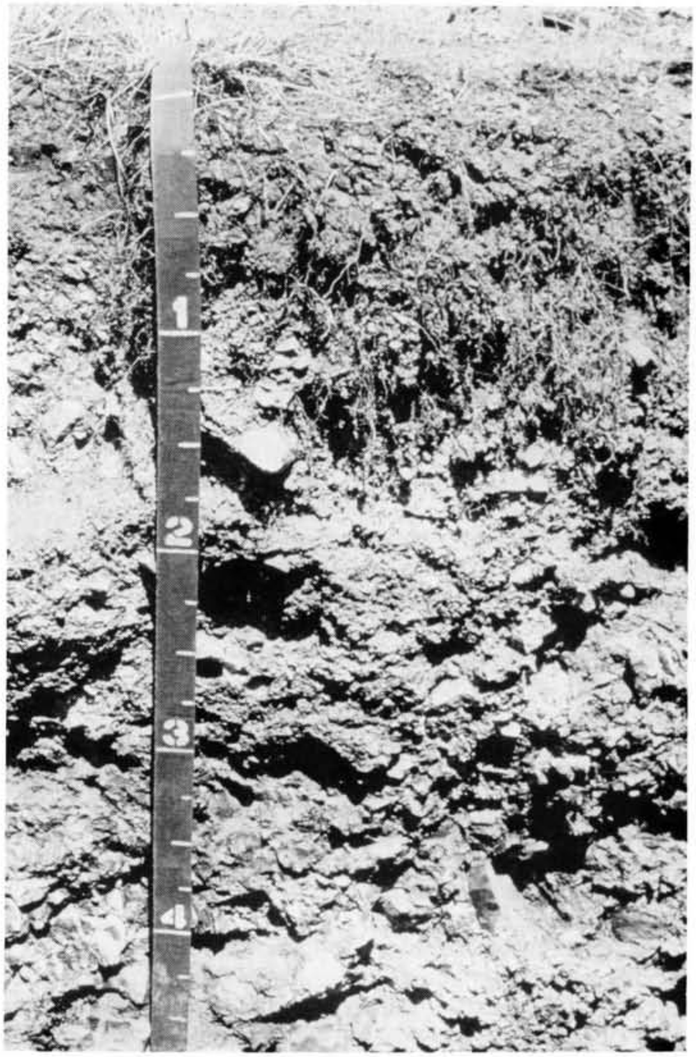

Figure 8.—Profile of Keeno very cherty silt loam, 3 to 9 percent slopes. Chert fragments are throughout the profile. Depth is marked in feet.

Most areas are used for pasture or hay. Some are used for row crops. This soil is suited to small grain, soybeans, and grain sorghum. Erosion, the very cherty surface layer, and the low available water capacity are management concerns. The hazard of erosion can be reduced by a conservation cropping system that includes several years of pasture or hay crops and by terraces, grassed waterways, a system of conservation tillage that leaves a protective amount of crop residue on the surface, and contour farming. Properly managing crop residue and growing cover crops and green manure crops help to maintain the organic matter content, improve tilth, and increase the rate of water infiltration.

This soil is well suited to lespedeza. It also is well suited to bermudagrass, Caucasian bluestem, and other commonly grown warm-season grasses. It is moderately suited to cool-season grasses, such as tall fescue and orchardgrass. Droughtiness, the high content of chert, and the limited rooting depth are management concerns. An adequate ground cover helps to control erosion. The chert can hinder tillage and haying. Using a heavy roller in the spring to push the chert down to the surface level causes a moderate amount of compaction and may reduce the infiltration rate if the practice is repeated for several years.

On sites for farm ponds, lakes, lagoons, and other water impoundments that require excavations to a depth of 4 feet or more, seepage is a hazard. It generally can be controlled by keeping the excavation shallow, by extending the excavation over an area that is larger than normal, and by establishing high berms around the impoundment. If depth is a factor, applications of soda ash, polyphosphate, silty material, or an expanding type clay can reduce the seepage rate.

This soil is suited to building site development and to some kinds of onsite waste disposal. The seasonal wetness and the slow permeability are limitations on sites for septic tank absorption fields. These fields generally can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. The soil generally is not suitable as a site for sewage lagoons because of the chert. The wetness and the large stones are problems on sites for dwellings. Installing tile drains around footings and basement walls helps to prevent the damage caused by excessive wetness. Backfill of sand or gravel may be needed on sites that have a high content of large stones.

The wetness and the potential for frost action limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water and constructing adequate side ditches minimize the damage caused by wetness and frost action.

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

35E—Nixa-Clarksville very cherty silt loams, 5 to 20 percent slopes. These deep, moderately sloping to moderately steep soils are on ridges and side slopes in the uplands. They are near the head of the tributaries that drain into the major streams. The landscape is characterized by many upland drainageways, narrow flood plains, colluvial fans, and small terraces. The moderately well drained Nixa soil is on the ridgetops and the upper side slopes. The somewhat excessively drained Clarksville soil is on the lower side slopes. Individual areas range from 5 to several hundred acres in size. They are about 60 percent Nixa soil and 25 percent Clarksville soil.

Typically, the surface layer of the Nixa soil is dark grayish brown, very friable very cherty silt loam about 4 inches thick. The subsurface layer is pale brown, very friable very cherty silt loam about 11 inches thick. The upper part of the subsoil is about 8 inches of pale brown and strong brown, friable very cherty silt loam and very cherty silty clay loam. The next part is a fragipan of strong brown, pale brown, light brownish gray, and dark red, mottled, firm and brittle very cherty silty clay loam about 27 inches thick. The lower part to a depth of 60 inches or more is dark red and dusky red, mottled, very firm very cherty clay. In a few areas slopes are less than 5 percent. In a few places bedrock is within a depth of 60 inches. In some areas clay is within 20 inches of the surface.

Typically, the surface layer of the Clarksville soil is very dark grayish brown, very friable very cherty silt loam about 3 inches thick. The subsurface layer is pale brown, very friable very cherty silt loam about 5 inches thick. The subsoil to a depth of 60 inches or more is pale brown, friable extremely cherty silty clay loam. Slopes are more than 20 percent in areas on escarpments, breaks, and some of the lower side slopes.

Included with these soils in mapping are areas of Tonti soils, stony areas, and Rock outcrop. These included areas make up about 10 to 15 percent of the unit. Tonti soils have more silt and less chert in the upper part of the subsoil than the Nixa and Clarksville soils. They are on the top and upper sides of ridges. The stony areas and the Rock outcrop are on the lower side slopes. Also included are breaks, which commonly are near narrow flood plains.

Permeability is moderately rapid in the Clarksville soil. It is moderate above and below the fragipan in the Nixa soil and very slow in the fragipan. Available water capacity is low in both soils. Runoff is medium or rapid. During winter and spring in most years, a perched water table is above the fragipan at a depth of 18 to 27 inches in the Nixa soil. The root zone is restricted by the fragipan. Organic matter content is moderately low in both soils, and natural fertility is low. The response to soil amendments is good on the Clarksville soil and fair on the Nixa soil.

Most areas support native hardwoods, mainly white oak and black oak on the Clarksville soil and post oak and blackjack oak on the Nixa soil. Most cleared areas are used as pasture.

Because of the chert and the slope, these soils are not suited to cultivation. They are moderately suited to some commonly grown warm-season grasses, such as Caucasian bluestem and bermudagrass, and to cool-season grasses, such as tall fescue and orchardgrass. They also are moderately suited to lespedeza. Droughtiness, erosion, the content of chert, and the limited rooting depth in the Nixa soil are management concerns. An adequate ground cover helps to control erosion. The soils should be tilled only during periods of stand establishment, renovation, or reseeding. New stands should be seeded early enough to ensure a good ground cover before winter. A no-till seeding method should be used. The chert and the slope hinder tillage and haying and make the operation of equipment hazardous. Using a heavy roller in the spring to push the chert down to the surface level causes a moderate amount of compaction and may reduce the infiltration rate if the practice is repeated for several years.

These soils are suited to trees. Seedling mortality is a management concern on both soils, and windthrow is a concern on the Nixa soil. Planting container-grown nursery stock increases the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Mainly because of the slope, these soils are unsuitable as sites for sewage lagoons. They are suitable as sites for septic tank absorption fields, but the slope of both soils and the wetness and very slow permeability in the Nixa soil are limitations. The absorption fields generally can function adequately if a properly constructed mound of fill material increases the depth to the fragipan in the Nixa soil. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Community sewers should be used if they are available.

These soils are suited to building site development. The slope is a limitation on sites for dwellings. The wetness of the Nixa soil also is a limitation. The dwellings can be designed so that they conform to the natural slope of the land. Some land shaping generally is necessary. Installing tile drains around footings helps to prevent the damage caused by excessive wetness.

The potential for frost action and slope of both soils and the wetness of the Nixa soils are limitations on sites for local roads and streets. Culverts and properly constructed side ditches help to remove excess water and prevent the damage caused by wetness in the Nixa soil and by frost action in both soils. The roads should be designed so that they conform to the natural slope of the land. Otherwise, some cutting and filling may be necessary.

The land capability classification is VIs. The woodland ordination symbol assigned to the Nixa soil is 2D, and that assigned to the Clarksville soil is 3F.

44G—Rock outcrop-Clarksville complex, 2 to 50 percent slopes. This map unit occurs as areas of Rock outcrop intermingled with areas of a deep, strongly sloping to very steep, somewhat excessively drained Clarksville soil. The Rock outcrop ranges from gently sloping to moderately sloping chert and limestone glades to nearly vertical rock bluffs. The bands of chert and limestone are intermittent and interbedded. The chert glades are small and vary in size. Individual areas are long and narrow and generally are less than 30 acres in size. They are about 60 percent Rock outcrop and 30 percent Clarksville soil.

Typically, the Rock outcrop is covered with 1 to 3 inches of very dark grayish brown silt loam. More than 60 percent of the surface has no vegetation. Some areas are nearly level, and others are nearly vertical.

Typically, the surface layer of the Clarksville soil is very dark grayish brown, very friable very cherty silt loam about 3 inches thick. The subsurface layer is light yellowish brown, very friable extremely cherty silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. It is light yellowish brown, friable extremely cherty silty clay loam in the upper part; brown, friable extremely cherty silty clay in the next part; and red, firm extremely cherty clay in the lower part. In places slopes are more than 35 percent.

Included with the Rock outcrop and Clarksville soil in mapping are areas of Nixa soils. These soils have a fragipan. They are in moderately sloping areas on the higher parts of the landscape. Also included are some areas of deep soils that have a dark surface layer less than 10 inches thick and that have clay within 20 inches of the surface. These soils are on the lower breaks near the streams or directly above or below limestone outcrops. Included soils make up about 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. Runoff is rapid. Available water capacity is low. Organic matter content is moderately low, and natural fertility is low.

Most of the acreage is used as wildlife habitat. Most areas support native hardwoods, mainly post oak and blackjack oak. Scattered areas support native grasses. Black oak and white oak grow in a few areas. Some areas support a few scattered black walnut trees. A few ridgetops have been cleared of trees and are seeded to pasture grasses, mainly tall fescue.

The Clarksville soil is suited to trees, but timber production is limited mainly to firewood. A few isolated trees are used for sawtimber. The equipment limitation and seedling mortality are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Logging roads and skid trails should be built on the contour.

The areas that support grasses are grazed. Because of inaccessibility, however, they generally are not managed separately and commonly are overgrazed and are invaded by brush and weeds.

The Clarksville soil generally is not suited to building site development or onsite waste disposal because of the slope. Some areas have been developed because of their esthetic qualities. Each project should be specifically designed for a particular site.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Clarksville soil is 3R; no woodland ordination symbol is assigned to the Rock outcrop.

45F—Clarksville very cherty silt loam, 14 to 35 percent slopes. This deep, moderately steep to very steep, somewhat excessively drained soil is on the sides and tops of upland ridges adjacent to flood plains and intermittent drainageways. Areas generally are long and narrow or irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is dark grayish brown and grayish brown, very friable very cherty silt loam about 5 inches thick. The subsurface layer is light yellowish brown, very friable very cherty silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. It is light yellowish brown and reddish yellow, very friable extremely cherty silt loam in the upper part; red, strong brown, and yellowish red, friable extremely cherty silt loam in the next part; and dark red and yellowish red, friable extremely cherty silty clay loam and extremely cherty silty clay in the lower part. In some narrow bands, cherty clay is within 20 inches of the surface.

Included with this soil in mapping are areas of Cedargap, Nixa, and Waben soils, which make up about 10 percent of the unit. Cedargap soils have a surface layer that is darker and thicker than that of the Clarksville soil. They are on flood plains. Nixa soils have a fragipan. They are on ridgetops and knobs. Waben soils are less acid than the Clarksville soil. They are on low stream terraces and on fans. Also included are some stony areas and Rock outcrop, which make up about 5 percent of the unit.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. Runoff is rapid. Available water capacity is low. Organic matter content is moderately low, and natural fertility is low.

Most areas are used for timber or pasture. This soil is moderately suited to legumes, such as crownvetch and lespedeza; cool-season grasses, such as tall fescue; and warm-season grasses, such as Caucasian bluestem and indiangrass. It generally is unsuitable as hayland because of the slope. Droughtiness, erosion, and the chert fragments in the surface layer are the main concerns in managing pasture. Tillage should be avoided.

Many areas support native hardwoods (fig. 9). This soil is suited to trees. The equipment limitation and seedling mortality are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Logging roads and skid trails should be built on the contour.

This soil is suited to some kinds of onsite waste disposal and to building site development. The slope, seepage, and the high content of chert are limitations. On sites for sewage lagoons, a blanket of suitable soil material or other additives are needed to control seepage. The distribution lines in septic tank absorption fields should be installed across the slope. Otherwise, extensive land shaping may be necessary. Sewage can be piped to adjacent areas that are better suited to waste disposal. Dwellings should be designed so that they conform to the natural slope of the land.

The slope and the potential for frost action limit the use of this soil as a site for local roads and streets. Cutting and filling are needed to modify the slope. Grading the roads so that they shed water helps to prevent the damage caused by frost action.

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

50C—Nixa very cherty silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on the tops and sides of ridges in the uplands. Individual areas range from 5 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, friable very cherty silt loam about 2 inches thick. The subsurface layer is brown, friable very cherty silt loam about 10 inches thick. The upper part of the subsoil is light yellowish brown, mottled, friable very cherty silt loam about 14 inches thick. The next part is a fragipan of strong brown, mottled, firm and brittle very cherty silty clay loam about 10 inches thick. The lower part to a depth of 60 inches or more is dark red, mottled, firm very cherty silty clay and mottled dark red and grayish brown, firm extremely cherty clay. In places the part of the subsoil above the fragipan is silty clay loam.

Included with this soil in mapping are narrow areas of soils that do not have a fragipan and have clay within 20 inches of the surface. These soils are on escarpments. Also included are areas of Clarksville and Tonti soils. Clarksville soils do not have a fragipan. They are on long, steep slopes. Tonti soils have less chert above the fragipan than the Nixa soil. They generally are on the wider ridgetops. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate above and below the fragipan in the Nixa soil and very slow in the fragipan. Runoff is medium or rapid. Available water capacity is low. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 18 to 27 inches (fig. 10). Organic matter content is moderately low, and natural fertility is low. The response to soil amendments is fair.

Most areas are used for pasture, hay, or native timber. A few small areas are used for cultivated crops. This soil is suited to some small grain crops and to grain sorghum. The main management concerns are erosion, the moderately low content of organic matter, tilth, the low available water capacity, and the content of chert in

Figure 9.—Native red oak and white oak on Clarksville very cherty silt loam, 14 to 35 percent slopes.

the surface layer. Erosion can be controlled by a cropping sequence that includes several years of pasture and hay crops and by grassed waterways, a system of conservation tillage that leaves a protective amount of crop residue on the surface, and contour farming. Properly managing crop residue and including cover crops and green manure crops in the cropping sequence increase the rate of water infiltration and the organic matter content and improve tilth.

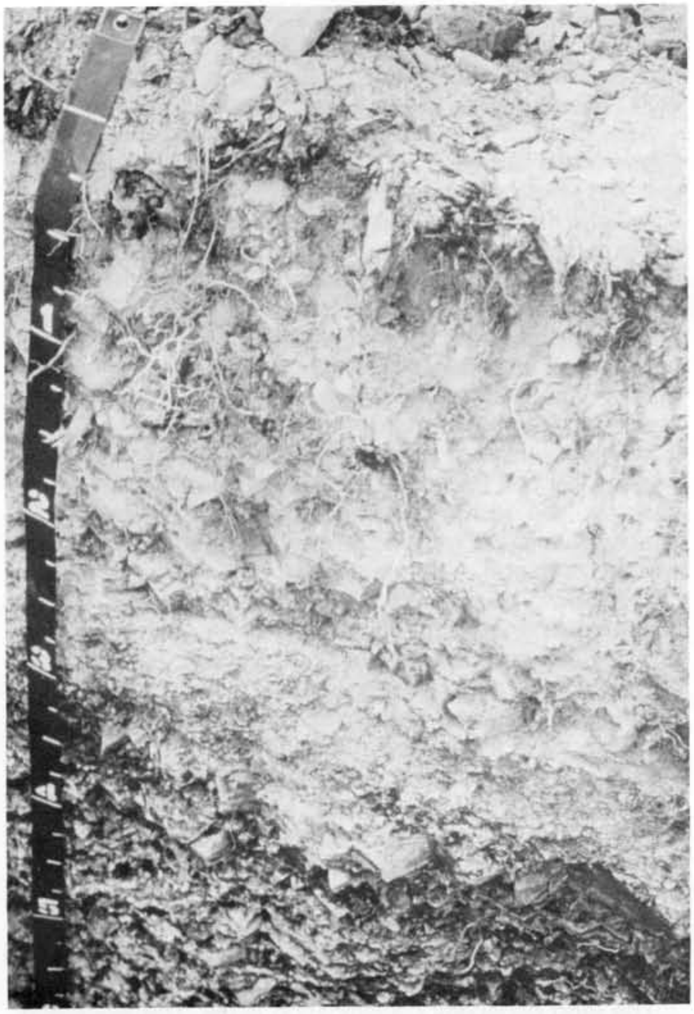

Figure 10.—Profile of Nixa very cherty silt loam, 3 to 9 percent slopes. The fragipan restricts root growth. Depth is marked in feet.

This soil is well suited to Caucasian bluestem and most of the other commonly grown warm-season grasses and to lespedeza. It is moderately suited to bermudagrass, tall fescue, orchardgrass, and alfalfa. Droughtiness, the high content of chert, the limited rooting depth, and the low available water capacity are management concerns. An adequate ground cover helps to control erosion. The chert may hinder tillage and haying. Using a heavy roller in the spring to push the chert down to the surface level causes a moderate amount of compaction and may reduce the infiltration rate if the practice is repeated for several years.

On sites for farm ponds, lakes, lagoons, and other water impoundments that require excavations to a depth of 4 feet or more, seepage is a hazard. It generally can be controlled by keeping the excavation shallow, by extending the excavation over an area that is larger than normal, and by establishing high berms around the impoundment. If depth is a factor, applications of soda ash, polyphosphate, silty material, or an expanding type of clay can reduce the seepage rate.

Many areas support native hardwoods, mainly post oak and blackjack oak. Black oak and white oak grow in scattered areas. This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Planting container-grown nursery stock increases 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 building site development and to some kinds of onsite waste disposal. The seasonal wetness and the very slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. The soil generally is not suitable as a site for sewage lagoons because of the chert. The wetness and the large stones are problems on sites for dwellings. Installing tile drains around footings and basement walls helps to prevent the damage caused by excessive wetness. Backfill of sand or gravel may be needed on sites that have a high content of large stones.

Low strength, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Properly constructed side ditches remove excess water and minimize the damage caused by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IVs. The woodland ordination symbol is 2D.

54—Dunning silt loam. This deep, nearly level, poorly drained soil is on broad flood plains and in depressional areas adjacent to the uplands. It is frequently flooded. Individual areas range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 6 inches thick. The subsurface layer is very dark gray, friable and firm silty clay loam about 12 inches thick. The subsoil is dark gray and very dark gray, mottled silty clay about 22 inches thick. The substratum to a depth of 60 inches or more is dark gray, firm silty clay loam. In places the lower part of the substratum is cherty.

Included with this soil in mapping are areas of Hepler and Huntington soils, which make up 5 to 10 percent of the unit. Hepler soils have less clay than the Dunning soil. They are on low terraces. The well drained Huntington soils are near stream channels.

Permeability is slow in the Dunning soil. Runoff also is slow. Available water capacity is high. A seasonal high water table is within a depth of 0.5 foot from December through May in most years. Organic matter content is moderate, and natural fertility is medium. The response to soil amendments is good if surface drainage is adequate.

Most areas are used for pasture and hay. This soil is moderately suited to hay. The best suited pasture plants are water-tolerant, shallow-rooted species, such as reed canarygrass, bluegrass, and ladino clover. Wetness and flooding are the main management concerns. The grazing system should accommodate the hazard of flooding. Maintaining stands of desirable species is difficult in the depressional areas. Land smoothing, surface ditches, and subsurface tile improve drainage.

This soil is suited to summer annuals, such as soybeans and grain sorghum. If these crops are grown, measures that reduce the wetness are needed.

This soil is suited to water-tolerant trees. The equipment limitation, seedling mortality, and plant competition are management concerns. Equipment should be used only during periods when the soil is dry or frozen. Ridging the soil and planting container-grown nursery stock on the ridges increase the seedling survival rate. Release treatments may be necessary to ensure seedling survival. Plant competition can be controlled by thorough site preparation.

Because of the high water table and the frequent flooding, this soil generally is unsuited to building site development and onsite waste disposal.

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

55—Huntington silt loam. This deep, nearly level, well drained soil is on flood plains. It is occasionally flooded. Some small areas are dissected by stream channels. Access to these areas is limited. Individual areas range from 10 to more than 500 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 10 inches thick. The subsoil to a depth of 60 inches or more is brown, dark yellowish brown, and yellowish brown, friable silt loam. In some places the dark surface soil is more than 24 inches thick. In other places the dark surface layer is less than 10 inches thick. In some areas the surface layer is lighter colored.

Included with this soil in mapping are areas of Cedargap, Dunning, Hepler, and Secesh soils. These soils make up as much as 15 percent of the mapped areas. Cedargap and Secesh soils have more chert in the lower part than the Huntington soil. Cedargap soils are on narrow flood plains. Secesh soils are on terraces along the smaller streams. Dunning soils are poorly drained and are in the lower areas adjacent to upland slopes. Hepler soils are somewhat poorly drained and are on low terraces.

The Huntington soil is moderately permeable. Runoff is medium. Available water capacity is very high. Organic matter content is moderate or high, and natural fertility is high. The response to soil amendments is very good.

About half of the acreage is used for cultivated crops. Some areas are used as pasture or hayland. A few isolated areas where access is limited are used as woodland. This soil is suited to corn, grain sorghum, small grain, and soybeans. The occasional flooding, which can occur during the period December through May, is a management concern in most years. The floodwater generally does not damage row crops that are planted after late May. Crop residue management, green manure crops, and conservation tillage help to maintain the organic matter content and tilth and increase the rate of water infiltration. Diversion terraces protect this soil from the runoff from the adjacent uplands. The soil can be irrigated, but the available supply of suitable water is limited. Land grading improves surface drainage in some areas.

This soil is well suited to cool-season grasses, such as bromegrass and orchardgrass; legumes, such as alfalfa and red clover; and warm-season grasses, such as bermudagrass and switchgrass. The occasional flooding is the main problem. The grazing system should accommodate the hazard of flooding.

This soil is suited to trees. Removal of undesirable trees increases the value of the existing stands of hardwoods. Plant competition is the only management concern. It can be controlled by thorough site preparation.

Because of the occasional flooding, this soil generally is unsuited to building site development and onsite waste disposal.

