SOIL SURVEY OF

Grayson County, Kentucky

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

Issued December 1972

Major fieldwork for this soil survey was done in the period 1962–66. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Grayson County Soil Conservation District.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

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

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

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

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

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

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

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

Cover picture: Burley tobacco and sudangrass on Sadler silt loam, 0 to 2 percent slopes.

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SOIL SURVEY OF GRAYSON COUNTY, KENTUCKY

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

GRAYSON COUNTY is in the west-central part of Kentucky and has an area of approximately 514 square miles, or 328,960 acres (fig. 1).

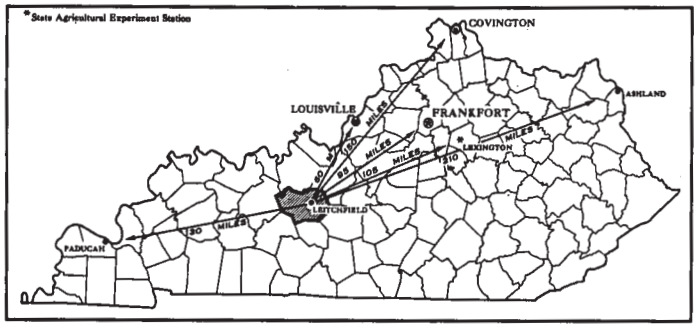

Figure 1.—**Location of Grayson County in Kentucky.**

Leitchfield is the county seat and the largest town in the county, and Caneyville and Clarkson are the only other incorporated towns. The county is bounded on the west by Ohio County, on the north by Breckinridge County, on the northeast by Hardin County, on the southeast by Hart County, on the south by Edmonson County, and on the southwest by Butler County.

This county is in the Western Coal Field and Western Pennyroyal physiographic regions. The soils are underlain by siltstone, sandstone, shale, and limestone. The relief ranges from nearly level to steep. The climate is moderate; it includes warm and humid summers and moderately cold winters and is favorable for many kinds of plants and animals. Precipitation is adequate and is fairly well distributed throughout the year. The sale of farm products provides the major part of the income of the residents. Burley tobacco is the most important cash crop.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Grayson County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by weathering, by leaching, or by the action of plant roots.

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

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Nolin and Steff, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Some soils are like the soils in a given series except for at least one differentiating characteristic. If the acreage is small, the soils are called a variant of that series and are given the name of the series as modified by the differentiating feature. An example is Wellston silt loam, clayey subsoil variant.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Wellston silt loam, 2 to 6 percent slopes, is one of several phases within the Wellston series.

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping

unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Soil complexes are the only such kind of mapping units shown on the detailed soil map of Grayson County. A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Weikert-Ramsey-Gilpin stony complex, 20 to 30 percent slopes.

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

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

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

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

General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is also useful in determining the value of the association for growing wood products, for wildlife habitat, for engineering work, and for town and country planning. A general soil map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

Three soil associations in Grayson County are described in the paragraphs that follow.

1. Zanesville-Gilpin-Wellston-Weikert Association

Well drained to moderately well drained, gently sloping soils that have a fragipan, on ridgetops, and deep to shallow, well drained, strongly sloping to steep soils on side slopes

This association consists of two large areas. The larger area extends from the Breckinridge County line in the northwestern part of Grayson County to the southeastern corner. The major streams in this area are the Rough River, Caney Creek, and Bear Creek. The smaller area lies just south of Big Clifty in the northeastern corner of the county and extends from Clifty Creek to the Hardin County line. The landscape consists of moderately broad ridgetops dissected by many small drains (fig. 2). The main streams are bordered by narrow flood plains and moderately steep to steep valley walls. The ridges rise from about 200 to 300 feet above the valley floor.

This association makes up about 68 percent of the county. About 20 percent of this is Zanesville soils, 18 percent Gilpin soils, 11 percent Wellston soils, 10 percent Weikert soils, and the remaining 41 percent minor soils. The minor soils are the Cuba, Steff, Rarden, Crider, Ramsey, Shelocta, Stendal, and Bonnie.

Zanesville soils occur on ridgetops and mostly are gently sloping. They have a brown to strong-brown subsoil, are moderately deep to a slowly permeable fragipan, and are well drained to moderately well drained.

Gilpin soils are on side slopes below the Zanesville soils, and are mostly sloping to moderately steep. They have a brown to strong-brown subsoil, are moderately deep to bedrock, and are well drained.

Wellston soils are on side slopes below the Zanesville soils, and are mostly sloping to moderately steep. They have a brown to strong-brown subsoil, are deep, and are well drained.

Weikert soils are strongly sloping to steep and are on side slopes below the Gilpin and Wellston soils. Weikert soils have a light yellowish-brown subsoil, are shallow to bedrock, are well drained, and contain many coarse fragments.

Most farms in this association are operated by their owners and have small tobacco allotments. The average-sized farm is about 100 acres. A few dairy farms are in the association. The acreage of corn grown on the bottom lands along Caney Creek is considerable. Several farmers plant cucumbers for a cash crop. A considerable acreage revegetates naturally. Several small pine plantations are in the association. The hazard of erosion is the main limitation to use of the soils in this association for row crops.