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

61B—Hoberg silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the tops and sides of ridges on uplands and terraces. Individual areas range from 5 to more than 400 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick (fig. 11). The subsoil extends to a depth of 60 inches or more. In sequence downward, it is dark brown, very friable silty clay loam; strong brown, friable cherty silty clay; strong brown, mottled, friable cherty silty clay loam; a fragipan of pale brown and dark red, mottled, very firm and brittle extremely cherty silty clay loam; and dark red, mottled, very firm extremely cherty silty clay. In some places the dark surface layer is less than 6 inches thick. In other places the part of the subsoil above the fragipan has less chert and more clay.

Included with this soil in mapping are areas of Keeno soils, which make up about 10 percent of the unit. These soils have more chert in the surface layer and the upper

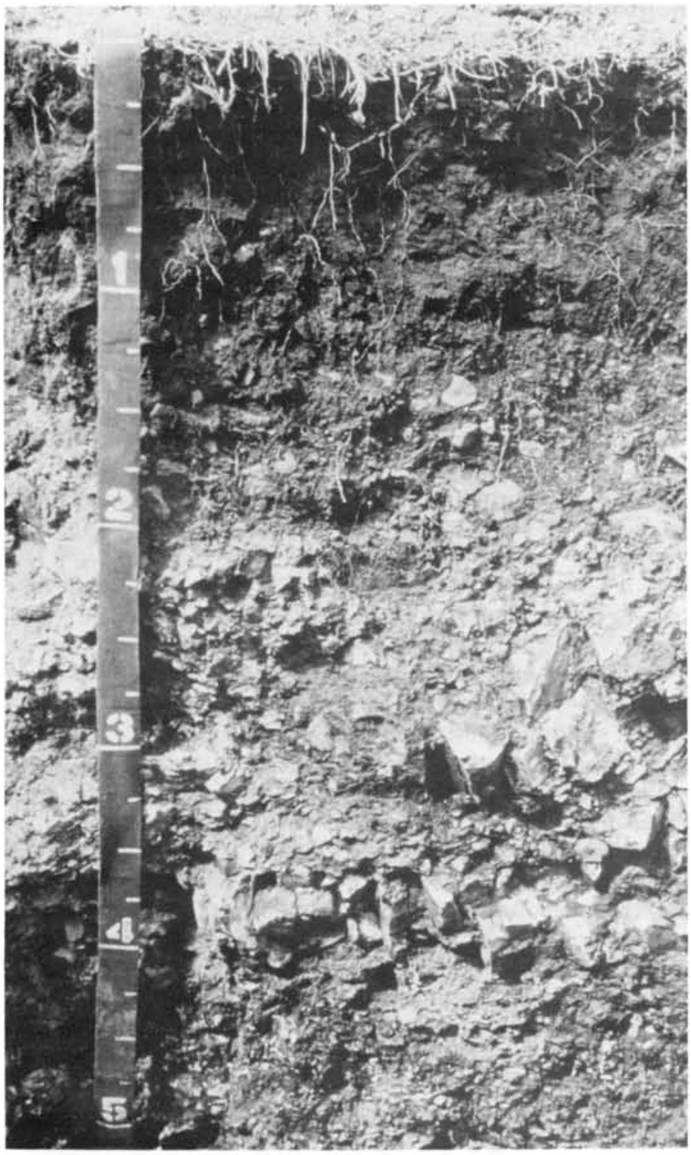

Figure 11.—Profile of Hoberg silt loam, 2 to 5 percent slopes. This soil has a dark surface layer. Depth is marked in feet.

part of the subsoil than the Hoberg soil. They are on knolls and breaks.

Permeability is moderate above and below the fragipan in the Hoberg soil and slow in the fragipan. Runoff is medium. Available water capacity is low. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 18 to 27 inches. Organic matter content is moderate, and natural fertility is medium. The response to soil amendments is good. The surface layer is very friable and can be easily tilled throughout a fairly wide range of moisture content.

More than half of the acreage is pasture or hayland. A few small areas support native prairie grasses. Some areas are used for cultivated crops. This soil is suited to small grain, grain sorghum, and soybeans. A moderate susceptibility to erosion and droughtiness in summer are the major management concerns. Because of cultivation in the past, numerous small areas are eroded. Contour farming, grassed waterways, and field terraces help to control erosion. The hazard of erosion also can be reduced by a system of conservation tillage that leaves a protective amount of crop residue on the surface and by a conservation cropping system that includes pasture and hay crops in the rotation. Crop residue management, cover crops, and green manure crops help to maintain the organic matter content and tilth and increase the rate of water infiltration.

This soil is well suited to cool-season grasses, such as tall fescue and orchardgrass; to warm-season grasses, such as Caucasian bluestem; and to lespedeza. It is moderately suited to bermudagrass and to alfalfa and red clover for hay. The rooting depth is only moderate, and droughtiness is a problem during midsummer months. Erosion is a hazard in newly seeded areas. It can be controlled by timely tillage and a quickly established ground cover.

On sites for farm ponds, lakes, lagoons, and water impoundments that require excavations to a depth of 4 feet or more, seepage is a hazard. It generally can be controlled by keeping the excavation shallow, by extending the excavation over an area that is larger than normal, and by establishing high berms around the impoundment. If depth is a factor, applications of soda ash, polyphosphate, silty material, or an expanding type of clay can reduce the seepage rate.

This soil is suited to trees. Windthrow is a management concern. 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 and to some kinds of onsite waste disposal. The seasonal wetness and the slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Properly constructed sewage lagoons can function adequately if the site is leveled. Installing tile drains around foundations, footings, and basement walls helps to prevent the damage to buildings caused by excessive wetness.

Low strength, the potential for frost action, and the wetness limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate side ditches minimize the damage caused by frost action and wetness.

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

76—Hepler silt loam. This deep, nearly level, somewhat poorly drained soil is on broad, low stream terraces and along narrow upland drainageways. It is occasionally flooded. Individual areas are elongated and range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is grayish brown, friable silt loam about 14 inches thick. The subsoil to a depth of 60 inches or more is silty clay loam. It is grayish brown and friable in the upper part; gray, mottled, and firm in the next part; and light brownish gray and brown, mottled, and friable in the lower part.

Included with this soil in mapping are areas of Cedargap, Dunning, Huntington, and Secesh soils. The well drained or somewhat excessively drained Cedargap and Secesh soils are on low terraces and flood plains. They have more chert than the Hepler soil. Dunning soils have more clay throughout than the Hepler soil. They are in depressional areas on flood plains. Huntington soils are well drained. They are on flood plains adjacent to stream channels. Included soils make up about 15 percent of the unit.

Permeability is moderately slow in the Hepler soil. Runoff is slow or very slow. Available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet during winter and spring in most years. Organic matter content and natural fertility are low. The response to soil amendments is good if surface drainage is adequate.

About half of the areas are used for cultivated crops and half for pasture and hay. This soil is suited to summer annuals, such as soybeans and grain sorghum. The wetness and the occasional flooding are the major management concerns. The floodwater generally does not damage row crops that are planted after late May. Land grading and shallow ditches improve surface drainage. Crop residue management helps to maintain the organic matter content and tilth and increases the rate of water infiltration.

This soil is well suited to cool-season grasses, such as reed canarygrass and tall fescue; to legumes, such as lespedeza and red clover; and to warm-season grasses, such as bermudagrass and switchgrass. The main management concern is the seasonal high water table. Deep-rooted species can grow better if a drainage system is installed. Timely deferment of grazing improves the pasture.

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

Because of the occasional flooding and the high water table, this soil generally is unsuited to building site development and onsite water disposal.

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

81B—Tonti silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the tops of ridges and on foot slopes in the uplands. Individual areas range from 5 to several hundred acres in size.

Typically, the surface layer is brown, very friable silt loam about 7 inches thick (fig. 12). The upper part of the subsoil is 18 inches of yellowish brown, very friable silt loam and yellowish red, friable cherty silty clay loam. The next part is a fragipan about 19 inches thick. It is reddish brown, mottled, firm and brittle cherty silt loam and mottled light brownish gray and red, very firm and brittle very cherty silt loam. The lower part to a depth of 60 inches or more is dark red, mottled, firm extremely cherty silty clay. In some places the surface layer is very dark grayish brown. In other places the content of chert fragments in the subsoil is less than 15 percent.

Included with this soil in mapping are areas of Bado, Needleye, and Nixa soils. Bado soils are grayer than the Tonti soil and have more clay in the subsoil. They are in nearly level areas or depressions on the wider ridgetops. Needleye soils are grayer in the upper part of the subsoil than the Tonti soil. They are near the head of drainageways. Nixa soils are cherty throughout. They are on breaks and in moderately sloping areas. Included soils make up about 10 to 15 percent of the unit.

Permeability is moderate above and below the fragipan in the Tonti soil and slow in the fragipan. Runoff is medium. Available water capacity is low. A perched water table is above the fragipan during winter and spring in most years. The root zone is restricted by the fragipan at a depth of 18 to 27 inches. Organic matter content is moderately low, and natural fertility is medium or low. The response to soil amendments is good. The surface layer is very friable and can be easily tilled throughout a fairly wide range of moisture content. It tends to crust or puddle if left fallow.

Most areas are used for pasture and hay, cultivated crops, or timber. This soil is suited to small grain and grain sorghum. Erosion and droughtiness are management concerns. Because of cultivation in the past, numerous small areas are eroded. A system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. A conservation cropping system that includes pasture and hay crops in the rotation also helps to control erosion.

This soil is well suited to cool-season grasses, such as tall fescue and orchardgrass; to shallow-rooted legumes, such as lespedeza; and to bermudagrass and most other

Figure 12.—Profile of Tonti silt loam, 2 to 5 percent slopes. This soil has a light colored surface layer. Depth is marked in feet.

commonly grown warm-season grasses. It is moderately suited to deep-rooted legumes, such as alfalfa and red clover. The rooting depth is only moderate, and droughtiness is a problem during midsummer months. Alfalfa stands generally are short lived. Erosion is a hazard in newly seeded areas. It can be controlled by timely tillage and a quickly established ground cover.

On sites for farm ponds, lakes, lagoons, and other water impoundments that require excavations to a depth of 4 feet or more, seepage is a hazard. It generally can be controlled by keeping the excavation shallow, by extending the excavation over an area that is larger than normal, and by establishing high berms around the impoundment. If depth is a factor, applications of soda ash, polyphosphate, silty material, or an expanding type of clay can reduce the seepage rate.

A few areas support native hardwoods. This soil is suited to trees. Seedling mortality and windthrow are management concerns. Planting container-grown nursery stock increases 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 building site development and to some kinds of onsite waste disposal. The seasonal wetness and the slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for surface exposure for evaporation and allows surface water to drain away from the lateral field. Properly constructed sewage lagoons can function adequately if the site is leveled. The bottom of the lagoon should not be below the bottom of the fragipan. Installing tile drains around foundations, footings, and basement walls helps to prevent the damage to buildings caused by excessive wetness.

Low strength, the potential for frost action, and the wetness limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate side ditches minimize the damage caused by wetness.

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

92A—Secesh-Cedargap silt loams, 0 to 3 percent slopes. These deep, nearly level and very gently sloping, well drained soils are along large intermittent streams and small perennial streams. The Secesh soil is on low terraces and is subject to rare flooding. The Cedargap soil is on flood plains and is frequently flooded. The Cedargap soil is dominant in the prairie areas and the Secesh soil in the timbered areas. An average timbered area is about 50 percent Secesh soil and 35 percent Cedargap soil. Individual areas are long and relatively narrow and range from about 10 to more than 100 acres in size.

Typically, the surface layer of the Secesh soil is dark brown, very friable silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is brown, very friable silt loam in the upper part; brown, friable silty clay loam in the next part; and reddish brown, friable cherty and extremely cherty silty clay loam in the lower part.

Typically, the surface layer of the Cedargap soil is very dark gray, friable silt loam about 8 inches thick. The subsurface layer is about 20 inches thick. It is black, very friable cherty silt loam in the upper part and very dark grayish brown, friable very cherty silt loam in the lower part (fig. 13). The substratum extends to a depth of 60 inches or more. It is dark grayish brown and dark brown, friable very cherty silty clay loam in the upper part and brown and grayish brown, friable extremely cherty silty clay loam in the lower part. In some places the surface layer is cherty silt loam. In other places the content of chert is less than 10 percent throughout the soil.

Included with these soils in mapping are areas of Claiborne, Hepler, Peridge, and Waben soils, which

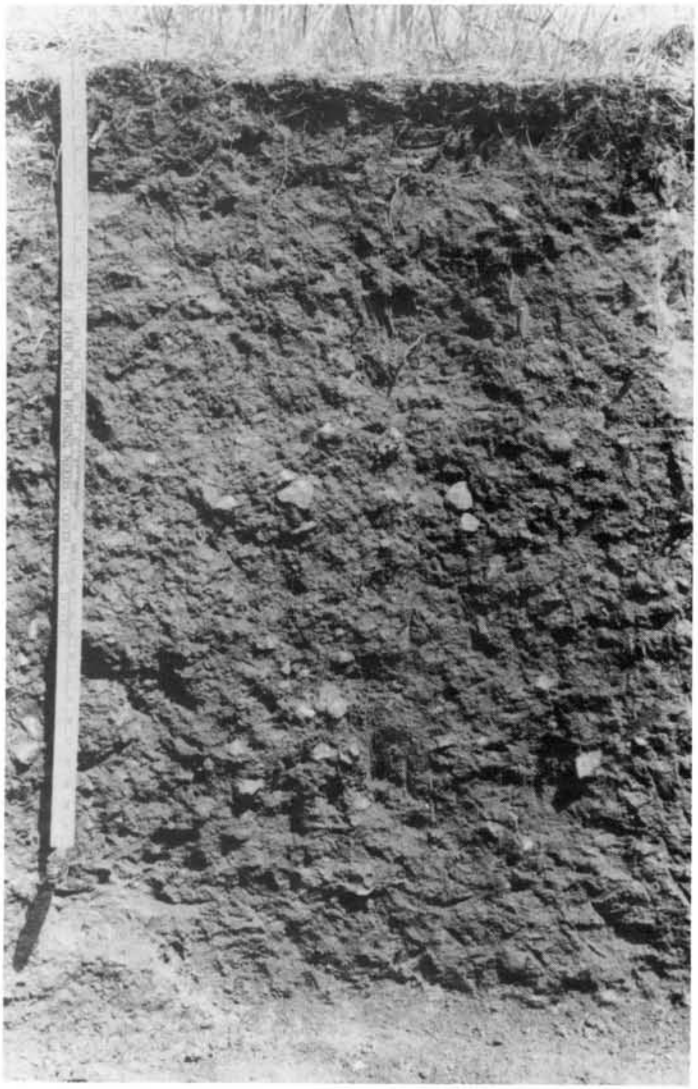

Figure 13.—Profile of Cedargap silt loam, in an area of Secesh-Cedargap silt loams, 0 to 3 percent slopes. The dark surface soil in Cedargap soils extends to a depth of 24 to 44 inches.

make up about 10 to 15 percent of the unit. Claiborne and Peridge soils have more clay in the subsoil than the Secesh and Cedargap soils. Also, they commonly are higher on the landscape. Hepler soils are somewhat poorly drained and typically are near the head of drainageways. Waben soils have more chert throughout than the Secesh soil and have a surface layer that is lighter colored than that of the Cedargap soil. They are in the higher, more sloping areas on terraces.

Permeability is moderate in the upper part of the Secesh soil and moderately rapid in the lower part. It is moderately rapid in the Cedargap soil. Runoff is slow on both soils. Available water capacity is moderate. Organic matter content is moderate in the Cedargap soil and moderately low in the Secesh soil. Natural fertility is medium in both soils. The response to soil amendments is good.

Most areas are used as pasture or hayland. A few isolated areas are used for timber. Some areas are cropped. These soils are suited to grain sorghum, soybeans, and small grain. The major management concerns are the frequent flooding on the Cedargap soil and droughtiness and erosion in the long, very gently sloping areas of the Secesh soil. The crop damage caused by floodwater is only moderate or slight in most years because of the short duration of the flooding and the time of year when it occurs. Crop residue management, cover crops, green manure crops, and a cropping sequence that includes pasture and hay crops help to maintain the organic matter content, improve tilth, and increase the rate of water infiltration. A system of conservation tillage that leaves a protective amount of crop residue on the surface helps to control runoff and erosion. Diversions help to control the runoff from other soils and reduce the susceptibility to erosion.

The Secesh soil is well suited to tall fescue, orchardgrass, bermudagrass, and Caucasian bluestem and to legumes, such as lespedeza and red clover. It is moderately suited to alfalfa. The dominant hay crop is a mixture of alfalfa and grasses. The grasses in this mixture reduce the hazards of frost heaving and summer kill. Bermudagrass has become a commonly grown species on these soils in the past few years. Droughtiness and flooding are the main concerns in managing pasture or hayland. Species that can withstand flooding should be selected for planting on the Cedargap soil. Forage quality and production can be improved by applications of the proper kinds and amounts of fertilizer. A good ground cover and streambank management help to control erosion and minimize the damage caused by flooding.

These soils are suited to trees. Plant competition is the only management concern. It can be controlled by thorough site preparation, which may include cutting or spraying.

Most areas of these soils provide good habitat for openland and woodland wildlife. The grain fields, the idle land, and the wooded areas that border fences and drainageways produce an abundance of food and good cover in most years.

These soils generally are not suited to building site development or onsite waste disposal because of the flooding. The Secesh soil can be used as a site for dwellings and sanitary facilities that are constructed on raised, well compacted fill material or that are otherwise protected from flooding.

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

93B—Waben-Cedargap very cherty silt loams, 1 to 5 percent slopes. These deep, very gently sloping and gently sloping soils are on low terraces and flood plains, commonly near the head of drainageways. The well drained Waben soil is on low, narrow terraces and on fans and is subject to rare flooding. The somewhat excessively drained Cedargap soil is on narrow flood plains and is frequently flooded. Because of a steep stream gradient, the water moves fast and the flooding is of short duration. Individual areas range from about 6 to more than 100 acres in size. They are about 60 percent Waben soil and 30 percent Cedargap soil.

Typically, the surface layer of the Waben soil is dark brown, very friable very cherty silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. It is friable. It is dark brown very cherty silt loam in the upper part, brown and strong brown extremely cherty and cherty silty clay loam in the next part, and brown and pale brown, friable very cherty silty clay loam in the lower part.

Typically, the surface layer of the Cedargap soil is very dark gray, very friable very cherty silt loam about 10 inches thick. The subsurface layer is about 17 inches thick. It is very dark gray and dark brown, very friable cherty silt loam in the upper part and very dark grayish brown, very friable very cherty silt loam in the lower part. The substratum to a depth of 60 inches or more is brown, friable extremely cherty and very cherty silty clay loam. In places the upper 20 inches has no chert.

Included with these soils in mapping are areas of Clarksville and Secesh soils, which make up about 10 percent of the unit. Clarksville soils are more acid than the Waben and Cedargap soils. They are on the lower parts of the adjacent uplands. Secesh soils contain less chert in the surface layer and the upper part of the subsoil than the Waben and Cedargap soils. They are on stream terraces.

Permeability is moderately rapid in the Waben and Cedargap soils. Runoff is medium on the Waben soil and slow on the Cedargap soil. Available water capacity is low in both soils. Organic matter content is moderately low in the Waben soil and moderate in the Cedargap soil. Natural fertility is medium in both soils. The response to soil amendments is good.

Most areas are used as pasture or hayland. Some isolated areas are used for timber. A few areas are cropped. These soils are suited to small grain, grain sorghum, and soybeans. The major management concerns are the frequent flooding on the Cedargap soil and droughtiness in both soils. The susceptibility to erosion also is a concern if cultivated crops are grown. Diversions and terraces can help to control erosion in most areas. Crop residue management, cover crops, and green manure crops help to maintain the organic matter content and improve tilth.

These soils are well suited to legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to Caucasian bluestem and most other warm-season grasses. The droughtiness and the flooding are the main problems. Haying is somewhat hindered by the chert fragments in the surface layer. Using a heavy roller in the spring to push the chert down to the surface level causes a moderate amount of compaction and may reduce the infiltration rate if the practice is repeated for several years. Species that can withstand flooding should be selected for planting on the Cedargap soil. Forage quality and production can be improved by applications of the proper kinds and amounts of fertilizer. A good ground cover and streambank management help to control erosion and minimize the damage caused by flooding.

Some areas support stands of native hardwoods. These soils are suited to trees. Seedling mortality is a management concern. Planting container-grown nursery stock increases the seedling survival rate.

In most areas these soils are suitable for the development of habitat for openland and woodland wildlife. Most of the existing pasture and woodland provides a poor or fair cover for wildlife and a minimum supply of food.

Unless protected from flooding, these soils generally are not suited to building site development or onsite waste disposal. Onsite investigation is needed to identify areas that are suitable sites for septic tank absorption fields, buildings, and local roads and streets.

The land capability classification is IIIw. The woodland ordination symbol is 3F.

94—Dumps-Orthents complex. This map unit occurs as areas of gently sloping to steep mine spoil and very gently sloping, well drained to somewhat poorly drained Orthents. It is on uplands and narrow flood plains. Individual areas range from 5 to nearly 40 acres in size. They generally are about 70 percent Dumps and 30 percent Orthents, but the composition varies from area to area.

The Dumps occur as mine spoil that is mostly chert and limestone rock fragments excavated from deep and shallow mine shafts. In places the rock is mixed with overburden soil material, which was removed prior to mining, and with debris from the processing of lead and zinc ore. Most of the dumps are more than 8 feet high, are circular or long and narrow, and are 100 to 1,000 square yards in size.

The Orthents are in areas that were used as sites for machinery, roads, sorting, and other mining activities. Typically, they are a mixture of chert, limestone, and clay and the original surface soil. They dominantly are extremely cherty silt loam to very cherty clay. The texture varies within short distances.

Permeability in the Orthents typically is moderate to slow, but it varies, depending on the amount of clay, the amount and size of the rocks, and the degree of compaction. Runoff generally is medium but ranges from slow to rapid. Available water capacity and organic matter content are low or very low, and natural fertility is low. The response to soil amendments is fair or poor.

Most areas are abandoned and support only sparse vegetation. The vegetation is mainly weeds, grasses, and some woody plants. In most places desirable vegetation has not become established. The amount and kind of vegetation depend on the kind of material and the extent to which it was mixed and compacted during the mining process.

The suitability for grasses and trees is limited. Were grasses, trees, or crops to be grown, extensive reclamation and soil treatment would be needed but probably would not be feasible. This map unit is moderately suited to openland wildlife. It has potential for some recreational uses. It generally is not suitable for building site development or onsite waste disposal. Some small areas that formerly were used for fill material have been leveled and now are used as building sites. Onsite investigation is needed in areas used for construction purposes.

This map unit is not assigned to a land capability classification or a woodland ordination symbol.

96—Orthents-Quarries complex. This map unit occurs as areas of gently sloping and moderately sloping soils and shallow open excavations from which limestone and tripoli have been or are now being quarried. Individual areas range from 6 to 40 acres in size. They generally are about 65 percent Orthents and 35 percent Quarries, but the composition varies from area to area.

The Orthents are in areas that were used as sites for machinery, roads, sorting, and other mining activities. Typically, they are a mixture of chert, limestone, and clay and the original surface soil. They dominantly are extremely cherty silt loam to very cherty clay. The texture varies within short distances.

The Quarries typically are open excavations that have a vertical face of quarried limestone or tripoli. These exposures extend from the bottom of the pit to a height of about 10 to 40 feet.

Permeability in the Orthents typically is moderate to rapid but ranges to slow in areas that are highly compacted. Runoff generally is slow or medium, but it can vary further in local areas. Available water capacity is low. Natural fertility and organic matter content also are low. The response to soil amendments is fair.

Most of the quarries have been abandoned. The vegetation is native species of weeds, grasses, and trees. If adequate soil treatments are applied, this map unit is suitable for the grasses and trees that enhance wildlife habitat. Droughtiness and the susceptibility to erosion are the main management concerns. The unit also could be used for certain types of recreational areas. Little reclamation would be needed.

This map unit generally is not suited to building site development or onsite waste disposal. Onsite investigation is needed to determine the limitations affecting these uses.

This map unit is not assigned to a land capability classification or a woodland ordination symbol.

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 55,750 acres in Newton County, or nearly 14 percent of the total acreage, meets the soil requirements for prime farmland. An additional 35,550 acres meets the requirements where drained or protected from flooding. The largest areas of this land are on uplands in the northeastern part of the county and on the larger flood plains. About half of the acreage of this land is used for cultivated crops, and half is used for hay and pasture.

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. The naturally wet soils in Newton County generally have been drained through the application of drainage measures or the incidental drainage that results from farming or other kinds of land development.

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, 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 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

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 262,000 acres in Newton County was used for crops, hay, or pasture in 1983 (*9*). Of this total, about 184,500 acres was used for permanent pasture, 47,000 acres for hay, and 30,450 acres for cultivated crops, mainly wheat and soybeans. The acreage used for row crops has steadily decreased from about 120,000 acres in 1900 to 50,000 acres in 1950 and 30,450 acres in 1983 (*10*). Most of the former cropland has been converted to pasture or hayland. The loss of cropland to highway construction and urban development has been slight.

Only about 39 percent of the cropland and hayland and 15 percent of the pasture are not managed in a manner that meets conservation needs. Most of the inadequately managed cropland is on uplands that are being farmed in a manner that causes excessive erosion. This cropland cannot sustain production over a long period. Erosion on most of the cropland and hayland in the county can be held within tolerable limits by conservation practices designed for specific sites.

Erosion is the major problem on nearly all of the cropland that has a slope of more than 2 percent. Because of long slopes, some of the upland soils that have a slope of less than 2 percent, such as Creldon and Newtonia, are subject to sheet erosion unless adequate conservation practices are applied.

Loss of the surface layer through erosion results in reduced productivity. It is especially damaging on soils that have a low organic matter content, a clayey subsoil, or a fragipan. Captina, Creldon, Gerald, Needleye, and Tonti are examples of soils that have a fragipan. The effects of erosion on Creldon and Needleye soils is doubly serious because it reduces the available water capacity and the effective rooting depth above the fragipan. Also, these soils commonly contain more clay in the surface layer if they are eroded.

Erosion on cropland soils results in sedimentation of streams, lakes, and ponds. Control of erosion minimizes this pollution and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

The best erosion-control measures are no-till farming or another system of conservation tillage that leaves a protective amount of residue on the surface and crop rotations that include grasses and legumes. These measures reduce the runoff rate, increase the rate of water infiltration, and improve tilth and productivity. A cropping system that maintains a protective cover of vegetation or crop residue can hold soil losses to an amount that will not reduce the productive capacity of the soils. Such legumes as red clover and alfalfa also provide nitrogen for the following crop.

Terraces help to control erosion by shortening the length of slopes and thus reducing the runoff rate. Conventional terraces are most practical on uneroded upland soils that have long, smooth slopes of less than 5 percent. Special construction and management techniques are necessary before a system of terraces can be effective on the moderately sloping Eldorado soils.

If the soil is unsuitable for terracing, other alternatives can be used. Contour stripcropping helps to control erosion by maintaining contour strips of meadow or close-growing crops. These strips of grasses or of grasses and legumes generally are harvested for hay. Row crops are planted on the contour in the areas between the strips.

Conservation tillage is the most cost-effective means of controlling erosion on cropland. It is becoming more common in the county and can be used on many of the soils.

A drainage system or flood control is needed on about 9 percent of the acreage in the county. The natural wetness of Dunning and Hepler soils generally reduces crop production. Some land grading or a surface drainage system may be needed on these soils. Flooding is a hazard on Huntington and Cedargap soils. It commonly occurs during the period November through May.

Most of the soils in the county are naturally low in fertility and are naturally acid in the upper part of the root zone. Additional plant nutrients are needed on all of the soils. On the acid soils, applications of ground limestone are needed to raise the pH and calcium levels sufficiently for the optimum growth of legumes, row crops, and most grasses. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. Tilth is a problem in the naturally wet Dunning and Hepler soils, which often stay wet until late in the spring. If they are tilled when wet, they tend to be cloddy when dry. As a result of the cloddiness, preparing a seedbed is difficult. Fall plowing of these soils generally improves tilth. It does not result in excessive erosion because the soils are nearly level.

In Newton County most of the uneroded upland soils that are used for crops have a silt loam surface layer and are moderate to low in content of organic matter. Tillage and compaction generally result in a weaker structure in these soils. Under these conditions, a crust forms on the surface during periods of intensive rainfall. The crust is hard when dry. It reduces the rate of water infiltration, hinders seed germination, and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve soil structure and tilth.

Currently, about 231,500 acres in Newton County is used for grasses and legumes that largely support the 80,000 head of cattle in the county. The number of dairy cows is only about 7,000. About 40,000 acres is harvested for hay. The annual yield from this acreage is about 2 tons per acre.

In 1983, tall fescue was grown on about 90 percent of the hayland and pasture. Alfalfa is the most commonly grown legume, followed by red clover, which is grown in a mixture with grasses. Lespedeza and hop clover are commonly grown in the tall fescue pastures. Orchardgrass and bromegrass are the most common cool-season grasses after tall fescue. Bermudagrass is the most common warm-season grass. It generally is grown in a mixture with tall fescue. The most common forage for beef cattle is tall fescue, and the most common forage for dairy herds is alfalfa and orchardgrass or bromegrass.

In the smoother areas, tall fescue commonly is harvested for seed in late June. The aftermath is bailed for hay. Grazing is then deferred in these areas until late fall or early winter. If the fescue is allowed to grow through the fall and is grazed in the winter, little or no hay is required in 3 out of every 5 years. This method cuts labor and machine costs, but it somewhat reduces the quantity and quality of the forage.

Tall fescue is not the most palatable forage species, nor does it produce the most beef per acre, but it requires less management and seems to survive under many adverse conditions. It does not furnish much nutrition during July and August, and some cattle grazing on tall fescue pastures often lose weight during these months.

In Newton County warm-season grasses are grown mainly because of the need for forage during the summer slump of cool-season grasses. Examples of suitable warm-season grasses in the county are big bluestem, Caucasian bluestem, bermudagrass, switchgrass, and indiangrass. These grasses are more difficult to establish and maintain than fescue, but they can provide 3 to 5 tons of forage per acre during the period June through August.

In some areas where warm-season grasses are grown, prescribed burning is necessary to control undesirable vegetation and to improve the quality and quantity of the forage. Burning generally is not necessary more often than once every 3 to 5 years. It should be done only when a specific management objective is to be met.

The chief problem in managing pasture is overgrazing. If good management is applied, 12-month grazing is possible in about 3 out of every 5 years. This management includes deferred or rotation grazing, proper stocking rates, applications of fertilizer, and weed control.

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 harvesting 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 rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*19*). 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.

There are no class I, V, or VIII soils in Newton County.

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

The capability classification of each map unit, except for Dumps-Orthents complex and Orthents-Quarries complex, is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Bruce Palmer, resource forester, Missouri Department of Conservation, helped prepare this section.

The past management of a timber stand has a definite effect on the growth and development of the forest. When settlement of Newton County began in 1830, approximately 241,000 acres, or 60 percent of the total acreage, was forest land. Saw mills were soon a common sight, converting the standing timber to building lumber and railroad ties. After lead deposits were discovered in the Granby area in 1850, the forest became very important in the development of the mining industry. Lumber was needed for buildings, railroad ties, timber to shore the mines, and fuel wood to fire the lead furnaces. In 1877, there were 12 furnaces in Granby, each one of which consumed 42 cords of wood every week (*7*).

After years of overcutting, the quality and quantity of the yield from the forests steadily declined. The cutover land became open range for livestock, and fires were set each spring to kill the ticks and snakes and to help establish grasses. Several times in the history of Newton County, large wildfires burned uncontrolled, consuming farmsteads, fences, and orchards. The result was a steady loss of soil fertility, a reduction in the population of wildlife, and erosion that carried tons of topsoil and gravel down into the streams (*11*).

Because of past mismanagement, many of the trees in the present forest are undesirable species or are desirable species of inferior quality. Good management can improve the forest by removing the low-quality trees and promoting the growth of the vigorous, higher quality trees.

The acreage of forest land in Newton County continues to diminish because of land clearing and urbanization. In 1981, an estimated 95,000 acres was forest.

Approximately 1 percent of the total forest cover currently grows on soils that formed under prairie vegetation. The option of managing these soils for forest species should not be automatically eliminated. The primary species are the early invaders, such as elm, sassafras, persimmon, and osageorange, and scattered oaks.

The Newtonia-Wanda association, which is described under the heading "General Soil Map Units," has good potential for timber production. The major soils in this association can support a variety of quality forest species, including black walnut. Multicropping black walnut with grain or forage crops is a viable management option. Other management options include tree nurseries.

Timber management on the Hoberg soils in the Hoberg-Keeno association is somewhat limited because of a fragipan, which restricts the growth of trees after they have reached about 35 years of age. Short-rotation tree crops are economically feasible on these soils. The forest management options open to the landowner include Christmas tree plantations and short-rotation fuel wood.

The Huntington-Secesh association supports about 9 percent of the county's forest cover. The major forest species on this association include sycamore, ash, black walnut, silver maple, and various oaks. Most areas have been cleared of trees and are used as cropland, but the remaining timber land is very productive if it is well managed. Most of the stands of native black walnut in the county are on this association. The major soils are suitable for multicropping black walnut with grain or forage crops.

About 25 percent of the forest land in the county is in areas of the Nixa-Tonti association. The most common forest species on this association are post oak and blackjack oak. The major soils have a restrictive fragipan. Short-rotation tree crops are economically feasible on these soils. The forest management options include Christmas tree plantations and short-rotation fuel wood.

The Nixa-Clarksville association supports about 65 percent of the forest cover in the county. It supports a variety of commercial species, mainly white oak, black oak, post oak, northern red oak, and hickory. The major soils are in the steeper areas and generally are unsuited to uses other than forest. Proper management of these timber stands can provide the landowner with quality sawlogs as well as fuel wood for home heating.

The county has several forest industries where landowners can market their forest products. These industries use more than 10 million board feet of lumber annually (*8*). Eight sawmills produce rough lumber and railroad ties. A box plant in Neosho produces several million berry boxes annually. This is one of the largest producers of berry boxes in the country (*8*).

Much of the rough lumber is used in the pallet industry. Three plants manufacture pallets, boxes, and crates. Other local industries include three furniture manufacturers and a flooring mill. A charcoal kiln uses the slabs and edgings from local sawmills to produce lump charcoal. Without the charcoal industry, these slabs and edgings would be considered waste products.

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; and *F*, a high content of rock fragments in the soil. 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, and F.

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 on 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

Winter winds can be a concern to landowners in the areas of prairie in the county. The soils in these areas are well suited to windbreaks. Fully established windbreaks reduce windchill around farmsteads and may lower heating bills by 20 to 30 percent.

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 local offices of the Soil Conservation Service, the Missouri Department of Conservation, or the Cooperative Extension Service or from a commercial nursery.

Recreation

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

In 1980, a total of 6,424 acres in Newton County was used for recreational development (*16*). Ownership of these areas was 3 percent federal, 40 percent state, 23 percent municipal, and 34 percent school, private, and other. The facilities included swimming areas, hunting and fishing areas, camping areas, trails, game courts, ball fields, picnic areas, play areas, historical sites, and wildlife-viewing areas. The demand for recreational facilities probably will increase because the population of the county is likely to increase to 44,600 by 1990 (*12*).

The Fort Crowder Wildlife Area, which is about 5,000 acres in size, is the largest public recreational area in the county. It provides opportunities for primitive camping, hiking, hunting, wildlife viewing, and other forms of outdoor recreation. McClelland, Wildcate, Morse, and Bicentennial Parks and the Crowder College Area are the only other public recreational areas more than 100 acres in size within the county.

Several private and semiprivate commercial recreational enterprises operate in the county (*15*). They include trout-fishing areas, saddle clubs, picnic areas, hunting areas, church camps, and campgrounds. The major recreational needs in the county are facilities for water sports and vacation farm developments.

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 sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also 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 have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing 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 fragipan 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.

Newton County is one of 13 counties included in the West Ozark Border Zoogeographic Region in Missouri (*14*). The native vegetation was a mixture of oak-hickory forest and tall prairie grasses. Currently, about half of the county is classified as grassland and the rest is either cropland or woodland (*12*).

A significant acreage of forest land has been converted to grassland during the past 30 years. The problems affecting the wildlife in the county are loss of the woodland habitat base through conversion to pasture, grazing of the shrinking woodland base, limited grain production, enlargement of the size of fields, and lack of suitable edge areas between different vegetative types. Most of the wildlife habitat is controlled by private landowners, and obtaining access for the purpose of hunting is becoming more difficult as additional land is posted.

The population of songbirds is good to excellent in each of the soil associations described under the heading "General Soil Map Units." The population of furbearers is fair. Raccoon, opossum, muskrat, gray fox, striped skunk, coyote, mink, and beaver are the principal animals trapped in the county. Several prairie species, such as badgers, blacktail jackrabbits, and prairie chickens, still inhabit small areas of the original tall prairie grasses interspersed with row crops.

The Nixa-Clarksville association is the only association having more than 50 percent woodland cover. It provides the primary habitat for the woodland wildlife in the county. The deer and squirrel populations are good. Turkeys were first stocked in 1972. The population is low but is increasing.

The Nixa-Tonti, Huntington-Secesh, Newtonia-Wanda, Hoberg-Keeno, and Gerald-Creldon associations provide the habitat for openland wildlife. Approximately 71 percent of the county is cropland or grassland. The scarcity of corn and small grain limits the existing food supply. Overgrazing of fescue pastures has reduced the quality of the grassland habitat. Increasing the extent of warm-season grasses would improve the quality of this habitat. The quail population is only fair and is likely to decrease during the next few years. The populations of rabbits and doves are poor to fair.

Wetland habitat is extremely scarce in Newton County. Surface water is very scarce. The Huntington-Secesh association is the only association that provides any habitat for wetland wildlife. A section of Five Mile Creek has a resident population of giant Canadian geese. Woodducks frequent sections of Lost, Shoal, and Indian Creeks.

The county has about 144 miles of perennial streams (*12*). Shoal, Indian, and Lost Creeks are the only streams that provide the general public opportunities for fishing. The fish species most commonly caught are largemouth bass, smallmouth bass, sucker, perch, crappie, catfish, and sunfish.

No impoundment fishing is available to the general public in the county. Approximately 135 farm ponds and small lakes have been stocked with fish. Largemouth bass, channel catfish, and bluegill are typical species in these small impoundments.

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 are also considerations. Examples of grain and seed crops are 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 are also considerations. Examples of grasses and legumes are fescue, bluegrass, switchgrass, orchardgrass, alfalfa, indiangrass, red clover, 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, ragweed, beggarweed, foxtail, croton, 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 hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, sumac, cherry, apple, hawthorn, dogwood, hickory, blackberry, persimmon, and sassafras. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are wild plum, hazelnut, Amur honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish winter cover, 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, cedar, and juniper.

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, cutgrass, cattail, 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, meadowlark, field sparrow, cottontail, mourning dove, 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, 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, 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 to 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, 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 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, and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 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, 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), 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 fragipan, 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 fragipan, and flooding affect absorption of the effluent. Large stones and bedrock or a fragipan 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 due to rapid permeability of 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. Slope, bedrock, and fragipans 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, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, 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 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, 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 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. They 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. 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 fragipan, 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; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, 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. The performance of a system is affected by the depth of the root zone 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 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 affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, 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 classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

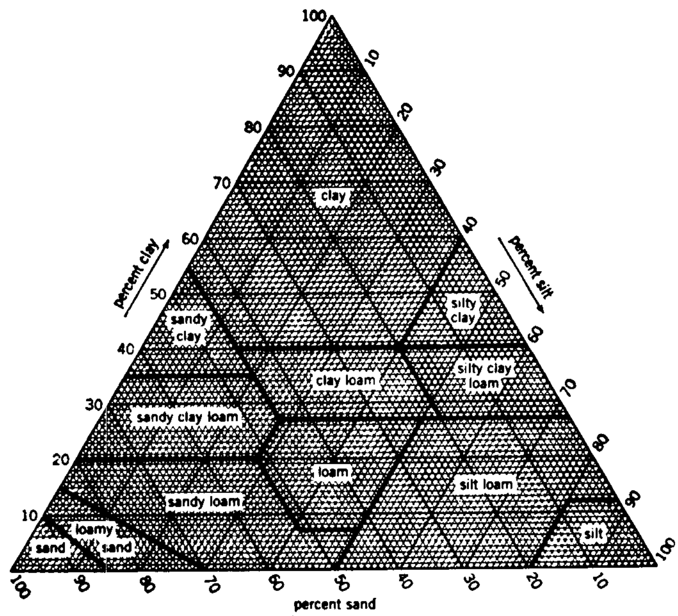

Figure 14.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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. 14). "Loam," for example, is soil that is 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, "cherty." 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 of 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 of 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 intake 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, such as a fragipan, 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.

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. Only saturated zones within a depth of about 6 feet are indicated.

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.

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.

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 (*20*). 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 Ultisol.

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 Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

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 Fragiudults (*Fragi*, meaning fragipan, plus *udult*, the suborder of the Ultisols 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 *Typic* identifies the subgroup that typifies the great group. An example is Typic Fragiudults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly 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-loamy, mixed, mesic Typic Fragiudults.

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. The soil is compared with similar soils and with nearby soils of other 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* (*18*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*20*). 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."

Bado Series

The Bado series consists of deep, poorly drained soils on uplands. These soils formed in silty and cherty sediments and in cherty limestone residuum. They have a fragipan at a depth of 20 to 32 inches. Permeability is slow above the fragipan, very slow in the fragipan, and moderate below the fragipan. Slopes range from 0 to 2 percent.

Bado soils are similar to Gerald soils and commonly are adjacent to Captina, Needleye, and Tonti soils. Captina, Needleye, and Tonti soils have less clay in the B horizon than the Bado soils and are not so gray. They are very gently sloping and gently sloping and are around the perimeter of areas of the Bado soils. Gerald soils have a surface layer that is darker than that of the Bado soils.

Typical pedon of Bado silt loam, 1,685 feet east and 230 feet south of the northwest corner of sec. 36, T. 25 N., R. 31 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine granular structure; very friable; many very fine roots; few fine rounded concretions of iron and manganese oxide; slightly acid; abrupt smooth boundary.

E—4 to 12 inches; grayish brown (10YR 5/2) silt loam; weak very thin platy structure; very friable; many very fine roots; few fine rounded concretions of iron and manganese oxide; extremely acid; clear smooth boundary.

Bt1—12 to 16 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine prominent dark reddish brown (2.5YR 3/4) mottles; moderate fine subangular blocky structure; firm; many fine roots; few faint clay films on faces of peds; few fine rounded concretions of iron and manganese oxide; extremely acid; clear smooth boundary.

Bt2—16 to 22 inches; dark grayish brown (10YR 4/2) silty clay; few fine faint dark yellowish brown (10YR 4/4) and gray (10YR 5/1) mottles; moderate fine angular blocky structure; very firm; many very fine roots; many prominent dark reddish brown (2.5YR 3/4) clay films on faces of peds; about 5 percent subrounded chert fragments; few fine rounded concretions of iron and manganese oxide; extremely acid; clear wavy boundary.

Bt3—22 to 29 inches; mottled dark gray (10YR 4/1) and gray (10YR 5/1) silty clay; moderate fine and medium angular blocky structure; very firm; few very fine roots; many distinct strong brown (7.5YR 5/8) clay films; about 10 percent subrounded chert fragments; few fine rounded concretions of iron and manganese oxide; extremely acid; clear smooth boundary.

2Btx1—29 to 41 inches; strong brown (7.5YR 5/6) extremely cherty silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak very fine subangular blocky structure; very firm; brittle; few distinct dark gray (10YR 4/1) clay films; about 65 percent angular chert fragments; extremely acid; clear smooth boundary.

2Btx2—41 to 48 inches; mottled yellowish brown (10YR 5/6), brown (7.5YR 5/4), and grayish brown (10YR 5/2) extremely cherty silty clay loam; few medium prominent dark red (2.5YR 3/6) mottles; weak very fine subangular blocky structure; very firm; few prominent very dark gray (10YR 3/1) clay films; about 65 percent angular chert fragments; extremely acid; clear smooth boundary.

3Bt—48 to 60 inches; dark red (2.5YR 3/6) extremely cherty silty clay; many medium distinct grayish brown (10YR 5/2) mottles; moderate fine angular blocky structure; very firm; common faint clay films on faces of peds; about 65 percent angular chert fragments (about 20 percent more than 3 inches in size); extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert ranges from 0 to 10 percent in the A and Bt horizons, from 5 to 65 percent in the fragipan, and from 30 to 65 percent in the 3Bt horizon.

The A or Ap horizon has value of 3 to 5 and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 2 or 3. The Bt horizon value of 3 to 6. It is silty clay loam, clay, or silty clay. The 2Btx horizon has value of 4 to 6 and chroma of 2 to 6. It has mottles with hue of 10YR to 2.5YR and with value and chroma similar to those in the matrix. It is the cherty, very cherty, or extremely cherty analogs of silty clay loam. Some pedons have a 2Ax horizon. The 3Bt horizon has hue of 2.5YR or 5YR, value of 3 to 6, and chroma of 4 to 6. It has mottles with value of 3 to 6 and chroma of 1 to 3. It is silty clay loam, silty clay, or the cherty, very cherty, or extremely cherty analogs of these textures.

Bolivar Series

The Bolivar series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from acid sandstone interbedded with thin layers of clayey or sandy shale. Slopes range from 2 to 9 percent.

These soils have a lower base saturation and are more acid in the 2Bt horizon than is definitive for the Bolivar series. These differences, however, do not significantly affect the usefulness or behavior of the soils.

Bolivar soils commonly are adjacent to Newtonia and Wanda soils. The adjacent soils are in high landscape positions similar to those of the Bolivar soils. They are deep, are redder than the Bolivar soils, and have a thick, dark surface layer. Also, Wanda soils are cherty in the lower part.

Typical pedon of Bolivar very fine sandy loam, 2 to 5 percent slopes, 2,220 feet east and 620 feet north of the southwest corner of sec. 34, T. 25 N., R. 29 W.

Ap—0 to 6 inches; brown (10YR 4/3) very fine sandy loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; common fine roots; medium acid; abrupt smooth boundary.

BE—6 to 11 inches; brown (10YR 4/3) and strong brown (7.5YR 5/6) loam; moderate very fine subangular blocky structure; very friable; common very fine roots; medium acid; clear smooth boundary.

Bt1—11 to 21 inches; strong brown (7.5YR 4/6) clay loam; moderate fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 10 percent sandstone fragments; strongly acid; abrupt smooth boundary.

Bt2—21 to 30 inches; yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) clay loam; common coarse prominent dark reddish brown (2.5YR 3/4) mottles; moderate fine angular blocky structure; friable; common prominent clay films on faces of peds; about 14 percent sandstone fragments; extremely acid; clear smooth boundary.

2Bt3—30 to 36 inches; light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) clay; common coarse prominent dark reddish brown (2.5YR 3/4) mottles; moderate fine angular blocky structure; firm; many prominent clay films on faces of peds; about 10 percent sandstone fragments; extremely acid; clear smooth boundary.

2Crt—36 to 55 inches; light gray (10YR 7/1 and 6/1), soft shale; common medium distinct yellow (10YR 7/6) mottles; few prominent reddish brown (2.5YR 4/4) clay flows along fractures; extremely acid; abrupt smooth boundary.

3Cr—55 to 60 inches; soft, red sandstone.

The thickness of the solum and the depth to weathered soft sandstone or shale bedrock are 20 to 40 inches. Stones cover 0 to 30 percent of the surface.

The Ap or A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. If the value is 3, these horizons are less than 7 inches thick. They typically are very fine sandy loam, but the range includes loam. Some pedons have an E horizon. The Bt horizon has value of 4 to 6 and chroma of 4 to 8. It ranges from loam to clay.

Captina Series

The Captina series consists of deep, moderately well drained soils on uplands. These soils formed in silty and cherty sediments and in cherty limestone residuum. They have a fragipan at a depth of 18 to 27 inches. Permeability is moderate above and below the fragipan and slow in the fragipan. Slopes range from 1 to 3 percent.

Captina soils are similar to Needleye soils and commonly are adjacent to Bado, Needleye, Nixa, and Tonti soils. Bado soils are poorly drained and are in nearly level or depressional areas on broad ridgetops. Needleye soils are mottled in the upper 10 inches of the B horizon. Nixa and Tonti soils have more chert in the B horizon than the Captina soils. Nixa soils commonly are in the lower, more sloping areas. Tonti soils are in landscape positions similar to those of the Captina soils.

Typical pedon of Captina silt loam, 1 to 3 percent slopes, 600 feet north and 650 feet west of the southeast corner of sec. 18, T. 24 N., R. 31 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

BE—6 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; common fine roots; extremely acid; clear smooth boundary.

Bt1—12 to 20 inches; strong brown (7.5YR 4/6) silty clay loam; moderate fine and very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; extremely acid; clear smooth boundary.

Bt2—20 to 24 inches; strong brown (7.5YR 4/6) silty clay loam; few fine distinct brown (10YR 5/3) mottles; moderate fine and medium subangular blocky structure; firm; common distinct dark red (2.5YR 3/6) clay films on faces of peds; about 5 percent subrounded chert fragments; few very fine roots; extremely acid; clear smooth boundary.

2Btx1—24 to 30 inches; mottled pale brown (10YR 6/3), light brownish gray (10YR 6/2), and red (2.5YR 4/8) silty clay loam; weak very fine subangular blocky structure; firm; brittle; common distinct dark red (2.5YR 3/6) clay films on faces of peds; about 10 percent subrounded chert fragments; extremely acid; clear smooth boundary.

2Btx2—30 to 54 inches; mottled light brownish gray (10YR 6/2), pale brown (10YR 6/3), and yellowish red (5YR 4/8) very cherty silty clay loam; weak very fine subangular blocky structure; firm; brittle; common distinct red (2.5YR 4/8) clay films on faces of peds; about 60 percent subrounded chert fragments; extremely acid; clear smooth boundary.

3Bt—54 to 60 inches; dark red (2.5YR 3/6) and yellowish brown (10YR 5/6) very cherty silty clay; moderate very fine angular blocky structure; firm; few faint clay films on faces of peds; about 40 percent angular chert fragments; extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert ranges from 0 to 15 percent above the fragipan and from 5 to 85 percent in and below the fragipan.

The A or Ap horizon either has value of 4 and chroma of 2 or 3 or has value of 5 and chroma of 3 or 4. Some pedons have an E horizon. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Btx horizon is mottled with hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 2 to 8. It is silty clay loam, silt loam, or the cherty, very cherty, or extremely cherty analogs of these textures. The 3Bt horizon has value of 3 to 5 and chroma of 4 to 6. It is silty clay loam, silty clay, clay, or the cherty, very cherty, or extremely cherty analogs of these textures.

Carytown Series

The Carytown series consists of deep, poorly drained, very slowly permeable, sodic soils on uplands and terraces. These soils formed in shale residuum. Slopes range from 0 to 2 percent.

Carytown soils commonly are adjacent to Creldon, Gerald, and Wanda soils. Creldon and Gerald soils have a fragipan. Creldon soils are very gently sloping and are in the slightly higher upland positions. Gerald soils are in upland positions similar to those of Carytown soils. Wanda soils are redder than the Carytown soils. They are gently sloping, are well drained, and are in the higher landscape positions.

Typical pedon of Carytown silt loam, 700 feet west and 1,050 feet south of the northeast corner of sec. 22, T. 25 N., R. 30 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

E—9 to 13 inches; dark gray (10YR 4/1) silt loam, light gray (10YR 6/1) dry; weak medium platy structure; very friable; few very fine roots; common fine rounded concretions of iron and manganese oxide; neutral; abrupt smooth boundary.

Bt—13 to 18 inches; very dark gray (10YR 3/1) silty clay; weak coarse columnar structure parting to moderate fine and very fine angular blocky; very firm; few fine roots; few faint clay films on faces of peds; common fine rounded concretions of iron and manganese oxide; neutral; clear smooth boundary.

Btg1—18 to 28 inches; dark grayish brown (2.5Y 4/2) clay; weak coarse prismatic structure parting to moderate fine angular blocky; extremely firm; few faint clay films on faces of peds; few fine rounded concretions of iron and manganese oxide; few very fine roots; about 5 percent chert fragments; moderately alkaline; gradual smooth boundary.

Btg2—28 to 40 inches; dark grayish brown (2.5Y 4/2) clay; weak coarse prismatic structure parting to strong fine angular blocky; extremely firm; few faint clay films on faces of peds; few fine rounded concretions of iron and manganese oxide; few prominent slickensides; few roots; moderately alkaline; gradual smooth boundary.

Cg—40 to 60 inches; gray (5Y 5/1 and 6/1) silty clay; massive; very firm; few prominent slickensides on vertical cleavage faces; common coarse and very coarse rounded carbonate concretions; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to bedrock is more than 60 inches. The depth to the Bt horizon ranges from about 6 to 20 inches. It varies widely within short distances.

The A or Ap horizon has chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 1 to 3. The Bt and Btg horizons have value of 3 or 4 and chroma of 1 to 3. The content of clay in these horizons ranges from 40 to 60 percent. Calcium and manganese concretions are at a depth of 30 to 60 inches in most pedons.

Cedargap Series

The Cedargap series consists of deep, well drained and somewhat excessively drained, moderately rapidly permeable soils on narrow flood plains along secondary streams. These soils formed in silty alluvium that has a high content of chert fragments. Slopes range from 0 to 3 percent.

Cedargap soils commonly are adjacent to Clarksville, Keeno, Secesh, and Waben soils. Clarksville, Secesh, and Waben soils have an argillic horizon. Clarksville soils are on uplands. Secesh and Waben soils are on low terraces. Keeno soils are on uplands. They have a fragipan.

Typical pedon of Cedargap silt loam, in an area of Secesh-Cedargap silt loams, 0 to 3 percent slopes, 1,000 feet north and 200 feet west of the southeast corner of sec. 12, T. 24 N., R. 32 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; many very fine and fine roots; about 5 percent subrounded chert fragments; neutral; clear smooth boundary.

A1—8 to 19 inches; black (10YR 2/1) cherty silt loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; many very fine and fine roots; about 15 percent subrounded chert fragments; slightly acid; clear smooth boundary.

A2—19 to 28 inches; very dark grayish brown (10YR 3/2) very cherty silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; common very fine roots; about 35 percent subrounded and angular chert fragments; medium acid; clear wavy boundary.

C1—28 to 48 inches; dark grayish brown (10YR 4/2) and dark brown (7.5YR 4/4) very cherty silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; about 50 percent subrounded and angular chert fragments; medium acid; gradual smooth boundary.

C2—48 to 60 inches; brown (10YR 4/3) and grayish brown (10YR 5/2) extremely cherty silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; about 70 percent subrounded and angular chert fragments; slightly acid.

The thickness of the solum ranges from 24 to 44 inches. The content of chert ranges from 5 to 55 percent in the Ap horizon and from 35 to 70 percent in the 10- to 40-inch control section.

The Ap and A horizons have hue of 10YR or 7.5YR and chroma of 1 to 3. They are silt loam or cherty or very cherty silt loam. The C horizon has hue of 10YR and 7.5YR, value of 2 to 5, and chroma of 1 to 4. It is the cherty, very cherty, or extremely cherty analogs of silt loam or silty clay loam.

Claiborne Series

The Claiborne series consists of deep, well drained, moderately permeable soils on high terraces and toe slopes along secondary streams. These soils formed in silty alluvium that has a moderate content of chert fragments. Slopes range from 2 to 5 percent.

Claiborne soils commonly are adjacent to Cedargap, Clarksville, Nixa, Peridge, and Secesh soils. Cedargap soils have a dark surface soil that is more than 24 inches thick. They are on flood plains. Clarksville and Nixa soils have more chert than the Claiborne soils. They are on uplands. Peridge soils have a lower content of fine chert and sand than the Claiborne soils. They are in positions on terraces similar to those of the Claiborne soils. Secesh soils have a higher base saturation than the Claiborne soils and have more chert in the lower part of the B horizon. They are on low stream terraces.

Typical pedon of Claiborne silt loam, in an area of Claiborne-Peridge silt loams, 2 to 5 percent slopes, 1,600 feet north and 1,400 feet east of the southwest corner of sec. 33, T. 24 N., R. 33 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; strong very fine granular structure; very friable; many very fine and fine roots; about 10 percent subrounded chert fragments; neutral; clear smooth boundary.

BA—9 to 19 inches; dark brown (7.5YR 4/4) and dark yellowish brown (10YR 3/4) silt loam; weak fine subangular blocky structure; friable; common very fine and fine roots; about 10 percent subrounded chert fragments; slightly acid; clear smooth boundary.

Bt1—19 to 50 inches; yellowish red (5YR 4/6) cherty silty clay loam; moderate fine subangular blocky structure; friable; common very fine roots; few faint clay films on faces of peds; about 25 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

Bt2—50 to 60 inches; yellowish red (5YR 4/6) cherty silty clay loam; common medium prominent pale brown (10YR 6/3) mottles; moderate fine subangular blocky structure; friable; few very fine roots; common distinct clay films on faces of peds; about 25 percent subrounded and angular chert fragments; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert ranges from 5 to 25 percent in the upper part of the Bt horizon and averages about 25 percent in the lower part.

The Ap horizon has chroma of 2 to 4. The BA horizon has chroma of 4 to 6. It is silt loam or silty clay loam. The Bt horizon has hue of 5YR or 2.5YR, value of 3 to 5, and chroma of 6 to 8. It is silty clay loam or cherty silty clay loam.

Clarksville Series

The Clarksville series consists of deep, somewhat excessively drained soils on uplands. These soils formed in cherty limestone residuum. Permeability is moderately rapid in the upper part of the profile and moderate or moderately rapid in the lower part. Slopes range from 9 to 35 percent.

Clarksville soils commonly are adjacent to Cedargap, Huntington, Nixa, Secesh, and Waben soils. Cedargap and Huntington soils have a thick, dark surface layer. They are on flood plains. Nixa soils have a fragipan. They are in the higher upland positions. Secesh and Waben soils have a base saturation that is higher than that of the Clarksville soils. They are on terraces.

Typical pedon of Clarksville very cherty silt loam, 14 to 35 percent slopes, 350 feet north and 1,950 feet west of the southeast corner of sec. 35, T. 24 N., R. 33 W.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) very cherty silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; very friable; many very fine roots; about 45 percent angular chert fragments; strongly acid; clear smooth boundary.

A2—2 to 5 inches; grayish brown (10YR 5/2) very cherty silt loam, light gray (10YR 7/2) dry; weak very fine granular structure; very friable; many coarse roots; about 45 percent angular chert fragments; very strongly acid; clear smooth boundary.

E—5 to 14 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak very fine granular structure; very friable; common fine and medium roots; about 55 percent angular chert fragments; very strongly acid; clear smooth boundary.

BE—14 to 21 inches; light yellowish brown (10YR 6/4) and reddish yellow (7.5YR 6/6) extremely cherty silt loam; weak very fine subangular blocky structure; very friable; few very fine roots; about 65 percent angular chert fragments; very strongly acid; clear smooth boundary.

Bt1—21 to 29 inches; red (2.5YR 4/6) and strong brown (7.5YR 5/6) extremely cherty silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 70 percent angular chert fragments; very strongly acid; clear smooth boundary.

Bt2—29 to 37 inches; red (2.5YR 4/6) and yellowish red (5YR 5/6) extremely cherty silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 75 percent angular chert fragments; strongly acid; clear smooth boundary.

Bt3—37 to 60 inches; dark red (2.5YR 3/6) and yellowish red (5YR 4/6) extremely cherty silty clay; moderate fine angular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; about 75 percent angular chert fragments; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert fragments ranges rrom 20 to 70 percent in the A horizon and from 35 to 85 percent in the Bt horizon.

The A or Ap horizon has value of 3 to 6 and chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 3 or 4. The A and E horizons are silt loam or cherty, very cherty, or extremely cherty silt loam. The Bt horizon has hue of 7.5YR to 2.5YR, value of 3 to 6, and chroma of 4 to 6. It is silty clay loam, silty clay, clay, or the cherty, very cherty, or extremely cherty analogs of these textures.

Creldon Series

The Creldon series consists of deep, moderately well drained soils on uplands. These soils formed in silty and cherty sediments and in cherty limestone residuum. They have a fragipan at a depth of 18 to 27 inches. Permeability is moderately slow above the fragipan, very slow in the fragipan, and moderate below the fragipan. Slopes range from 1 to 3 percent.

Creldon soils are similar to Hoberg soils and commonly are adjacent to Gerald, Hoberg, Keeno, and Wanda soils. Gerald soils are grayer than the Creldon soils. They are in nearly level areas on uplands. Hoberg, Keeno, and Wanda soils have less clay than the Creldon soils. Also, Wanda soils have a higher base saturation. They are on uplands or terraces. Keeno soils are cherty throughout. They are in the lower areas on narrow divides.

Typical pedon of Creldon silt loam, 1 to 3 percent slopes, 1,155 feet north and 100 feet east of the southwest corner of sec. 18, T. 25 N., R. 30 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; strong very fine granular structure; very friable; many fine roots; medium acid; clear smooth boundary.

A2—6 to 10 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate very fine and fine granular structure; very friable; many fine roots; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt1—10 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of peds; few faint silt coatings in pores; common fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt2—14 to 20 inches; dark brown (7.5YR 4/4) silty clay; common fine prominent dark reddish brown (2.5YR 3/4) and dark red (2.5YR 3/6) and few fine faint dark brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; firm; common fine roots; few faint clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt3—20 to 26 inches; yellowish brown (10YR 5/4) silty clay; many fine prominent red (2.5YR 4/8) and dark red (2.5YR 3/6) and common medium faint dark brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

2Btx1—26 to 33 inches; yellowish red (5YR 4/6) and brown (10YR 5/3) silty clay loam; common medium prominent grayish brown (10YR 5/2) and red (2.5YR 5/6) and few fine distinct light gray (10YR 7/2) mottles; weak medium platy structure; very firm; brittle; few fine roots; few distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; about 10 percent subrounded chert fragments; strongly acid; clear wavy boundary.

2Btx2—33 to 41 inches; yellowish red (5YR 4/6) and pale brown (10YR 6/3) extremely cherty silty clay loam; common medium prominent light brownish gray (10YR 6/2) and dark red (2.5YR 3/6) and few fine distinct strong brown (7.5YR 5/6) and light gray (10YR 6/1) mottles; massive; very firm; brittle; few distinct clay films in pores; few fine rounded concretions of iron and manganese oxide; about 60 percent subrounded chert fragments; medium acid; clear wavy boundary.

3Bt1—41 to 53 inches; dark red (2.5YR 3/6) and red (2.5YR 4/8) extremely cherty silty clay; few fine prominent grayish brown (10YR 5/2), light brownish gray (10YR 6/2), and light gray (10YR 7/2) mottles; moderate very fine and fine angular blocky structure; very firm; common prominent clay films on faces of peds; about 70 percent angular chert fragments; medium acid; gradual smooth boundary.

3Bt2—53 to 60 inches; dark red (2.5YR 3/6) very cherty clay; moderate very fine and fine angular blocky structure; very firm; common prominent clay films on faces of peds; about 50 percent angular chert fragments; medium acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert fragments commonly ranges from 0 to 5 percent in the A and Bt horizons but in some pedons is as much as 10 percent directly above the fragipan. The content of chert in and below the fragipan ranges from 0 to 75 percent.

The A or Ap horizon has value of 2 or 3. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 2 to 6. Some pedons have mottles with chroma of 2 or less and value of 4 or more in the upper 10 inches of this horizon. The 2Btx horizon is silt loam, silty clay loam, or the cherty, very cherty, or extremely cherty analogs of these textures. The 3Bt horizon has value of 3 or 4 and chroma of 6 to 8. It is silty clay, clay, or the cherty, very cherty, or extremely cherty analogs of these textures.

Dunning Series

The Dunning series consists of deep, poorly drained, slowly permeable soils in depressions and seepy areas on flood plains. These soils formed in silty and clayey alluvium. Slopes range from 0 to 2 percent.

Dunning soils commonly are adjacent to Clarksville, Hepler, and Huntington soils. Clarksville soils are cherty throughout. They are on uplands. Hepler soils have less clay than the Dunning soils. They are on low stream terraces. Huntington soils are well drained and are adjacent to stream channels.

Typical pedon of Dunning silt loam, 2,130 feet north and 600 feet west of the southeast corner of sec. 26, T. 26 N., R. 30 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure; friable; many fine roots; neutral; clear smooth boundary.

A1—6 to 11 inches; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silty clay loam, gray (10YR 5/1) and grayish brown (10YR 5/2) dry; moderate fine subangular and angular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

A2—11 to 18 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine subangular and angular blocky structure; firm; common fine roots; slightly acid; gradual smooth boundary.

Bg—18 to 40 inches; dark gray (10YR 4/1) and very dark gray (10YR 3/1) silty clay; few fine distinct olive brown (2.5Y 4/4) mottles; weak fine prismatic structure parting to strong fine and very fine angular blocky; very firm; few very fine roots; slightly acid; gradual smooth boundary.

Cg—40 to 60 inches; dark gray (N 4/0) silty clay loam; many fine distinct brownish yellow (10YR 6/6) mottles; weak very fine angular blocky structure; firm; few very fine roots; slightly acid.

The thickness of the solum is 24 to 40 inches. The depth to bedrock is more than 60 inches.

The A and Ap horizons have value of 2 or 3 and chroma of 1 or 2. They typically are silt loam, but the range includes silty clay loam. The Bg horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 and chroma of 2 or less. It is mottled with shades of brown, gray, and red. It is silty clay loam, silty clay, or clay.

Eldorado Series

The Eldorado series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty limestone residuum. Slopes range from 3 to 9 percent.

Eldorado soils commonly are adjacent to Cedargap, Newtonia, Secesh, and Wanda soils. Cedargap soils have a thick, dark surface layer and do not have a B horizon. They are on flood plains. Newtonia and Wanda soils are in the less sloping, higher landscape positions. Newtonia soils are nearly free of chert. Wanda soils have less sand and chert in the B horizon than the Eldorado soils. Secesh soils have less chert in the B horizon than the Eldorado soils. They are on terraces.

Typical pedon of Eldorado cherty silt loam, 3 to 9 percent slopes, 1,200 feet west and 2,850 feet north of the southeast corner of sec. 26, T. 25 N., R. 30 W.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) cherty silt loam, brown (10YR 5/3) dry; weak very fine granular structure; very friable; many very fine roots; about 20 percent angular chert fragments (about 10 percent more than 3 inches in size); slightly acid; clear smooth boundary.

BA—7 to 14 inches; dark brown (7.5YR 3/2) very cherty silty clay loam; weak very fine subangular blocky structure; friable; many very fine roots; about 60 percent angular chert fragments (about 20 percent more than 3 inches in size); slightly acid; gradual smooth boundary.

Bt1—14 to 23 inches; dark reddish brown (5YR 3/4) extremely cherty silty clay loam; moderate very fine subangular blocky structure; friable; common very fine roots; few faint clay films on faces of peds; about 70 percent angular chert fragments (about 20 percent more than 3 inches in size); slightly acid; gradual smooth boundary.

Bt2—23 to 34 inches; yellowish red (5YR 4/6) extremely cherty silty clay loam; moderate very fine subangular blocky structure; friable; common very fine roots; few faint clay films on faces of peds; about 70 percent angular chert fragments (about 35 percent more than 3 inches in size); medium acid; clear smooth boundary.

Bt3—34 to 45 inches; yellowish red (5YR 4/6 and 5/6) and reddish yellow (7.5YR 6/6) extremely cherty silty clay loam; common fine prominent pale brown (10YR 6/3) mottles; weak fine subangular blocky structure; friable; common very fine roots; few faint clay films on faces of peds; about 80 percent angular chert fragments (about 40 percent more than 3 inches in size); strongly acid; gradual wavy boundary.

Bt4—45 to 54 inches; red (2.5YR 4/6) cherty silty clay loam; moderate very fine and fine subangular and angular blocky structure; firm; few very fine roots; common distinct dark red (2.5YR 3/6) clay films on faces of peds; about 25 percent angular chert fragments (about 15 percent more than 3 inches in size); extremely acid; clear smooth boundary.

Bt5—54 to 60 inches; red (2.5YR 4/8) cherty silty clay; moderate fine angular blocky structure; firm; few very fine roots; common distinct dark red (2.5YR 3/6) clay films on faces of peds and on surfaces of chert fragments; about 30 percent angular chert fragments (about 20 percent more than 3 inches in size); extremely acid.

The depth to limestone bedrock and the thickness of the solum are more than 60 inches. The A or Ap horizon has hue of 10YR or 7.5YR and chroma of 2 or 3. The content of chert in these horizons ranges from 15 to 35 percent. The BA horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 to 4. It is the very cherty analogs of silt loam or silty clay loam. The Bt horizon has hue of 5YR, 7.5YR, or 2.5YR and value and chroma of 3 to 6. It is silty clay loam, silty clay, or the very cherty and extremely cherty analogs of these textures. The content of chert ranges from 35 to 75 percent in the upper part of this horizon and from 15 to 50 percent in the lower part.

Gerald Series

The Gerald series consists of deep, somewhat poorly drained soils on uplands. These soils formed in silty and cherty sediments and in cherty limestone residuum. They have a fragipan at a depth of 20 to 30 inches. Permeability is very slow in the fragipan and moderate below the fragipan. Slopes range from 0 to 2 percent.

Gerald soils are similar to Bado soils and commonly are adjacent to Creldon, Hoberg, and Tonti soils. Bado soils have a surface layer that is lighter colored than that of the Gerald soils. Creldon, Hoberg, and Tonti soils are in the lower areas on uplands. Creldon soils are not so gray as the Gerald soils. Hoberg and Tonti soils have less clay in the B horizon than the Gerald soils.

Typical pedon of Gerald silt loam, 530 feet south and 25 feet east of the northwest corner of sec. 3, T. 26 N., R. 31 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

E—7 to 15 inches; grayish brown (10YR 5/2) silt loam; weak very thin and thin platy structure; very friable; few very fine roots; about 5 percent subrounded chert fragments; very strongly acid; abrupt smooth boundary.

Bt1—15 to 23 inches; dark brown (7.5YR 4/2) silty clay; common medium prominent yellowish red (5YR 4/6) mottles; moderate medium angular blocky structure; firm; few very fine roots; common faint grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent subrounded chert fragments; very strongly acid; abrupt smooth boundary.

Bt2—23 to 28 inches; dark yellowish brown (10YR 4/4) silty clay; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium columnar structure parting to weak medium angular blocky; firm; few very fine roots; many prominent grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

Btx1—28 to 38 inches; grayish brown (10YR 5/2) silty clay loam; many medium faint dark grayish brown (10YR 4/2) and many fine distinct strong brown (7.5YR 5/6) mottles; weak medium and thick platy structure parting to weak fine subangular blocky; firm; brittle; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; about 10 percent subrounded chert fragments; very strongly acid; clear wavy boundary.

2Btx2—38 to 48 inches; strong brown (7.5YR 5/6) extremely cherty silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak fine angular blocky structure; firm; brittle; few prominent dark red (2.5YR 3/6) and very dark gray (10YR 3/1) clay films on faces of peds; about 75 percent angular chert fragments (about 20 percent more than 3 inches in size); very strongly acid; clear wavy boundary.

2Bt—48 to 60 inches; grayish brown (10YR 5/2) extremely cherty silty clay; many medium prominent dark red (2.5YR 3/6) mottles; weak fine angular blocky structure; firm; few prominent dark red (2.5YR 3/6) clay films on faces of peds and on surfaces of chert fragments; about 75 percent angular chert fragments (about 25 percent more than 3 inches in size); extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert ranges from 0 to 15 percent above the fragipan. In and below the fragipan, it ranges from 0 to 75 percent and 10 to 25 percent of the chert is more than 3 inches in size.

The A or Ap horizon has chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 1 or 2. The Bt horizon has hue of 10YR to 5YR, value of 2 to 6, and chroma of 1 to 4. It is silty clay loam, silty clay, or clay. Some pedons have a BE horizon. The 2Btx horizon is mottled with shades of red, gray, and brown. It is silt loam, silty clay loam, or the cherty, very cherty, or extremely cherty analogs of these textures. The 2Bt horizon is multicolored or mottled with shades of red, gray, yellow, or brown. It is clay, silty clay, silty clay loam, or the cherty, very cherty, or extremely cherty analogs of these textures.

Hepler Series

The Hepler series consists of deep, somewhat poorly drained, moderately slowly permeable soils on low stream terraces. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Hepler soils commonly are adjacent to Clarksville, Dunning, and Huntington soils. Clarksville soils are cherty throughout. They are on uplands. Dunning soils have a thick, dark surface soil and have more clay throughout than the Hepler soils. They are in the slightly lower landscape positions and in depressional areas around seeps. Huntington soils are well drained and are nearer to stream channels than the Hepler soils.

Typical pedon of Hepler silt loam, 1,250 feet south and 950 feet east of the northwest corner of sec. 8, T. 25 N., R. 31 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common fine roots; mildly alkaline; clear smooth boundary.

E—9 to 23 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very thin platy structure; friable; common fine roots; few fine rounded concretions of iron and manganese oxide; neutral; abrupt smooth boundary.

Btg1—23 to 37 inches; grayish brown (10YR 5/2) silty clay loam; many fine distinct yellowish brown (10YR 5/8) mottles; weak very fine subangular blocky structure; friable; common fine roots; common faint clay films on faces of peds; about 5 percent rounded chert fragments; few fine rounded concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg2—37 to 47 inches; gray (10YR 5/1) silty clay loam; many fine distinct brownish yellow (10YR 6/8) mottles; weak very fine subangular blocky structure; firm; common fine roots; common faint clay films on faces of peds; about 5 percent subrounded chert fragments; medium acid; clear smooth boundary.

BCg—47 to 60 inches; light brownish gray (10YR 6/2) and brown (10YR 5/3) silty clay loam; many fine distinct strong brown (7.5YR 5/6) mottles; weak very fine subangular blocky structure; friable; few fine roots; about 5 percent subrounded chert fragments; medium acid.

The thickness of the solum ranges from 40 to more than 60 inches. The A or 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 2 or 3. The Btg horizon has value of 4 or 5 and chroma of 1 or 2. It is mottled with colors that have a higher chroma. It is silty clay loam or silty clay.

Hoberg Series

The Hoberg series consists of deep, moderately well drained soils on uplands and terraces. These soils formed in cherty sediments and in cherty limestone residuum. They have a fragipan at a depth of 18 and 27 inches. Permeability is moderate above and below the fragipan and slow in the fragipan. Slopes range from 2 to 5 percent.

These soils have more clay in the B horizon than is definitive for the Hoberg series. This difference, however, does not significantly affect the usefulness or behavior of the soils.

Hoberg soils are similar to Creldon and Tonti soils and commonly are adjacent to Creldon, Gerald, and Keeno soils. Creldon soils have more clay and less sand and chert in the B horizon than the Hoberg soils. Gerald soils are grayer than the Hoberg soils. They are in depressional areas on broad divides. Keeno soils have more chert than the Hoberg soils. They are on the lower side slopes. Tonti soils have a surface layer that is lighter colored than that of the Hoberg soils.

Typical pedon of Hoberg silt loam, 2 to 5 percent slopes, 1,000 feet west and 50 feet south of the northeast corner of sec. 8, T. 24 N., R. 29 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine and fine granular structure; very friable; common very fine roots; about 5 percent subrounded chert fragments; neutral; clear smooth boundary.

BA—9 to 14 inches; dark brown (7.5YR 4/4) silty clay loam; moderate very fine and fine subangular blocky structure; very friable; common very fine roots; few distinct very dark grayish brown (10YR 3/2) silt coatings on faces of peds in the upper part; about 5 percent subrounded chert fragments; slightly acid; clear smooth boundary.

Bt1—14 to 19 inches; strong brown (7.5YR 4/6) cherty silty clay; moderate fine and medium subangular blocky structure; friable; common very fine roots; few faint clay films on faces of peds; about 20 percent subrounded chert fragments; medium acid; clear smooth boundary.

Bt2—19 to 24 inches; strong brown (7.5YR 4/6) cherty silty clay loam; common fine and medium prominent red (2.5YR 4/6) mottles; strong fine and medium angular blocky structure; friable; common very fine roots; few distinct clay films on faces of peds; about

35 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

2Btx1—24 to 29 inches; pale brown (10YR 6/3) and dark red (2.5YR 3/6) extremely cherty silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; massive; very firm; brittle; few very fine roots in polygonal cracks; few distinct clay films in pores; about 75 percent subrounded and angular chert fragments; very strongly acid; clear smooth boundary.

3Btx2—29 to 46 inches; dark red (2.5YR 3/6) extremely cherty silty clay loam; common fine prominent light brownish gray (10YR 6/2) mottles; massive; very firm; brittle; few distinct dark grayish brown (10YR 4/2) clay films on surfaces of chert fragments; about 75 percent angular chert fragments; extremely acid; clear smooth boundary.

3Bt—46 to 60 inches; dark red (2.5YR 3/6) extremely cherty silty clay; few fine prominent light yellowish brown (10YR 6/4) mottles; moderate very fine and fine angular blocky structure; very firm; few faint clay films on faces of peds; about 65 percent angular chert fragments; extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert fragments ranges from 0 to 15 percent in the A horizon, from 5 to 40 percent in the Bt horizon, and from 20 to 80 percent in and below the fragipan.

The A or Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 to 6. It is silt loam, silty clay, silty clay loam, or the cherty or very cherty analogs of these textures. The 2Btx and 3Btx horizons have hue of 10YR to 2.5YR and value and chroma of 3 to 6. They have mottles with hue of 10YR or 7.5YR, value of 6 or 7, and chroma of 2 or 3. The 2Btx horizon is the cherty, very cherty, or extremely cherty analogs of silt loam or silty clay loam. The 3Bt horizon has value of 3 or 4 and chroma of 4 to 6. It is the cherty, very cherty, or extremely cherty analogs of silty clay.

Huntington Series

The Huntington series consists of deep, well drained, moderately permeable soils on flood plains along the major streams. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Huntington soils commonly are adjacent to Cedargap, Clarksville, Dunning, Hepler, and Secesh soils. Cedargap and Secesh soils have more sand and chert than the Huntington soils. Cedargap soils are on secondary flood plains, and Secesh soils are on low terraces. Clarksville soils are cherty throughout. They are on uplands. Dunning soils are poorly drained and are in nearly level or slightly depressional areas. Hepler soils are somewhat poorly drained and are on low stream terraces.

Typical pedon of Huntington silt loam, 1,600 feet south and 1,000 feet west of the northeast corner of sec. 6, T. 26 N., R. 32 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common medium roots; neutral; clear smooth boundary.

Bw1—10 to 16 inches; brown (10YR 4/3) silt loam; dark brown (10YR 3/3) silt coatings on faces of peds; weak very fine subangular blocky structure; friable; common fine roots; many fine rounded concretions of iron and manganese oxide; neutral; clear smooth boundary.

Bw2—16 to 44 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; few fine rounded concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

BC—44 to 60 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; few very fine roots; few fine rounded concretions of iron and manganese oxide; medium acid.

The thickness of the solum and the depth to nonconforming cherty layers are more than 40 inches. They commonly are more than 60 inches. The content of coarse fragments is less than 5 percent throughout the profile.

The A or Ap horizon has chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR and value of 4 or 5. It is silt loam or silty clay loam.

Keeno Series

The Keeno series consists of deep, moderately well drained soils on uplands. These soils formed in cherty limestone residuum. They have a fragipan at a depth of 18 to 27 inches. Permeability is moderate above and below the fragipan and slow in the fragipan. Slopes range from 3 to 9 percent.

These soils have a lower base saturation than is definitive for the Keeno series. This difference, however, does not significantly affect the usefulness or behavior of the soils.

Keeno soils are similar to Nixa soils and commonly are adjacent to Cedargap, Creldon, Hoberg, and Secesh soils. Cedargap and Secesh soils do not have a fragipan. They are on flood plains and stream terraces. Creldon and Hoberg soils have less chert in the B horizon than the Keeno soils. Typically they are in the less sloping areas. Nixa soils have a surface layer that is lighter colored than that of the Keeno soils.

Typical pedon of Keeno very cherty silt loam, 3 to 9 percent slopes, 1,800 feet north and 1,250 feet east of the southwest corner of sec. 36, T. 27 N., R. 32 W.

A1—0 to 6 inches; black (10YR 2/1) very cherty silt loam, dark gray (10YR 4/1) dry; weak very fine and fine granular structure; very friable; common very fine roots; about 40 percent angular chert fragments; extremely acid; clear smooth boundary.

A2—6 to 12 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) very cherty silt loam, brown (10YR 5/3) dry; weak very fine and fine granular structure; very friable; about 45 percent angular chert fragments; extremely acid; clear smooth boundary.

Bt—12 to 19 inches; brown (10YR 4/3) extremely cherty silty clay loam; moderate very fine and fine subangular blocky structure; friable; few faint clay films on faces of peds; common very fine roots; about 70 percent angular chert fragments; extremely acid; clear smooth boundary.

2E—19 to 23 inches; grayish brown (10YR 5/2) extremely cherty silt loam; few fine prominent dark red (2.5YR 3/6) mottles; weak very fine and fine subangular blocky structure; friable; few very fine roots; about 80 percent angular chert fragments; extremely acid; clear smooth boundary.

2Bx—23 to 34 inches; red (2.5YR 4/6 and 5/6) extremely cherty silty clay loam; common fine prominent light brownish gray (10YR 6/2) mottles; massive; very firm; brittle; about 80 percent angular chert fragments; extremely acid; clear wavy boundary.

2Bt—34 to 60 inches; red (2.5YR 4/6) extremely cherty silty clay; common medium prominent gray (10YR 5/1) mottles; weak very fine and fine angular blocky structure; very firm; few distinct clay films on faces of peds; about 85 percent angular chert fragments (about 10 percent more than 3 inches in size); extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert fragments more than 3 inches in size ranges from 0 to 50 percent throughout the profile.

The A or Ap horizon has chroma of 1 to 3. The content of chert in this horizon is 15 to 50 percent. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is very cherty or extremely cherty silty clay loam. The content of chert in this horizon is 35 to 70 percent. The 2Bx horizon is mottled with shades of red, gray, and brown. It is the very cherty or extremely cherty analogs of silt loam or silty clay loam. The content of chert in this horizon is 45 to 80 percent. The 2Bt horizon has hue of 2.5YR or 5YR, value of 3 or 4, and chroma of 4 to 6. It is the very cherty or extremely cherty analogs of clay or silty clay.

Needleye Series

The Needleye series consists of deep, moderately well drained soils on uplands. These soils formed in silty and cherty sediments and in cherty limestone residuum. They have a fragipan at a depth of 18 to 27 inches. Permeability is moderately slow above the fragipan, very slow in the fragipan, and moderate below the fragipan. Slopes range from 1 to 3 percent.

Needleye soils are similar to Captina soils and commonly are adjacent to Bado, Captina, and Tonti soils. Bado soils have more clay in the B horizon than the Needleye soils. They are in nearly level or depressional areas on uplands. Captina soils do not have mottles with chroma of 2 or less in the part of the subsoil above the fragipan. Tonti soils have more sand and chert in the B horizon than the Needleye soils. They are in upland positions similar to those of the Needleye soils.

Typical pedon of Needleye silt loam, 1 to 3 percent slopes, 800 feet north and 1,200 feet east of the southwest corner of sec. 17, T. 24 N., R. 31 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; very friable; common very fine roots; neutral; clear smooth boundary.

Bt1—7 to 12 inches; yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) silt loam; weak very fine subangular blocky structure; friable; common very fine roots; few faint clay films in pores; strongly acid; clear smooth boundary.

Bt2—12 to 17 inches; brownish yellow (10YR 6/6) and light yellowish brown (10YR 6/4) silty clay loam; few fine prominent red (2.5YR 4/6) and few fine faint grayish brown (10YR 5/2) mottles; weak very fine and fine subangular blocky structure; friable; few fine roots; few faint clay films in pores; extremely acid; clear smooth boundary.

Bt3—17 to 27 inches; light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) silty clay loam; common fine prominent red (2.5YR 4/6) mottles; moderate very fine and fine angular blocky structure; friable; few very fine roots; common distinct clay films on faces of peds; extremely acid; clear smooth boundary.

2Btx1—27 to 42 inches; mottled yellowish red (5YR 4/6), gray (10YR 5/1), and light brownish gray (10YR 6/2) extremely cherty silt loam; massive; firm; brittle; common distinct clay films on surfaces of chert fragments; about 70 percent subrounded chert fragments; extremely acid; clear smooth boundary.

2Btx2—42 to 48 inches; mottled strong brown (7.5YR 5/6), grayish brown (10YR 5/2), light brownish gray (10YR 6/2), and brownish yellow (10YR 6/6) very cherty silty clay loam; massive; firm; brittle; common distinct clay films on surfaces of chert fragments; about 50 percent subrounded and angular chert fragments; extremely acid; clear smooth boundary.

2Bt1—48 to 56 inches; strong brown (7.5YR 5/6) very cherty silty clay; common medium prominent dark red (2.5YR 3/6) and common medium distinct grayish brown (10YR 5/2) mottles; weak very fine subangular blocky structure; firm; common distinct clay films on faces of peds; about 50 percent angular and subrounded chert fragments; extremely acid; clear smooth boundary.

3Bt2—56 to 60 inches; dark red (2.5YR 3/6) very cherty clay; many medium prominent grayish brown (10YR 5/2) mottles; moderate fine angular blocky structure; very firm; common faint clay films on faces of peds; about 50 percent angular chert fragments (about 15 percent more than 3 inches in size); extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert fragments is 0 to 10 percent in the A horizon, 0 to 20 percent in the Bt horizon, 35 to 85 percent in the fragipan, and 35 to 80 percent below the fragipan.

The A or Ap horizon has chroma of 2 or 3. The upper part of the Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. The upper 10 inches of this horizon has mottles with low chroma. The lower part has hue of 10YR, value of 4 to 6, and chroma of 2. The Bt horizon is silt loam or silty clay loam in the upper part and silty clay loam, silty clay, or the cherty analogs of these textures in the lower part. The 2Btx horizon is silt loam, silty clay loam, or the cherty, very cherty, or extremely cherty analogs of these textures. The 2Bt and 3Bt horizons have hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 4 to 6. They are clay to silty clay or are the cherty, very cherty, or extremely cherty analogs of these textures.

Newtonia Series

The Newtonia series consists of deep, well drained, moderately permeable soils on broad upland divides. These soils formed in silty sediments and in material weathered from limestone and tripoli. Slopes range from 1 to 3 percent.

Newtonia soils are similar to Wanda soils and commonly are adjacent to Creldon and Wanda soils. Creldon soils have a fragipan. They are in upland positions similar to those of the Newtonia soils. Wanda soils have chert in the B horizon.

Typical pedon of Newtonia silt loam, 1 to 3 percent slopes, 1,600 feet west and 20 feet south of the northeast corner of sec. 24, T. 25 N., R. 30 W.

Ap—0 to 11 inches; dark brown (7.5YR 3/2) silt loam, dark brown (7.5YR 4/4) dry; weak very fine granular structure; very friable; common very fine roots; about 2 percent chert fragments; neutral; clear smooth boundary.

BA—11 to 22 inches; reddish brown (5YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; common fine and very fine roots; about 2 percent chert fragments; neutral; clear smooth boundary.

Bt1—22 to 31 inches; dark reddish brown (2.5YR 3/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine and very fine roots; few distinct clay films on faces of peds; about 2 percent chert fragments; neutral; clear smooth boundary.

Bt2—31 to 46 inches; dark red (2.5YR 3/6) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; about 5 percent chert fragments; very strongly acid; clear smooth boundary.

BC—46 to 60 inches; dark red (2.5YR 3/6) silty clay; common medium prominent yellowish brown (10YR 5/4) mottles; moderate medium angular blocky structure; firm; few very fine roots; few fine rounded concretions of iron and manganese oxide; about 5 percent chert fragments; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The A or Ap horizon has hue of 10YR or 7.5YR and value and chroma of 2 or 3. The Bt horizon has hue of 2.5YR to 7.5YR and chroma of 3 to 6. It is silty clay loam in the upper part and silty clay loam or silty clay in the lower part.

Nixa Series

The Nixa series consists of deep, moderately well drained soils on uplands. These soils formed in cherty limestone residuum. They have a fragipan at a depth of 18 to 27 inches. Permeability is moderate above and below the fragipan and very slow in the fragipan. Slopes range from 3 to 9 percent.

These soils have more clay in the fragipan than is definitive for the Nixa series. This difference, however, does not significantly affect the usefulness or behavior of the soils.

Nixa soils are similar to Keeno soils and commonly are adjacent to Captina, Cedargap, Clarksville, Keeno, Tonti, and Waben soils. Captina and Tonti soils have less chert in the B horizon than the Nixa soils. They are on the broader ridgetops. Cedargap and Waben soils do not have a fragipan. They are on flood plains or low terraces. Clarksville soils are on the steeper slopes. They have an argillic horizon. Keeno soils have a dark surface layer that is thicker than that of the Nixa soils.

Typical pedon of Nixa very cherty silt loam, 3 to 9 percent slopes, 300 feet east and 20 feet south of the northwest corner of sec. 17, T. 24 N., R. 31 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) very cherty silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common fine roots; about 35 percent angular chert fragments; very strongly acid; clear smooth boundary.

E—2 to 12 inches; brown (10YR 5/3) very cherty silt loam; weak very thin platy structure; friable; common fine and medium roots; about 45 percent angular chert fragments; very strongly acid; gradual smooth boundary.

BE—12 to 26 inches; light yellowish brown (10YR 6/4) very cherty silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common fine and medium roots; about 55 percent angular chert fragments; very strongly acid; clear smooth boundary.

Btx—26 to 36 inches; strong brown (7.5YR 5/6) very cherty silty clay loam; common medium distinct light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) mottles; moderate thin and medium platy structure parting to moderate very fine and fine subangular blocky; firm; brittle; few prominent dark red (2.5YR 3/6) clay films on faces of peds and on surfaces of rock fragments; about 50 percent angular chert fragments; very strongly acid; clear wavy boundary.

Bt1—36 to 46 inches; dark red (2.5YR 3/6) very cherty silty clay; common medium prominent grayish brown (2.5Y 5/2) mottles; moderate medium and thin platy structure parting to moderate very fine angular blocky; firm; slightly brittle; few prominent clay films on faces of peds; about 60 percent angular chert fragments (about 20 percent more than 3 inches in size); very strongly acid; clear wavy boundary.

Bt2—46 to 60 inches; mottled dark red (2.5YR 3/6) and grayish brown (2.5Y 5/2) extremely cherty clay; moderate fine and medium angular blocky structure; firm; few prominent clay films on faces of peds; about 65 percent angular chert fragments (about 35 percent more than 3 inches in size); very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert ranges from 35 to 80 percent throughout the profile.

The A or Ap horizon has chroma of 2 to 4. The E horizon has value of 5 or 6 and chroma of 3 or 4. The BE horizon has value of 5 or 6 and chroma of 3 to 6. It is the very cherty analogs of silt loam or silty clay loam. The Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is mottled with colors that have higher value and lower chroma. It is the very cherty or extremely cherty analogs of silt loam, silty clay loam, or silty clay. The Bt horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 8. It is silty clay, clay, silty clay loam, or the very cherty or extremely cherty analogs of these textures.

Peridge Series

The Peridge series consists of deep, well drained, moderately permeable soils on terraces and toe slopes along secondary streams. These soils formed in silty and cherty sediments. Slopes range from 2 to 5 percent.

Peridge soils commonly are adjacent to Cedargap, Claiborne, Clarksville, Nixa, and Secesh soils. Cedargap soils have a dark surface soil that is more than 24 inches thick and are cherty throughout. They are on flood plains. Claiborne soils have more sand and chert in the B horizon than the Peridge soils. They are in positions on terraces similar to those of the Peridge soils. Clarksville and Nixa soils are on uplands. Clarksville soils are cherty throughout. Nixa soils have a fragipan. Secesh soils are cherty in the lower part. They are on low stream terraces.

Typical pedon of Peridge silt loam, in an area of Claiborne-Peridge silt loams, 2 to 5 percent slopes, 1,580 feet west and 160 feet south of the northeast corner of sec. 36, T. 25 N., R. 30 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; common very fine roots; medium acid; abrupt smooth boundary.

Bt1—10 to 16 inches; dark brown (7.5YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; common very fine roots; few faint clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—16 to 23 inches; strong brown (7.5YR 4/6) silty clay loam; moderate fine subangular blocky structure; very friable; few very fine roots; common distinct clay films on faces of peds; medium acid; clear smooth boundary.

2Bt3—23 to 40 inches; yellowish red (5YR 4/6) silty clay loam; strong fine and medium subangular blocky structure; friable; few very fine roots; common distinct clay films and few prominent iron stains on faces of peds; few rounded concretions of iron and manganese oxide; about 5 percent subrounded chert fragments; medium acid; clear smooth boundary.

2Bt4—40 to 53 inches; yellowish red (5YR 4/6) cherty silty clay loam; strong fine and medium subangular blocky structure; friable; common distinct clay films and few distinct iron stains on faces of peds; about 25 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

2Bt5—53 to 60 inches; yellowish red (5YR 4/6) very cherty silty clay loam; moderate fine subangular blocky structure; friable; few distinct clay films on faces of peds; about 50 percent subrounded chert fragments; medium acid.

The depth to bedrock and the thickness of the solum are 60 inches or more. The content of chert ranges from 0 to 10 percent in the control section and from 0 to 60 percent below the control section.

The Ap horizon has value of 4 or 5. The Bt and 2Bt horizons have hue of 5YR, 2.5YR, or 7.5YR and chroma of 4 to 8. They are silt loam, silty clay loam, or the cherty, very cherty, or extremely cherty analogs of these textures.

Secesh Series

The Secesh series consists of deep, well drained soils on low stream terraces along secondary drainageways. These soils formed in cherty alluvium and in the underlying reworked limestone residuum. Permeability is moderate in the upper part of the profile and moderately rapid in the lower part. Slopes range from 0 to 3 percent.

Secesh soils commonly are adjacent to Cedargap, Claiborne, Clarksville, Huntington, and Peridge soils. Cedargap and Huntington soils have a dark surface layer that is thicker than that of the Secesh soils. They are on flood plains. Claiborne and Peridge soils are on high stream terraces. Claiborne soils have a base saturation that is lower than that of the Secesh soils. Peridge soils have less sand and chert in the B horizon than the Secesh soils. Clarksville soils are cherty throughout. They are on uplands.

Typical pedon of Secesh silt loam, in an area of Secesh-Cedargap silt loams, 0 to 3 percent slopes, 740 feet north and 300 feet east of the southwest corner of sec. 7, T. 24 N., R. 31 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak very fine granular structure; very friable; common fine roots; about 5 percent subrounded chert fragments; neutral; clear smooth boundary.

BA—8 to 14 inches; brown (7.5YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; few fine and very fine roots; about 5 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

Bt1—14 to 25 inches; brown (7.5YR 4/4) silty clay loam; weak fine and very fine subangular blocky structure; friable; few fine and very fine roots; few faint clay films on faces of peds; about 10 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

2Bt2—25 to 33 inches; reddish brown (5YR 5/4) cherty silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 25 percent subrounded chert fragments; very strongly acid; clear wavy boundary.

2Bt3—33 to 43 inches; reddish brown (5YR 4/4) extremely cherty silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 75 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

2Bt4—43 to 60 inches; brown (7.5YR 4/4) extremely cherty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 80 percent subrounded chert fragments; strongly acid.

The depth to chert beds is less than 40 inches. The depth to bedrock is more than 60 inches. The content of chert is less than 10 percent in the A horizon and in the upper part of the Bt horizon, 5 to 35 percent in the lower part of the Bt horizon, and 25 to 80 percent in the 2Bt horizon.

The A or Ap horizon has value and chroma of 2 or 3. The 2Bt horizon is silty clay loam, clay loam, sandy clay loam, or the cherty, very cherty, or extremely cherty analogs of these textures.

Tonti Series

The Tonti series consists of deep, moderately well drained soils on uplands. These soils formed in cherty sediments and in cherty limestone residuum. They have a fragipan at a depth of 18 to 27 inches. Permeability is moderate above and below the fragipan and slow in the fragipan. Slopes range from 2 to 5 percent.

These soils have a redder hue and a lower chroma than is definitive for the Tonti series. These differences, however, do not significantly affect the usefulness or behavior of the soils.

Tonti soils are similar to Hoberg soils and commonly are adjacent to Bado, Captina, Gerald, Needleye, and Nixa soils. Bado and Gerald soils are poorly drained and are in nearly level or depressional areas on uplands. Captina and Needleye soils have less sand or fine chert in the B horizon than the Tonti soils. They are in landscape positions similar to those of the Tonti soils. Hoberg soils have a dark colored surface layer. Nixa soils have more chert than the Tonti soils. They are on the lower side slopes.

Typical pedon of Tonti silt loam, 2 to 5 percent slopes, 1,600 feet north and 2,100 feet east of the southwest corner of sec. 14, T. 24 N., R. 32 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate medium platy structure parting to weak very fine granular; very friable; many very fine roots; about 5 percent rounded chert fragments; slightly acid; clear smooth boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak very fine subangular blocky structure; very friable; common fine roots; about 10 percent rounded chert fragments; medium acid; clear smooth boundary.

Bt1—12 to 15 inches; yellowish red (5YR 4/6 and 5/6) cherty silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 20 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

Bt2—15 to 25 inches; yellowish red (5YR 4/6) cherty silty clay loam; strong fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; about 20 percent subrounded chert fragments; extremely acid; clear smooth boundary.

2Btx1—25 to 39 inches; reddish brown (2.5YR 4/4 and 5YR 5/4) cherty silt loam; few fine distinct light gray (10YR 7/2) mottles; massive; firm; brittle; few distinct clay films in pores; about 25 percent subrounded chert fragments; very strongly acid; clear smooth boundary.

3Btx2—39 to 44 inches; mottled light brownish gray (10YR 6/2) and red (2.5YR 4/6) very cherty silt loam; massive; very firm; brittle; few distinct clay films in pores; about 50 percent angular chert fragments; very strongly acid; clear smooth boundary.

3Bt—44 to 60 inches; dark red (2.5YR 3/6) extremely cherty silty clay; light brownish gray (10YR 6/2) seams and streaks; weak very fine angular blocky structure; firm; common distinct clay films on faces of peds and on surfaces of chert fragments; about 70 percent angular cherty fragments; extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert ranges from 5 to 15 percent in the A horizon and in the upper part of the B horizon, from 15 to 25 percent in the lower part of the B horizon, and from 20 to 70 percent in and below the fragipan.

The A or Ap horizon has value of 3 to 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 6. It is cherty silt loam or cherty silty clay loam. The Btx horizon is mottled with shades of red, gray, and brown. Any of these colors may be dominant. This horizon has hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 2 to 6. It is silty clay loam, silt loam, or the cherty, very cherty, or extremely cherty analogs of these textures. The 3Bt horizon has value of 3 to 5 and chroma of 4 to 6. It is the cherty, very cherty, or extremely cherty analogs of clay or silty clay.

Waben Series

The Waben series consists of deep, well drained, moderately rapidly permeable soils on low terraces. These soils formed in silty alluvium that has a high content of chert fragments. Slopes range from 1 to 5 percent.

Waben soils commonly are adjacent to Cedargap and Clarksville soils. Cedargap soils have a dark surface soil that is more than 24 inches thick. They are on flood plains. Clarksville soils have a base saturation that is lower than that of the Waben soils and have more clay in the lower part of the B horizon. They are on uplands.

Typical pedon of Waben very cherty silt loam, in an area of Waben-Cedargap very cherty silt loams, 1 to 5 percent slopes, 1,200 feet west and 1,100 feet north of the southeast corner of sec. 12, T. 24 N., R. 32 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) very cherty silt loam, brown (10YR 5/3) dry; weak thin platy structure; very friable; many very fine roots; about 40 percent subrounded chert fragments; slightly acid; clear smooth boundary.

BA—7 to 14 inches; dark brown (7.5YR 4/4) very cherty silt loam; weak very fine subangular blocky structure; friable; common very fine roots; about 35 percent subrounded chert fragments; slightly acid; clear smooth boundary.

Bt1—14 to 22 inches; brown (7.5YR 4/4) extremely cherty silty clay loam; weak very fine and fine subangular blocky structure; friable; few very fine roots; few faint clay films; about 65 percent subrounded chert fragments; slightly acid; clear wavy boundary.

Bt2—22 to 30 inches; strong brown (7.5YR 4/6) extremely cherty silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; few faint clay films; about 70 percent subrounded chert fragments; slightly acid; clear wavy boundary.

Bt3—30 to 43 inches; strong brown (7.5YR 4/6) cherty silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; few faint clay films; about 30 percent subrounded chert fragments; medium acid; clear wavy boundary.

BC—43 to 60 inches; strong brown (7.5YR 4/6) and pale brown (10YR 6/3) very cherty silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; about 50 percent subrounded chert fragments; slightly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The A or Ap horizon has value of 3 or 4 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is the cherty, very cherty, or extremely cherty analogs of silt loam or silty clay loam.

Wanda Series

The Wanda series consists of deep, well drained, moderately permeable soils on broad upland divides. These soils formed in silty and cherty sediments and in material weathered from cherty limestone and tripoli. Slopes range from 1 to 5 percent.

Wanda soils are similar to Newtonia soils and commonly are adjacent to Carytown, Cedargap, Creldon, Keeno, and Newtonia soils. Carytown soils are grayer than the Wanda soils. They are in depressions above the head of drainageways. Cedargap soils have a dark surface soil that is more than 24 inches thick. They are on small flood plains. Creldon and Keeno soils have a fragipan. They are in convex areas on uplands. Newtonia soils have less chert in the B horizon than the Wanda soils.

Typical pedon of Wanda silt loam, 1 to 5 percent slopes, 920 feet south and 2,600 feet west of the northeast corner of sec. 26, T. 25 N., R. 30 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate fine and very fine granular structure; very friable; many fine roots; about 5 percent subrounded chert fragments; medium acid; clear smooth boundary.

Bt1—10 to 16 inches; dark reddish brown (5YR 3/2 and 3/3) silty clay loam, reddish gray (5YR 5/2) and reddish brown (5YR 5/3) dry; weak fine and very fine subangular blocky structure; friable; many fine roots; few faint clay films on faces of peds; about 10 percent subrounded chert fragments; medium acid; gradual smooth boundary.

Bt2—16 to 22 inches; dark reddish brown (2.5YR 3/4) cherty silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of peds; about 15 percent subrounded chert fragments; medium acid; gradual smooth boundary.

Bt3—22 to 36 inches; dark red (2.5YR 3/6) cherty silty clay loam; moderate fine subangular blocky structure; friable; common very fine roots; common distinct clay films on faces of peds; common fine dark concretions of iron and manganese oxide; about 20 percent subrounded chert fragments; medium acid; gradual smooth boundary.

Bt4—36 to 48 inches; dark red (2.5YR 3/6) cherty silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots; common distinct clay films on faces of peds; common medium rounded concretions of iron and manganese oxide; about 30 percent subrounded chert fragments; medium acid; gradual smooth boundary.

Bt5—48 to 60 inches; red (2.5YR 4/6) very cherty silty clay; moderate fine and medium angular blocky structure; firm; few very fine roots; common faint clay films on faces of peds; common fine and medium concretions of iron and manganese oxide; about 35 percent subrounded chert fragments; medium acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of coarse fragments averages less than 30 percent to a depth of 40 inches. Below a depth of 40 inches, it is 35 to 50 percent.

The A or Ap horizon has hue of 10YR, 7.5YR, or 5YR and chroma of 2 or 3. The Bt horizon has hue of 2.5YR to 7.5YR and chroma of 2 to 6. It is silty clay loam in the upper part and the cherty or very cherty analogs of silty clay loam or silty clay in the lower part.

Geology and Physiography

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Newton County is situated entirely within the Springfield Plateau portion of the Ozark Plateau Province.

Bedrock within the county consists of sedimentary rocks ranging in age from Mississippian Reed Springs limestone to Pennsylvanian sandstone (*3*). A layer of loess that is generally 6 inches or less thick covers the bedrock and residuum. Erosion has removed much of the loess. In the nearly level uplands, however, remnants of the loess are 1 to 2 feet thick.

Although the rock strata appear to lie horizontally, there is a regional dip to the northwest. The direction of dip is influenced by several geologic events, principally the Ozark Uplift. The apex of the uplift is in southeast Missouri. Bedrock dips away from the uplift in all directions. Newton County is located on the far western edge of the uplift.

Several faults, such as the Seneca and Granby Faults, are in Newton County (*3*). They are geologically old and inactive and are not considered seismic risks.

Most of the exposed bedrock in the county consists of cherty limestone formations that have thick layers of chert. The cherty limestone is several hundred feet thick and overlies very thick dolomite, cherty dolomite, and sandstone. This thick sequence of dolomite and sandstone rests on Precambrian igneous basement granite. The depth to the igneous bedrock is 1,500 to 1,850 feet.

The cherty limestone has had a significant effect on soil formation in the county (*17*). Physical and chemical weathering cause a slow disintegration of the cherty limestone into its least soluble components, which are chert and clay. Weathering has altered the soluble carbonate portion of the limestone into a reddish clay, but the chert is crypocrystalline silica, which is more resistant to weathering. The chert remains in the form of angular fragments or wavy horizontal beds sandwiched between layers of clay. In areas where downslope movement by gravitional creep or vertical movement by bedrock slumping have not been significant, the sequence of clay and chert retains the ghost structure or fabric of the original unweathered limestone bedrock. The clay and chert that remain after bedrock disintegration is called residuum.

Large areas of Newton County are nearly level to gently rolling upland prairies (*17*). The major stream valleys, such as those along Shoal, Indian, and Buffalo Creeks, are well defined and have steep, wooded slopes. Most of the bedrock outcrops in the county are in these valleys. Because of extensive weathering, the bedrock surface is quite uneven. Thus, areas where the mantle of soil material is relatively thin and bedrock crops out give way to areas where the mantle of soil material is thick. While faulting, folding, joint density, and geomorphic events can be shown to cause these variations, it is still almost impossible to predict variations in soil depth without some drilling information. On the upland prairies, the bedrock is covered by a thick mantle of cherty residuum.

From the oldest to the youngest, the bedrock formations in the county are the Reed Springs Formation, the Elsey Formation, Burlington-Keokuk limestone, the Warsaw Formation, and Pennsylvanian sandstone (*13*). The Reed Springs and Elsey Formations are 150 to 200 feet thick. They occur as altering layers of limestone and chert. The chert generally occurs as long, wavy beds less than 1 foot thick. In some areas, however, it occurs as massive layers more than 6 feet thick. Grand Falls, which is in an area along Shoal Creek in the northwestern part of the county, is characterized by a single massive layer. A tabular, sheetlike mass of chert 30 to 35 feet thick crops out in scattered areas along the creek. The content of chert in the two formations is an estimated 40 to 60 percent. Intensive weathering has resulted in a very cherty residual soil consisting of layers of broken chert and red clay. The thickness of these layers ranges from less than 1 foot on steep valley slopes to more than 25 feet in the uplands.

The Burlington-Keokuk Formation is 70 to 100 feet thick. It consists of massive, light gray, coarse crystalline limestone that has bands of chert and isolated chert nodules. The limestone is quarried for crushed stone. It also is used as a site for several underground warehouses.

The Burlington-Keokuk Formation has a number of sinkholes. Surface water infiltrating through cracks and fractures in the bedrock has slowly dissolved the limestone and formed a network of underground openings. A sinkhole forms when the ceiling of an underground opening becomes so weak that it collapses.

The cherty residuum overlying this formation ranges from less than 5 to more than 25 feet in thickness.

The Warsaw Formation overlies the Burlington-Keokuk Formation. It occurs as thick beds of coarse crystalline, fossiliferous limestone and cherty limestone. It is 10 to 50 feet thick and weathers into cherty clay residuum 1 to more than 30 feet thick.

In the southwestern part of the county, the Burlington-Keokuk and Warsaw Formations have soft, porous, insoluable residues, which are called tripoli (*21*).

The Pennsylvanian Sandstone Formation, the youngest bedrock unit in the county, overlies the Warsaw Formation. The residuum overlying the Pennsylvanian Formation generally has scattered pieces of flat, tabular sandstone. The thickness of the sandstone is an estimated 5 to 25 feet, and that of the residuum generally is 0 to 8 feet. The resistance of sandstone to weathering results in prominent upland topographic features. The outcrop area of the sandstone is small. The sandstone crops out on hills or ridges on the prairies.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Anderson, K.H. 1979. Geologic map of Missouri. Missouri Dep. of Nat. Resour., Div. of Geol. and Land Survey.

(4) Bretz, J. Harlen. 1965. Geomorphic history of the Ozarks of Missouri. Missouri Geol. Surv. and Water Resour., 2nd Ser., Vol. 41, 147 pp., illus.

(5) Cozad, Mary. March 22, 1964. History of Neosho and Newton County. Neosho Daily News.

(6) Edwards, John P. 1882. Edwards historical atlas of Newton County. 3 pp., illus.

(7) Goodspeed Publishing Co. 1888. History of Newton, Lawrence, Barry, and McDonald Counties, Missouri. 391 pp., illus.

(8) Jones, Shelby. 1981. Missouri forest products industries. Missouri Dep. of Conserv., 158 pp.

(9) Missouri Crop and Livestock Reporting Service. 1984. Missouri farm facts. 56 pp.

(10) Missouri Crop and Livestock Reporting Service. 1985. Newton County agri-facts. 4 pp.

(11) Missouri Department of Conservation. 1981. Missouri forest resources: An assessment. 15 pp.

(12) Missouri Department of Natural Resources, Division of Parks and Recreation. 1976. Missouri statewide comprehensive outdoor recreation plan.

(13) Missouri Geological Survey and Water Resources. 1961. The stratigraphic succession in Missouri. 185 pp., illus.

(14) Nagel, Werner, ed. and comp. 1970. Conservation contrasts. Missouri Dep. of Conserv., 453 pp., illus.

(15) National Association of Conservation Districts. NACD nationwide outdoor recreation inventory—Missouri. (Unpublished data assembled in 1974; available in field offices of the Soil Conservation Service)

(16) State Interagency Council for Outdoor Recreation. 1980. Missouri statewide comprehensive outdoor recreation plan. 127 pp., illus.

(17) Sweet, A.T., E.S. Vanatta, and E.W. Knobel. 1917. Soil survey of Newton County, Missouri. U.S. Dep. Agric., Bur. of Soils, 41 pp., illus.

(18) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(19) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(20) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(21) Wharton, H.M., and others. 1969. Missouri minerals—resources, production, and forecasts. Missouri Geol. Surv. and Water Resour., Spec. Pub. 1, 303 pp., illus.

Glossary

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.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

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—

	Inches
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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

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, 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.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically 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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

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.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (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.

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.

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.

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 soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

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.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

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 the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (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.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

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.

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 of 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.

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 degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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.

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.

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 multipled 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.

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 of separates recognized in the United States are as follows:

	Millimeters
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.

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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

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.

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.

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.

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 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 1952-80 at Neosho, 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----	46.0	22.7	34.4	71	-5	19	1.51	0.62	2.27	3	3.8
February---	51.6	27.2	39.4	76	0	27	2.12	1.02	3.06	4	3.0
March------	60.3	34.7	47.5	85	7	122	3.42	1.63	4.95	6	2.6
April------	72.4	45.8	59.1	89	23	288	4.14	2.45	5.64	7	.0
May--------	78.9	54.3	66.6	90	30	515	4.65	2.68	6.40	8	.0
June-------	86.2	62.7	74.5	96	43	735	4.82	1.98	7.21	7	.0
July-------	91.3	66.8	79.1	101	48	902	3.46	1.18	5.32	5	.0
August-----	90.7	64.7	77.7	101	49	859	3.30	1.67	4.71	5	.0
September--	83.6	57.6	70.6	96	36	618	4.45	1.48	6.88	6	.0
October----	73.8	46.3	60.1	91	24	324	3.74	1.06	5.88	5	.0
November---	59.1	35.2	47.2	80	9	69	2.99	.93	4.65	5	1.4
December---	49.9	27.5	38.7	72	-2	13	2.27	1.08	3.29	4	1.4
Yearly:											
Average--	70.3	45.5	57.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	103	-9	---	---	---	---	---	---
Total----	---	---	---	---	---	4,491	40.87	32.72	48.54	65	12.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1952-80 at Neosho, Missouri)

Probability	Temperature		
	24^{o} F or lower	28^{o} F or lower	32^{o} F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 9	Apr. 23	May 8
2 years in 10 later than--	Apr. 4	Apr. 18	May 2
5 years in 10 later than--	Mar. 25	Apr. 8	Apr. 21
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 23	Oct. 11	Oct. 3
2 years in 10 earlier than--	Oct. 28	Oct. 16	Oct. 7
5 years in 10 earlier than--	Nov. 8	Oct. 27	Oct. 16

TABLE 3.--GROWING SEASON

(Recorded in the period 1952-80 at Neosho, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24^{o} F	Higher than 28^{o} F	Higher than 32^{o} F
	Days	Days	Days
9 years in 10	203	179	155
8 years in 10	211	187	163
5 years in 10	227	201	177
2 years in 10	243	216	192
1 year in 10	251	223	199

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1B	Newtonia silt loam, 1 to 3 percent slopes	2,700	0.7
2B	Wanda silt loam, 1 to 5 percent slopes	4,050	1.0
3C	Eldorado cherty silt loam, 3 to 9 percent slopes	810	0.2
6B	Creldon silt loam, 1 to 3 percent slopes	18,500	4.6
8B	Captina silt loam, 1 to 3 percent slopes	4,300	1.1
9B	Needleye silt loam, 1 to 3 percent slopes	1,400	0.3
10	Bado silt loam	2,400	0.6
21B	Claiborne-Peridge silt loams, 2 to 5 percent slopes	11,000	2.7
23B	Bolivar very fine sandy loam, 2 to 5 percent slopes	680	0.2
25	Gerald silt loam	18,200	4.5
26	Carytown silt loam	700	0.2
27C	Bolivar loam, 3 to 9 percent slopes, stony	353	0.1
30C	Keeno very cherty silt loam, 3 to 9 percent slopes	18,900	4.7
35E	Nixa-Clarksville very cherty silt loams, 5 to 20 percent slopes	12,900	3.2
44G	Rock outcrop-Clarksville complex, 2 to 50 percent slopes	1,450	0.4
45F	Clarksville very cherty silt loam, 14 to 35 percent slopes	45,750	11.4
50C	Nixa very cherty silt loam, 3 to 9 percent slopes	121,500	30.3
54	Dunning silt loam	1,000	0.2
55	Huntington silt loam	14,000	3.5
61B	Hoberg silt loam, 2 to 5 percent slopes	26,250	6.6
76	Hepler silt loam	4,800	1.2
81B	Tonti silt loam, 2 to 5 percent slopes	49,250	12.3
92A	Secesh-Cedargap silt loams, 0 to 3 percent slopes	29,750	7.4
93B	Waben-Cedargap very cherty silt loams, 1 to 5 percent slopes	9,700	2.4
94	Dumps-Orthents complex	620	0.2
96	Orthents-Quarries complex	106	*
	Total	401,069	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
1B	Newtonia silt loam, 1 to 3 percent slopes
2B	Wanda silt loam, 1 to 5 percent slopes
6B	Creldon silt loam, 1 to 3 percent slopes
8B	Captina silt loam, 1 to 3 percent slopes
9B	Needleye silt loam, 1 to 3 percent slopes
21B	Claiborne-Peridge silt loams, 2 to 5 percent slopes
54	Dunning silt loam (where drained and either protected from flooding or not frequently flooded during the growing season)
55	Huntington silt loam
76	Hepler silt loam (where drained)
92A	Secesh-Cedargap silt loams, 0 to 3 percent slopes (where the Cedargap soil is 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	Soybeans	Grain sorghum	Winter wheat	Tall fescue-red clover hay	Alfalfa hay	Tall fescue	Improved bermuda-grass
		Bu	Bu	Bu	Tons	Tons	AUM*	AUM*
1B-------------- Newtonia	IIe	35	90	50	3.5	5.0	8.5	9.0
2B-------------- Wanda	IIe	35	85	45	3.3	4.5	8.0	8.5
3C-------------- Eldorado	IVs	20	40	30	2.6	3.5	5.5	6.0
6B-------------- Creldon	IIe	30	60	40	3.0	3.9	6.0	6.5
8B-------------- Captina	IIe	26	55	35	3.0	3.9	6.0	6.5
9B-------------- Needleye	IIe	26	50	30	2.7	---	5.5	6.0
10-------------- Bado	IIIw	---	55	25	2.6	---	5.0	5.5
21B------------- Claiborne-Peridge	IIe	30	80	40	3.2	5.0	6.5	7.0
23B------------- Bolivar	IIIe	28	55	32	3.0	---	6.0	6.5
25-------------- Gerald	IIIw	25	50	35	3.2	---	6.0	6.5
26-------------- Carytown	IIIw	25	60	30	3.1	---	5.0	---
27C------------- Bolivar	VIs	---	---	---	---	---	4.0	---
30C------------- Keeno	IVs	---	45	25	2.3	---	4.6	5.0
35E------------- Nixa-Clarksville	VIs	---	---	---	---	---	3.6	---
44G------------- Rock outcrop-Clarksville	VIIs	---	---	---	---	---	---	---
45F------------- Clarksville	VIIs	---	---	---	---	---	2.6	---
50C------------- Nixa	IVs	---	---	---	1.8	---	3.8	---
54-------------- Dunning	IIIw	40	90	45	5.0	---	8.5	9.0

See footnotes 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	Soybeans	Grain sorghum	Winter wheat	Tall fescue-red clover hay	Alfalfa hay	Tall fescue	Improved bermuda-grass
		Bu	Bu	Bu	Tons	Tons	AUM*	AUM*
55-------------- Huntington	IIw	40	90	40	4.3	5.5	8.5	9.0
61B------------- Hoberg	IIIe	28	60	38	2.9	3.7	5.2	6.0
76-------------- Hepler	IIw	34	77	38	4.0	4.5	7.0	7.5
81B------------- Tonti	IIIe	25	50	35	2.8	3.6	5.5	6.0
92A------------- Secesh-Cedargap	IIIw	---	---	38	3.6	4.2	7.4	8.0
93B------------- Waben-Cedargap	IIIw	---	---	---	3.0	3.9	7.0	7.5
94**. Dumps-Orthents								
96**. Orthents-Quarries								

* 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.

** See description of the map unit for composition and behavior characteristics of the map unit.

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
8B Captina	3D	Slight	Slight	Slight	Moderate	Black oak	60	43	Black oak, white ash, black locust.
						Post oak	---	---	
9B Needleye	3D	Slight	Slight	Moderate	Moderate	Black oak	60	43	Black oak, pin oak, white ash.
						Post oak	---	---	
						Blackjack oak	---	---	
10 Bado	2W	Slight	Severe	Moderate	Moderate	Black oak	52	36	Black oak, pin oak, green ash, American sycamore.
						Post oak	50	36	
						Blackjack oak	---	---	
21B**:									
Claiborne	4A	Slight	Slight	Slight	Slight	Northern red oak	70	52	Black walnut, shortleaf pine, loblolly pine.
						White oak	65	47	
						Black oak	70	52	
Peridge	4A	Slight	Slight	Slight	Slight	Northern red oak	70	52	Shortleaf pine, loblolly pine, black walnut, northern red oak, white ash.
						Black walnut	---	---	
						White oak	---	---	
						White ash	---	---	
23B Bolivar	3A	Slight	Slight	Slight	Slight	White oak	57	40	White oak, white ash, shortleaf pine.
						Black oak	---	---	
						Northern red oak	---	---	
						Black walnut	---	---	
26 Carytown	2W	Slight	Severe	Moderate	Moderate	Pin oak	50	34	Pin oak, American sycamore.
27C Bolivar	3X	Slight	Moderate	Slight	Slight	White oak	57	40	White oak, white ash, shortleaf pine.
						Blackjack oak	---	---	
						Post oak	---	---	
						Northern red oak	---	---	
						Black walnut	---	---	
35E**:									
Nixa	2D	Slight	Slight	Moderate	Moderate	Black oak	50	34	Black oak, white ash, black locust.
						Blackjack oak	---	---	
						Post oak	---	---	
						Hickory	---	---	
Clarksville	3F	Slight	Slight	Moderate	Slight	White oak	58	41	White oak, shortleaf pine, white ash.
						Black oak	61	44	
						Northern red oak	61	44	
44G**:									
Rock outcrop.									
Clarksville	3R	Slight	Moderate	Moderate	Slight	White oak	58	41	White oak, shortleaf pine, white ash, northern red oak.
						Black oak	61	44	
						Northern red oak	61	44	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Volume*	
45F------------- Clarksville	3R	Slight	Moderate	Moderate	Slight	White oak----------- Black oak----------- Northern red oak----	58 61 61	41 44 44	White oak, shortleaf pine, white ash.
50C------------- Nixa	2D	Slight	Slight	Moderate	Moderate	Black oak----------- Blackjack oak------- Post oak------------ Hickory-------------	50 --- --- ---	34 --- --- ---	Black oak, white ash, black locust.
54-------------- Dunning	4W	Slight	Severe	Severe	Severe	Pin oak------------- Red maple----------- American sycamore--- Boxelder------------ Black willow--------	75 --- --- --- ---	57 --- --- --- ---	Pin oak, American sycamore, baldcypress.
55-------------- Huntington	5A	Slight	Slight	Slight	Slight	Northern red oak----	86	68	Black walnut, black locust, eastern white pine.
61B------------- Hoberg	3D	Slight	Slight	Slight	Moderate	Black oak----------- Blackjack oak------- Post oak------------	60 --- ---	43 --- ---	Black oak, white oak, white ash.
76-------------- Hepler	3A	Slight	Slight	Slight	Slight	Northern red oak---- Eastern cottonwood-- Hackberry----------- Green ash----------- Pin oak-------------	67 90 76 73 80	49 --- --- 82 62	Pecan, white ash, American sycamore.
81B------------- Tonti	3D	Slight	Slight	Moderate	Moderate	Black oak----------- Post oak------------	60 ---	43 ---	Black oak, black locust, white ash.
92A**:									
Secesh----------	3A	Slight	Slight	Slight	Slight	White oak----------- American sycamore--- Black walnut-------- Black oak-----------	60 --- --- ---	43 --- --- ---	Black walnut, shortleaf pine, American sycamore.
Cedargap--------	3A	Slight	Slight	Slight	Slight	Black oak-----------	66	48	Black oak, shortleaf pine.
93B**:									
Waben-----------	3F	Slight	Slight	Moderate	Slight	Black oak----------- Black walnut-------- Black cherry-------- Black locust-------- White oak-----------	66 --- --- --- ---	48 --- --- --- ---	Shortleaf pine, loblolly pine, eastern redcedar, black walnut, black locust, southern red oak.
Cedargap--------	3F	Slight	Slight	Moderate	Slight	Black oak-----------	66	48	Black oak, shortleaf pine.

* 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.

** See description of the map unit for composition and behavior characteristics of the map unit.

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
1B---------------- Newtonia	---	Lilac, Amur honeysuckle.	Eastern redcedar, ponderosa pine, Austrian pine.	Bur oak, honeylocust, hackberry, Russian-olive, autumn-olive, green ash, silver maple.	---
2B---------------- Wanda	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Eastern redcedar, hackberry, Russian-olive.	Eastern white pine, Norway spruce, green ash, honeylocust, pin oak.	---
3C---------------- Eldorado	Amur honeysuckle, lilac.	Fragrant sumac----	Eastern redcedar, green ash, Russian-olive, bur oak, honeylocust, Austrian pine, hackberry.	Siberian elm------	---
6B---------------- Creldon	Lilac-------------	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust-------	---
8B---------------- Captina	Lilac-------------	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust-------	---
9B---------------- Needleye	Lilac-------------	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust-------	---
10---------------- Bado	Lilac-------------	Manchurian crabapple, autumn-olive, Amur honeysuckle, Amur maple.	Hackberry, Austrian pine, green ash, Russian-olive, jack pine, eastern redcedar.	Honeylocust-------	---
21B*: Claiborne---------	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar, Russian-olive, hackberry.	Norway spruce, green ash, honeylocust, pin oak, eastern white pine.	---

See footnote at end of table.

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
21B*:					
Peridge	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar, Russian-olive, hackberry.	Norway spruce, green ash, honeylocust, pin oak, eastern white pine.	---
23B Bolivar	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Green ash, hackberry, bur oak, Russian-olive, Austrian pine, eastern redcedar.	Siberian elm, honeylocust.	---
25 Gerald	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---
26 Carytown	Tatarian honeysuckle, lilac, silver buffaloberry.	Eastern redcedar, Siberian peashrub.	Green ash, Russian-olive.	Siberian elm, golden willow, white willow.	Eastern cottonwood.
27C Bolivar	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Russian-olive, hackberry, bur oak, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
30C Keeno	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
35E*:					
Nixa	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Russian-olive, Austrian pine, eastern redcedar, bur oak, hackberry, green ash, honeylocust.	Siberian elm	---
Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
44G*:					
Rock outcrop.					

See footnote at end of table.

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
44G*:					
Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
45F Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
50C Nixa	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Russian-olive, Austrian pine, eastern redcedar, bur oak, hackberry, green ash, honeylocust.	Siberian elm	---
54 Dunning	American plum, redosier dogwood.	Common chokecherry	Eastern redcedar, common hackberry.	Norway spruce, green ash, golden willow, honey-locust, northern red oak, silver maple.	Eastern cottonwood.
55 Huntington	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar	Austrian pine, hackberry, green ash, pin oak, honeylocust, eastern white pine.	Eastern cottonwood.
61B Hoberg	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---
76 Hepler	---	Peking cotoneaster, Amur honeysuckle, lilac, American plum.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
81B Tonti	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---

See footnote at end of table.

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
92A*:					
Secesh	---	Autumn-olive, Amur honeysuckle, Amur maple, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, hackberry, green ash.	Eastern cottonwood.
Cedargap	---	Amur maple, Amur honeysuckle, autumn-olive, lilac.	Eastern redcedar	Hackberry, Austrian pine, eastern white pine, green ash, honeylocust, pin oak.	Eastern cottonwood.
93B*:					
Waben	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Russian-olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm	---
Cedargap	---	Amur maple, Amur honeysuckle, autumn-olive, lilac.	Eastern redcedar	Hackberry, Austrian pine, eastern white pine, green ash, honeylocust, pin oak.	Eastern cottonwood.
94*:					
Dumps.					
Orthents.					
96*:					
Orthents.					
Quarries.					

* See description of the map unit for composition and behavior characteristics of the map unit.

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
1B Newtonia	Slight	Slight	Slight	Slight	Slight.
2B Wanda	Slight	Slight	Moderate: slope.	Slight	Slight.
3C Eldorado	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, droughty.
6B Creldon	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness.
8B Captina	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
9B Needleye	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
10 Bado	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
21B*:					
Claiborne	Slight	Slight	Moderate: small stones.	Slight	Moderate: small stones.
Peridge	Slight	Slight	Moderate: slope.	Slight	Slight.
23B Bolivar	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
25 Gerald	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
26 Carytown	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, excess sodium, percs slowly.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, erodes easily.	Severe: excess sodium, wetness.
27C Bolivar	Slight	Slight	Severe: slope.	Moderate: large stones.	Severe: large stones.
30C Keeno	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: large stones, wetness.	Severe: small stones, large stones, droughty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
35E*:					
Nixa	Severe: small stones, percs slowly, wetness.	Severe: small stones, percs slowly.	Severe: slope, small stones, wetness.	Severe: small stones.	Severe: small stones.
Clarksville	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.
44G*:					
Rock outcrop.					
Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
45F Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
50C Nixa	Severe: small stones, percs slowly, wetness.	Severe: small stones, percs slowly.	Severe: slope, small stones, wetness.	Severe: small stones.	Severe: small stones.
54 Dunning	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness, erodes easily.	Severe: wetness, flooding.
55 Huntington	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
61B Hoberg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Severe: erodes easily.	Moderate: wetness, droughty.
76 Hepler	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
81B Tonti	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Severe: erodes easily.	Moderate: wetness, droughty.
92A*:					
Secesh	Severe: flooding.	Slight	Moderate: small stones.	Slight	Moderate: large stones.
Cedargap	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
93B*:					
Waben	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
93B*:					
Cedargap	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones, flooding.	Severe: small stones.	Severe: small stones, flooding.
94*:					
Dumps.					
Orthents.					
96*:					
Orthents.					
Quarries.					

* See description of the map unit for composition and behavior characteristics of the map unit.

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 herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1B Newtonia	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
2B Wanda	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
3C Eldorado	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
6B Creldon	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
8B Captina	Fair	Good	Good	Good	Good	Poor	Poor	Good	Fair	Poor.
9B Needleye	Fair	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
10 Bado	Fair	Fair	Good	Fair	Fair	Good	Fair	Fair	Fair	Fair.
21E*:										
Claiborne	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Peridge	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
23B Bolivar	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
25 Gerald	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
26 Carytown	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
27C Bolivar	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
30C Keeno	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
35E*:										
Nixa	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Clarksville	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
44G*:										
Rock outcrop.										
Clarksville	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

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 herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
45F-----Clarksville	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
50C-----Nixa	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
54-----Dunning	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
55-----Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
61B-----Hoberg	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
76-----Hepler	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
81B-----Tonti	Fair	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Very poor.
92A*:										
Secesh-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Cedargap-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
93B*:										
Waben-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Cedargap-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
94*:										
Dumps.										
Orthents.										
96*:										
Orthents.										
Quarries.										

* See description of the map unit for composition and behavior characteristics of the map unit.

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
1B---------------- Newtonia	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
2B---------------- Wanda	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
3C---------------- Eldorado	Moderate: too clayey.	Slight---------	Moderate: shrink-swell.	Moderate: slope.	Slight---------	Moderate: small stones, droughty.
6B---------------- Creldon	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
8B---------------- Captina	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Slight.
9B---------------- Needleye	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Moderate: wetness, droughty.
10---------------- Bado	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
21B*: Claiborne--------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: small stones.
Peridge----------	Moderate: too clayey.	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
23B--------------- Bolivar	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: depth to rock.
25---------------- Gerald	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
26---------------- Carytown	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: excess sodium, wetness.
27C--------------- Bolivar	Moderate: depth to rock, large stones.	Moderate: shrink-swell, large stones.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope, large stones.	Moderate: low strength, frost action.	Severe: large stones.

See footnote at end of table.

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
30C: Keeno	Severe: wetness.	Moderate: wetness, large stones.	Severe: wetness.	Moderate: wetness, slope, large stones.	Moderate: wetness, frost action.	Severe: small stones, large stones, droughty.
35E*:						
Nixa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Severe: low strength.	Severe: small stones, large stones, droughty.
Clarksville	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Severe: small stones.
44G*:						
Rock outcrop.						
Clarksville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
45F: Clarksville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
50C: Nixa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Severe: small stones, large stones.
54: Dunning	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
55: Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
61B: Hoberg	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
76: Hepler	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding.	Moderate: wetness, flooding.
81B: Tonti	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
92A*:						
Secesh	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Moderate: large stones.
Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

See footnote at end of table.

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
93B*:						
Waben	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: small stones.
Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, flooding.
94*:						
Dumps.						
Orthents.						
96*:						
Orthents.						
Quarries.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," 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
1B: Newtonia	Slight	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
2B: Wanda	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: small stones.
3C: Eldorado	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, small stones.
6B: Creldon	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
8B: Captina	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, small stones.
9B: Needleye	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
10: Bado	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness, thin layer.
21B*:					
Claiborne	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
Peridge	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
23B: Bolivar	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
25: Gerald	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey, large stones.	Severe: wetness.	Poor: too clayey, hard to pack, large stones.
26: Carytown	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
27C: Bolivar	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.

See footnote at end of table.

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
30C Keeno	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness, large stones.	Severe: seepage.	Poor: small stones.
35E*:					
Nixa	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, large stones.	Severe: wetness.	Poor: wetness, large stones.
Clarksville	Moderate: slope.	Severe: seepage, slope.	Moderate: slope, too clayey.	Severe: seepage.	Poor: small stones.
44G*:					
Rock outcrop.					
Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
45F Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
50C Nixa	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness, large stones.	Severe: wetness.	Poor: wetness, large stones.
54 Dunning	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
55 Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
61B Hoberg	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Poor: small stones.
76 Hepler	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, wetness.
81B Tonti	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack, small stones.
92A*:					
Secesh	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Cedargap	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.

See footnote at end of table.

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
93B*:					
Waben	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
Cedargap	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
94*:					
Dumps.					
Orthents.					
96*:					
Orthents.					
Quarries.					

* See description of the map unit for composition and behavior characteristics of the map unit.

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
1B------------------- Newtonia	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
2B------------------- Wanda	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
3C------------------- Eldorado	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
6B------------------- Creldon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
8B------------------- Captina	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
9B------------------- Needleye	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
10------------------- Bado	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
21B*:				
Claiborne------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Peridge--------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
23B------------------ Bolivar	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
25------------------- Gerald	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
26------------------- Carytown	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
27C------------------ Bolivar	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
30C----------------- Keeno	Fair: large stones, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
35E*:				
Nixa-----------------	Poor: low strength.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones.
Clarksville----------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
44G*: Rock outcrop.				
Clarksville----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
45F----------------- Clarksville	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
50C----------------- Nixa	Poor: low strength.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones.
54------------------ Dunning	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
55------------------ Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
61B----------------- Hoberg	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
76------------------ Hepler	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
81B----------------- Tonti	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
92A*:				
Secesh---------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Cedargap-------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
93B*:				
Waben	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
Cedargap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
94*:				
Dumps				
Orthents.				
96*:				
Orthents.				
Quarries.				

* See description of the map unit for composition and behavior characteristics of the map unit.

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
1B Newtonia	Severe*: seepage.	Moderate: hard to pack.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
2B Wanda	Severe*: seepage.	Severe: thin layer.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
3C Eldorado	Severe*: seepage.	Slight	Deep to water	Droughty, slope.	Large stones	Droughty, large stones.
6B Creldon	Severe*: seepage.	Moderate: thin layer, hard to pack, wetness.	Percs slowly	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
8B Captina	Severe*: seepage.	Moderate: piping, wetness.	Percs slowly	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
9B Needleye	Severe*: seepage.	Moderate: wetness.	Percs slowly	Wetness, droughty, percs slowly.	Large stones, erodes easily, wetness.	Erodes easily, droughty, rooting depth.
10 Bado	Moderate: seepage.	Severe: thin layer, wetness.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Wetness, erodes easily, rooting depth.	Wetness, erodes easily, rooting depth.
21B:						
Claiborne	Moderate: seepage, slope.	Moderate: piping, thin layer.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Peridge	Moderate: seepage.	Moderate: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
23B Bolivar	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Depth to rock.
25 Gerald	Moderate: seepage.	Severe: hard to pack.	Percs slowly, large stones, frost action.	Wetness, percs slowly, rooting depth.	Large stones, erodes easily, wetness.	Large stones, wetness, erodes easily.
26 Carytown	Slight	Severe: hard to pack, wetness, excess sodium.	Percs slowly, excess sodium.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, excess sodium, erodes easily.
27C Bolivar	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Large stones, soil blowing, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
30C: Keeno	Severe: seepage.	Severe: large stones.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, droughty.
35E:						
Nixa	Severe*: seepage, slope.	Severe: large stones.	Percs slowly, large stones, slope.	Large stones, wetness, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.
Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
44G:						
Rock outcrop.						
Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
45F: Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
50C: Nixa	Severe*: seepage.	Severe: large stones.	Percs slowly, large stones, slope.	Large stones, wetness, droughty.	Large stones, rooting depth.	Large stones, droughty.
54: Dunning	Slight	Severe: wetness.	Percs slowly, flooding.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
55: Huntington	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
61B: Hoberg	Severe*: seepage.	Moderate: large stones, wetness.	Percs slowly, large stones, slope.	Wetness, droughty, percs slowly.	Large stones, erodes easily, wetness.	Large stones, erodes easily, droughty.
76: Hepler	Moderate: seepage.	Severe: wetness.	Flooding	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
81B: Tonti	Severe*: seepage.	Severe: hard to pack.	Percs slowly, slope.	Wetness, droughty, percs slowly.	Large stones, erodes easily.	Large stones, erodes easily.
92A:						
Secesh	Severe: seepage.	Slight	Deep to water	Favorable	Large stones	Favorable.
Cedargap	Severe: seepage.	Severe: seepage.	Deep to water	Flooding	Large stones	Favorable.
93B:						
Waben	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Favorable	Droughty.
Cedargap	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, flooding.	Large stones	Large stones.

* This soil is rated one class lower for pond reservoir areas because of the mineralogy and coarse aggregation of the clay in the subsoil and substratum.

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	
1B---------------Newtonia	0-11	Silt loam--------	CL	A-4, A-6	0	95-100	95-100	96-100	65-97	30-37	9-14
	11-22	Silt loam, silty clay loam.	CL	A-4, A-6	0	95-100	95-100	96-100	80-98	30-40	9-16
	22-60	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	75-100	75-100	70-98	70-98	37-60	15-34
2B---------------Wanda	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	85-95	65-85	25-40	5-15
	10-16	Silty clay loam, cherty silty clay loam.	CL	A-6, A-7	0	75-95	70-95	70-95	65-90	35-50	20-35
	16-48	Cherty silty clay loam, very cherty silty clay loam.	GC, CL, SG	A-6, A-7, A-2-6, A-2-7	0-5	35-70	30-70	30-70	25-60	35-50	20-35
	48-60	Cherty silty clay, very cherty silty clay.	GC, CH, SC	A-7, A-2-7	0-5	35-70	30-70	30-70	25-60	50-70	30-50
3C---------------Eldorado	0-7	Cherty silt loam	SM, SC, CL, ML	A-2, A-4	0-10	55-80	50-75	45-75	30-70	22-31	2-10
	7-45	Very cherty silty clay loam, extremely cherty silty clay loam.	GC	A-2, A-4, A-6	0-40	25-55	20-50	15-50	13-48	30-40	10-17
	45-60	Cherty silty clay, cherty silty clay loam.	GC	A-2, A-6, A-7	0-40	25-55	20-50	20-50	17-48	37-55	15-28
6B---------------Creldon	0-10	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	95-100	90-100	80-95	20-40	2-15
	10-26	Silty clay loam, silty clay.	CH	A-7	0	90-100	90-100	85-95	80-95	50-60	25-35
	26-33	Silt loam, silty clay loam, cherty silty clay loam.	CL	A-6, A-7	0-5	75-100	70-100	65-95	60-90	35-45	15-25
	33-41	Very cherty silty clay loam, extremely cherty silty clay loam.	GC	A-2, A-6, A-7	0-25	30-65	30-60	25-55	20-50	35-45	15-25
	41-53	Extremely cherty silty clay, very cherty silty clay.	GC, CH	A-2, A-7	5-35	45-75	40-75	35-70	30-65	55-70	35-50
	53-60	Very cherty clay, extremely cherty clay, cherty clay.	GC, CH	A-2, A-7	5-35	45-75	40-75	35-70	30-65	55-80	35-60

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8B--------------- Captina	0-6	Silt loam--------	CL-ML, CL	A-4	0	95-100	90-100	85-100	75-90	25-40	4-10
	6-24	Silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	95-100	90-100	85-100	80-95	30-45	8-25
	24-30	Silt loam, silty clay loam, cherty silty clay loam.	CL	A-4, A-6, A-7	0-5	60-95	55-95	55-95	55-90	30-45	8-25
	30-54	Very cherty silty clay loam, cherty silt loam, very cherty silt loam.	GC, CL	A-4, A-6, A-7	0-15	30-75	30-75	30-75	25-70	30-50	5-30
	54-60	Very cherty clay, extremely cherty clay, very cherty silty clay.	GC, GP-GC	A-2	5-30	20-50	10-50	10-40	5-30	40-60	25-45
9B--------------- Needleye	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	85-100	80-90	25-35	4-12
	7-27	Silt loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	90-100	80-95	35-45	11-20
	27-48	Very cherty silty clay loam, extremely cherty silt loam.	GC, SC, CL	A-2, A-4, A-6	5-25	30-90	30-80	30-80	25-75	25-35	8-15
	48-60	Extremely cherty clay, very cherty silty clay, very cherty clay.	GC	A-2, A-7	5-25	30-50	30-50	30-50	25-45	45-80	20-50
10--------------- Bado	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	75-95	25-35	5-15
	12-16	Silty clay loam	CL, CH	A-7	0	95-100	95-100	90-100	80-100	45-55	20-30
	16-29	Clay, silty clay	CH	A-7	0	90-100	85-100	80-100	75-100	50-70	30-45
	29-48	Extremely cherty silty clay loam, very cherty silty clay loam.	CL, GC	A-6, A-7, A-2-6, A-2-7	0-20	30-60	25-60	25-60	20-55	30-45	15-30
	48-60	Very cherty silty clay, extremely cherty silty clay.	CH, GC	A-7, A-2-7	10-40	40-60	35-60	35-60	30-60	55-70	35-45
21B*: Claiborne--------	0-19	Silt loam--------	ML, CL, CL-ML	A-4	0-5	85-100	70-95	65-90	55-80	24-35	4-10
	19-60	Silty clay loam, cherty silty clay loam.	CL	A-4, A-6	0-5	85-100	70-95	65-90	60-80	28-40	8-20
Peridge---------	0-10	Silt loam--------	ML, CL-ML	A-4	0	95-100	90-100	85-90	80-85	<20	NP-5
	10-40	Silty clay loam, silt loam.	CL	A-6	0	95-100	90-100	85-95	80-95	30-40	11-20
	40-60	Cherty silty clay loam, very cherty silty clay loam.	CL, SC, GC	A-6	0	35-100	50-100	45-90	40-85	30-40	11-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
23B: Bolivar	0-6	Very fine sandy loam.	ML, SM	A-4	0	100	90-100	70-95	40-55	20-30	NP-5
	6-36	Loam, clay loam, clay.	CL, SC	A-6	0-10	85-100	85-100	70-95	45-80	25-40	10-25
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
25: Gerald	0-15	Silt loam	CL-ML, ML	A-4	0	95-100	85-100	80-95	75-90	25-35	4-10
	15-28	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	85-100	70-100	65-95	60-90	45-60	20-35
	28-38	Silt loam, silty clay loam, cherty silty clay loam.	CL	A-6, A-7	0-10	65-90	60-85	55-80	50-75	35-45	15-25
	38-48	Very cherty silty clay loam, extremely cherty silty clay loam.	CL, GC	A-6, A-7	15-40	50-70	45-70	40-70	40-65	35-45	15-25
	48-60	Very cherty silty clay loam, extremely cherty silty clay.	CL, CH, GC	A-7	15-40	50-70	45-70	40-70	40-65	40-65	25-50
26: Carytown	0-13	Silt loam	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	80-95	20-30	5-15
	13-40	Clay, silty clay	CH	A-7	0	100	95-100	90-100	90-100	51-70	30-45
	40-60	Silty clay loam, silty clay.	CH	A-7	0	100	95-100	90-100	85-100	51-65	30-40
27C: Bolivar	0-5	Loam	SC, CL-ML, CL, SM-SC	A-4	15-40	80-100	75-95	70-90	40-75	15-25	5-10
	5-27	Flaggy loam, flaggy sandy clay loam, shaly clay loam.	SC, GC	A-6, A-2-6	25-50	60-80	50-75	45-65	25-45	30-40	11-20
	27-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
	40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
30C: Keeno	0-12	Very cherty silt loam.	SM, GC, GM, SC	A-2-4, A-4	0-35	45-90	35-75	30-70	30-65	15-25	2-10
	12-23	Extremely cherty silty clay loam, extremely cherty silt loam.	GC, GM-GC, GP-GC	A-2-4, A-2-6, A-6, A-4	0-35	10-50	10-50	5-40	5-40	20-35	5-15
	23-34	Very cherty silt loam, extremely cherty silty clay loam.	GC, GP-GC	A-2, A-6, A-7	15-55	10-50	10-50	5-40	5-40	30-45	11-20
	34-60	Very cherty clay, extremely cherty silty clay, extremely cherty clay.	CL, CH, GC, SC	A-2-7, A-7	0-40	40-80	30-70	25-65	20-60	45-70	25-40

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
35E*:											
Nixa	0-15	Very cherty silt loam.	GM, GC, SM, SC	A-2, A-4, A-6, A-1	0-10	40-70	30-60	25-55	20-50	<25	NP-8
	15-23	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-2, A-4, A-6	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	23-50	Very cherty silt loam, very cherty silty clay loam.	CL	A-6, A-7	45-70	75-95	70-95	65-90	60-90	25-45	15-25
	50-60	Very cherty silty clay, extremely cherty clay, very cherty clay.	CL, CH	A-7	45-70	75-95	70-95	65-95	60-90	41-75	35-50
Clarksville	0-8	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	8-60	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
44G*:											
Rock outcrop.											
Clarksville	0-13	Very cherty silt loam, extremely cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	13-31	Very cherty silt loam, extremely cherty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	31-60	Very cherty silty clay, extremely cherty clay, extremely cherty silty clay.	GC, SC, GP-GC, SP-SC	A-7, A-2-7	5-20	30-70	10-60	10-50	10-45	55-75	35-55
45F Clarksville	0-14	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	14-37	Extremely cherty silt loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	37-60	Very cherty silty clay, very cherty clay, extremely cherty silty clay.	GC, SC, GP-GC, SP-SC	A-7, A-2-7	5-20	30-70	10-60	10-50	10-45	55-75	35-55

See footnote at end of table.

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	
50C-------------- Nixa	0-12	Very cherty silt loam.	GM, GC, SM, SC	A-2, A-4, A-6, A-1	0-10	40-70	30-60	25-55	20-50	<25	NP-8
	12-26	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-2, A-4, A-6	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	26-36	Very cherty silt loam, very cherty silty clay loam.	CL	A-6, A-7	45-70	75-95	70-95	65-90	60-90	25-45	15-25
	36-60	Very cherty silty clay, extremely cherty clay, very cherty clay.	CL, CH	A-7	45-70	75-95	70-95	65-95	60-90	41-75	35-50
54--------------- Dunning	0-6	Silt loam--------	ML, CL, CL-ML	A-6, A-4	0	100	95-100	90-100	85-100	25-35	2-11
	6-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-5	90-100	70-100	60-100	60-100	45-70	20-40
55--------------- Huntington	0-10	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	10-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
61B-------------- Hoberg	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	80-100	75-100	70-95	65-90	25-35	7-15
	9-14	Silt loam, silty clay loam, clay loam.	CL	A-6	0	80-100	75-100	70-95	60-95	30-40	11-20
	14-24	Cherty silty clay loam, cherty silty clay.	GC, CL	A-6	0-10	55-80	50-75	45-70	40-65	30-40	11-20
	24-46	Extremely cherty silty clay loam, very cherty silt loam.	GC, GP-GC	A-2, A-6	5-40	20-50	15-45	15-45	12-40	30-40	11-20
	46-60	Very cherty clay, very cherty silty clay, extremely cherty silty clay.	GC, GP-GC	A-2, A-7	5-40	20-50	15-45	15-45	12-40	50-75	35-55
76--------------- Hepler	0-23	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	75-95	20-35	2-15
	23-37	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	95-100	85-95	35-50	15-25
	37-60	Silty clay loam, silty clay.	CL	A-6, A-7	0	95-100	90-100	95-100	85-95	35-50	15-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
81B-------------- Tonti	0-12	Silt loam--------	CL-ML, CL	A-4	0-5	80-95	75-95	70-90	60-85	15-30	4-10
	12-25	Cherty silty clay loam, cherty silt loam.	CL-ML, CL	A-4, A-6	0-5	55-80	50-75	45-75	45-70	25-40	6-15
	25-44	Cherty silt loam, very cherty silt loam, very cherty silty clay loam.	GC, CL-ML, CL	A-2, A-4, A-6	5-35	35-75	30-70	25-65	20-60	25-40	6-15
	44-60	Extremely cherty silty clay, very cherty clay, very cherty silty clay.	GC, CL, CH	A-2, A-7	5-15	30-70	25-65	25-60	20-55	40-70	15-45
92A*:											
Secesh----------	0-8	Silt loam--------	ML	A-4	0-10	85-100	80-100	75-95	60-90	20-30	NP-7
	8-25	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0-10	80-100	75-100	70-95	60-90	25-35	5-12
	25-33	Cherty silty clay loam, cherty sandy clay loam, cherty clay loam.	CL, GC, SC	A-6	0-10	65-90	55-80	50-75	40-65	30-40	11-20
	33-60	Very cherty sandy clay loam, extremely cherty clay loam, extremely cherty silty clay loam.	GC, SC, GP-GC, SP-SC	A-6, A-2-6	15-45	40-70	20-65	20-45	10-40	30-40	11-20
Cedargap--------	0-8	Silt loam--------	ML	A-4	0-5	90-100	85-95	75-95	70-95	25-35	3-9
	8-28	Cherty silt loam, cherty loam, very cherty silt loam.	SM, GM	A-1, A-2, A-4	2-15	40-85	20-65	15-45	15-40	25-35	3-9
	28-60	Extremely cherty silty clay loam, very cherty silty clay loam, extremely cherty loam.	GC	A-2-6, A-6	5-20	25-50	20-50	15-45	15-40	30-40	15-25
93B*:											
Waben-----------	0-14	Very cherty silt loam.	GM, GM-GC, GP-GM	A-1, A-2	0-10	20-53	15-50	10-40	5-35	<30	NP-7
	14-43	Very cherty silt loam, extremely cherty silty clay loam, cherty silty clay loam.	GM, GC, GP-GM, GM-GC	A-1, A-2	0-10	20-53	15-50	10-40	5-35	20-40	3-20
	43-60	Very cherty silt loam, extremely cherty clay loam, very cherty silty clay loam.	GM, GM-GC, GP-GM	A-1, A-2	0-10	20-53	15-50	10-35	5-30	<35	NP-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
93B*:											
Cedargap--------	0-10	Very cherty silt loam.	SM, GM	A-1, A-2-4, A-4	2-15	40-85	30-75	20-60	15-50	25-35	3-9
	10-27	Cherty silt loam, cherty loam, very cherty silt loam.	SM, GM	A-1, A-2, A-4	2-15	40-85	20-65	15-45	15-40	25-35	3-9
	27-60	Extremely cherty silty clay loam, very cherty silty clay loam, extremely cherty loam.	GC	A-2-6, A-6	5-20	25-50	20-50	15-45	15-40	30-40	15-25
94*:											
Dumps.											
Orthents.											
96*:											
Orthents.											
Quarries.											

* See description of the map unit for composition and behavior characteristics of the map unit.

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
1B: Newtonia	0-11	10-24	1.30-1.55	0.6-2.0	0.15-0.24	5.6-7.3	Low	0.37	5	6	1-3
	11-22	20-35	1.40-1.55	0.6-2.0	0.16-0.22	5.1-7.3	Moderate	0.37			
	22-60	32-45	1.35-1.55	0.6-2.0	0.12-0.20	4.5-7.3	Moderate	0.32			
2B: Wanda	0-10	15-25	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37	4	6	1-3
	10-16	27-40	1.40-1.55	0.6-2.0	0.13-0.20	5.6-7.3	Moderate	0.37			
	16-48	27-40	1.40-1.55	0.6-2.0	0.10-0.17	5.1-6.5	Moderate	0.37			
	48-60	40-60	1.40-1.55	0.6-2.0	0.06-0.11	5.1-6.5	Moderate	0.28			
3C: Eldorado	0-7	18-26	1.30-1.50	0.6-2.0	0.04-0.20	5.6-6.5	Low	0.28	3	7	1-3
	7-45	18-35	1.30-1.50	0.6-2.0	0.06-0.10	5.1-6.5	Low	0.24			
	45-60	35-45	1.35-1.65	0.6-2.0	0.05-0.09	3.6-6.0	Moderate	0.20			
6B: Creldon	0-10	10-25	1.20-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.32	4-3	5	1-3
	10-26	35-45	1.30-1.50	0.2-0.6	0.12-0.17	4.5-6.5	Moderate	0.32			
	26-33	25-35	1.60-1.90	<0.06	0.07-0.12	3.6-5.0	Low	0.43			
	33-41	25-35	1.60-1.90	<0.06	0.05-0.12	3.6-5.0	Low	0.43			
	41-53	40-60	1.30-1.55	0.6-2.0	0.05-0.12	4.5-6.0	High	0.32			
	53-60	40-70	1.30-1.55	0.6-2.0	0.04-0.10	4.5-6.0	High	0.32			
8B: Captina	0-6	15-24	1.30-1.50	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.43	3	5	1-3
	6-24	20-40	1.30-1.50	0.6-2.0	0.18-0.22	3.6-5.5	Low	0.43			
	24-30	20-35	1.60-1.90	0.06-0.2	0.04-0.10	3.6-5.5	Low	0.37			
	30-54	20-35	1.60-1.90	0.06-0.2	0.02-0.08	3.6-5.5	Low	0.32			
	54-60	40-80	1.25-1.45	0.6-2.0	0.04-0.12	3.6-5.5	Moderate	0.32			
9B: Needleye	0-7	15-25	1.20-1.40	0.6-2.0	0.18-0.24	4.5-7.3	Low	0.37	3	6	.5-2
	7-27	25-35	1.25-1.45	0.2-0.6	0.12-0.20	3.6-5.5	Low	0.37			
	27-48	20-32	1.60-1.90	<0.06	0.02-0.06	3.6-5.0	Low	0.15			
	48-60	40-75	1.10-1.40	0.6-2.0	0.03-0.08	3.6-5.0	Moderate	0.15			
10: Bado	0-12	15-25	1.20-1.40	0.6-2.0	0.22-0.24	3.6-6.5	Low	0.43	3	6	.5-2
	12-16	30-40	1.30-1.50	0.2-0.6	0.18-0.20	3.6-5.5	Moderate	0.43			
	16-29	40-55	1.30-1.50	0.06-0.2	0.09-0.13	3.6-5.5	High	0.32			
	29-48	27-35	1.60-1.90	<0.06	0.08-0.12	3.6-5.5	Moderate	0.10			
	48-60	40-70	1.30-1.50	0.6-2.0	0.06-0.10	3.6-6.0	Moderate	0.10			
21B*:											
Claiborne	0-19	20-32	1.30-1.50	0.6-2.0	0.17-0.21	4.5-7.3	Low	0.37	4	6	1-3
	19-60	27-35	1.35-1.55	0.6-2.0	0.17-0.20	4.5-5.5	Moderate	0.32			
Peridge	0-10	10-20	1.25-1.45	0.6-2.0	0.16-0.24	4.5-6.0	Low	0.37	5	6	1-3
	10-40	20-34	1.25-1.45	0.6-2.0	0.18-0.22	4.5-6.0	Low	0.32			
	40-60	30-40	1.25-1.40	0.6-2.0	0.13-0.22	4.5-6.0	Low	0.28			
23B: Bolivar	0-6	12-18	1.20-1.45	2.0-6.0	0.16-0.18	5.1-6.0	Low	0.24	4	3	.5-2
	6-36	20-35	1.30-1.50	0.6-2.0	0.12-0.16	3.6-6.0	Moderate	0.32			
	36-60	---	---	---	---	---	-------------	----			
25: Gerald	0-15	20-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	3	6	.5-2
	15-28	35-45	1.40-1.60	0.06-0.2	0.11-0.13	4.5-5.5	High	0.43			
	28-38	25-35	1.60-1.90	<0.06	0.01-0.04	4.5-5.5	Low	0.43			
	38-48	25-35	1.60-1.90	<0.06	0.03-0.08	4.5-5.5	Low	0.15			
	48-60	35-60	1.40-1.60	0.6-2.0	0.03-0.08	3.6-5.5	Moderate	0.15			

See footnote at end of table.

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
26----------------- Carytown	0-13	12-25	1.20-1.40	0.6-2.0	0.19-0.24	5.1-7.3	Low-----------	0.43	3	6	.5-2
	13-40	40-60	1.45-1.65	<0.06	0.08-0.11	5.6-8.4	High----------	0.43			
	40-60	30-55	1.40-1.60	0.06-0.2	0.10-0.13	6.6-9.0	High----------	0.43			
27C---------------- Bolivar	0-5	12-18	1.30-1.50	2.0-6.0	0.16-0.20	5.1-6.0	Low-----------	0.24	4	3	.5-2
	5-27	25-40	1.35-1.55	0.6-2.0	0.08-0.12	3.6-4.4	Moderate------	0.32			
	27-40	---	---	---	---	---	--------------	----			
	40	---	---	---	---	---	--------------	----			
30C---------------- Keeno	0-12	15-25	1.30-1.60	2.0-6.0	0.06-0.15	3.6-7.3	Low-----------	0.24	2	7	1-3
	12-23	25-35	1.50-1.80	0.6-2.0	0.02-0.10	3.6-5.5	Low-----------	0.24			
	23-34	25-35	1.60-1.90	0.06-0.2	0.01-0.05	3.6-5.5	Low-----------	0.24			
	34-60	40-80	1.10-1.40	0.6-2.0	0.04-0.10	3.6-5.5	Moderate------	0.24			
35E*:											
Nixa--------------	0-15	10-25	1.30-1.50	0.6-2.0	0.08-0.10	4.5-5.5	Low-----------	0.32	2	8	.5-2
	15-23	20-35	1.30-1.50	0.6-2.0	0.08-0.10	4.5-5.5	Low-----------	0.32			
	23-50	20-40	1.60-1.90	<0.06	0.05-0.08	4.5-5.5	Low-----------	0.32			
	50-60	40-80	1.30-1.45	0.6-2.0	0.03-0.06	4.5-5.5	Moderate------	0.28			
Clarksville------	0-8	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	8-60	25-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			
44G*: Rock outcrop.											
Clarksville------	0-13	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	13-31	25-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			
	31-60	40-75	1.40-1.65	0.6-2.0	0.05-0.08	3.6-5.5	Low-----------	0.10			
45F---------------- Clarksville	0-14	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	14-37	25-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			
	37-60	40-75	1.40-1.65	0.6-2.0	0.05-0.08	3.6-5.5	Low-----------	0.10			
50C---------------- Nixa	0-12	10-25	1.30-1.50	0.6-2.0	0.08-0.10	4.5-5.5	Low-----------	0.32	2	8	.5-2
	12-26	20-35	1.30-1.50	0.6-2.0	0.08-0.10	4.5-5.5	Low-----------	0.32			
	26-36	20-40	1.60-1.90	<0.06	0.05-0.08	4.5-5.5	Low-----------	0.32			
	36-60	40-80	1.30-1.45	0.6-2.0	0.03-0.06	4.5-5.5	Moderate------	0.28			
54----------------- Dunning	0-6	12-27	1.20-1.40	0.6-2.0	0.19-0.23	5.6-7.8	Low-----------	0.37	5	7	2-4
	6-60	35-60	1.40-1.65	0.06-0.2	0.14-0.18	5.6-7.8	Moderate------	0.28			
55----------------- Huntington	0-10	18-30	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low-----------	0.28	5	6	3-6
	10-60	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low-----------	0.32			
61B---------------- Hoberg	0-9	15-25	1.20-1.40	0.6-2.0	0.17-0.24	5.1-7.3	Low-----------	0.37	3	6	1-3
	9-14	20-30	1.25-1.45	0.6-2.0	0.15-0.22	5.1-7.3	Low-----------	0.37			
	14-24	20-40	1.30-1.50	0.6-2.0	0.09-0.14	4.5-6.5	Low-----------	0.24			
	24-46	20-40	1.60-1.90	0.06-0.2	0.02-0.06	3.6-6.0	Low-----------	0.15			
	46-60	40-70	1.10-1.40	0.6-2.0	0.02-0.06	3.6-6.0	High----------	0.10			
76----------------- Hepler	0-23	12-27	1.25-1.35	0.6-2.0	0.22-0.24	4.5-7.8	Low-----------	0.37	5	6	.5-1
	23-37	27-35	1.35-1.45	0.6-2.0	0.18-0.20	4.5-6.5	Moderate------	0.37			
	37-60	27-42	1.35-1.45	0.2-0.6	0.14-0.17	4.5-6.5	Moderate------	0.37			
81B---------------- Tonti	0-12	10-25	1.30-1.50	0.6-2.0	0.15-0.20	5.6-6.5	Low-----------	0.37	3	5	1-3
	12-25	20-35	1.30-1.50	0.6-2.0	0.12-0.18	3.6-6.0	Low-----------	0.32			
	25-44	18-35	1.60-1.90	0.06-0.2	0.02-0.08	3.6-5.0	Low-----------	0.28			
	44-60	40-80	1.20-1.40	0.6-2.0	0.05-0.10	3.6-5.0	Moderate------	0.32			

See footnote at end of table.

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
92A*:											
Secesh----------	0-8	15-25	1.10-1.30	0.6-2.0	0.16-0.20	5.1-7.3	Low----------	0.32	4	5	<2
	8-25	20-30	1.20-1.40	0.6-2.0	0.13-0.19	4.5-6.0	Low----------	0.32			
	25-33	25-35	1.20-1.40	0.6-2.0	0.09-0.14	4.5-6.0	Low----------	0.32			
	33-60	25-35	1.30-1.50	2.0-6.0	0.03-0.08	4.5-6.0	Low----------	0.24			
Cedargap--------	0-8	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6	1-4
	8-28	12-27	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	Low----------	0.24			
	28-60	25-35	1.40-1.55	2.0-6.0	0.04-0.10	5.6-7.3	Low----------	0.10			
93B*:											
Waben-----------	0-14	5-20	1.20-1.50	2.0-6.0	0.05-0.15	5.1-6.5	Low----------	0.28	5	8	.5-2
	14-43	20-35	1.30-1.60	2.0-6.0	0.05-0.15	5.1-6.5	Low----------	0.24			
	43-60	10-30	1.30-1.60	2.0-6.0	0.05-0.15	5.1-6.5	Low----------	0.24			
Cedargap--------	0-10	12-25	1.20-1.45	2.0-6.0	0.11-0.18	5.6-7.3	Low----------	0.24	5	8	1-4
	10-27	12-27	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	Low----------	0.24			
	27-60	25-35	1.40-1.55	2.0-6.0	0.04-0.10	5.6-7.3	Low----------	0.10			
94*:											
Dumps.											
Orthents.											
96*:											
Orthents.											
Quarries.											

* See description of the map unit for composition and behavior characteristics of the map unit.

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	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1B----------------- Newtonia	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
2B----------------- Wanda	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
3C----------------- Eldorado	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
6B----------------- Creldon	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	High-----	High.
8B----------------- Captina	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	Moderate	High.
9B----------------- Needleye	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate	High.
10----------------- Bado	D	None--------	---	---	0-2.0	Perched	Dec-Apr	>60	---	High-----	High.
21B*:											
Claiborne---------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Peridge-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
23B---------------- Bolivar	B	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate.
25----------------- Gerald	D	None--------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	High-----	High.
26----------------- Carytown	D	None--------	---	---	0-1.0	Perched	Dec-Apr	>60	---	High-----	Moderate.
27C---------------- Bolivar	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High.
30C---------------- Keeno	C	None--------	---	---	1.5-2.5	Perched	Dec-Apr	>60	---	Moderate	High.
35E*:											
Nixa--------------	C	None--------	---	---	1.0-2.0	Perched	---	>60	---	Moderate	Moderate.
Clarksville------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
44G*:											
Rock outcrop.											
Clarksville------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
45F---------------- Clarksville	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
50C---------------- Nixa	C	None--------	---	---	1.0-2.0	Perched	---	>60	---	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
54----------------- Dunning	D	Frequent----	Brief-----	Dec-May	0-0.5	Apparent	Dec-Apr	>60	---	High-----	Moderate.
55----------------- Huntington	B	Occasional	Brief-----	Dec-May	>6.0	---	---	>60	---	Low------	Moderate.
61B---------------- Hoberg	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate	High.
76----------------- Hepler	C	Occasional	Brief-----	Dec-May	1.0-3.0	Apparent	Dec-Apr	>60	---	High-----	Moderate.
81B---------------- Tonti	C	None--------	---	---	1.5-2.5	Perched	Dec-Apr	>60	---	High-----	High.
92A*:											
Secesh------------	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
Cedargap----------	B	Frequent----	Very brief	Dec-May	>6.0	---	---	>60	---	Low------	Low.
93B*:											
Waben-------------	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
Cedargap----------	B	Frequent----	Very brief	Dec-May	>6.0	---	---	>60	---	Low------	Low.
94*:											
Dumps.											
Orthents.											
96*:											
Orthents.											
Quarries.											

* See description of the map unit for composition and behavior characteristics of the map unit.

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
Bado	Fine, mixed, mesic Typic Fragiaqualfs
*Bolivar	Fine-loamy, mixed, thermic Ultic Hapludalfs
Captina	Fine-silty, siliceous, mesic Typic Fragiudults
Carytown	Fine, mixed, thermic Albic Natraqualfs
Cedargap	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Claiborne	Fine-loamy, siliceous, mesic Typic Paleudults
Clarksville	Loamy-skeletal, siliceous, mesic Typic Paleudults
Creldon	Fine, mixed, mesic Mollic Fragiudalfs
Dunning	Fine, mixed, mesic Fluvaquentic Haplaquolls
Eldorado	Loamy-skeletal, mixed, thermic Typic Paleudolls
Gerald	Fine, mixed, mesic Umbric Fragiaqualfs
Hepler	Fine-silty, mixed, thermic Udollic Ochraqualfs
*Hoberg	Fine-loamy, siliceous, mesic Mollic Fragiudalfs
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
*Keeno	Loamy-skeletal, siliceous, mesic Mollic Fragiudalfs
Needleye	Fine-silty, mixed, mesic Aquic Fragiudults
Newtonia	Fine-silty, mixed, thermic Typic Paleudolls
*Nixa	Loamy-skeletal, siliceous, mesic Glossic Fragiudults
Orthents	Typic Udorthents
Peridge	Fine-silty, mixed, mesic Typic Paleudalfs
Secesh	Fine-loamy, siliceous, mesic Ultic Hapludalfs
*Tonti	Fine-loamy, mixed, mesic Typic Fragiudults
Waben	Loamy-skeletal, siliceous, mesic Ultic Hapludalfs
Wanda	Fine-loamy, mixed, mesic Typic Paleudolls

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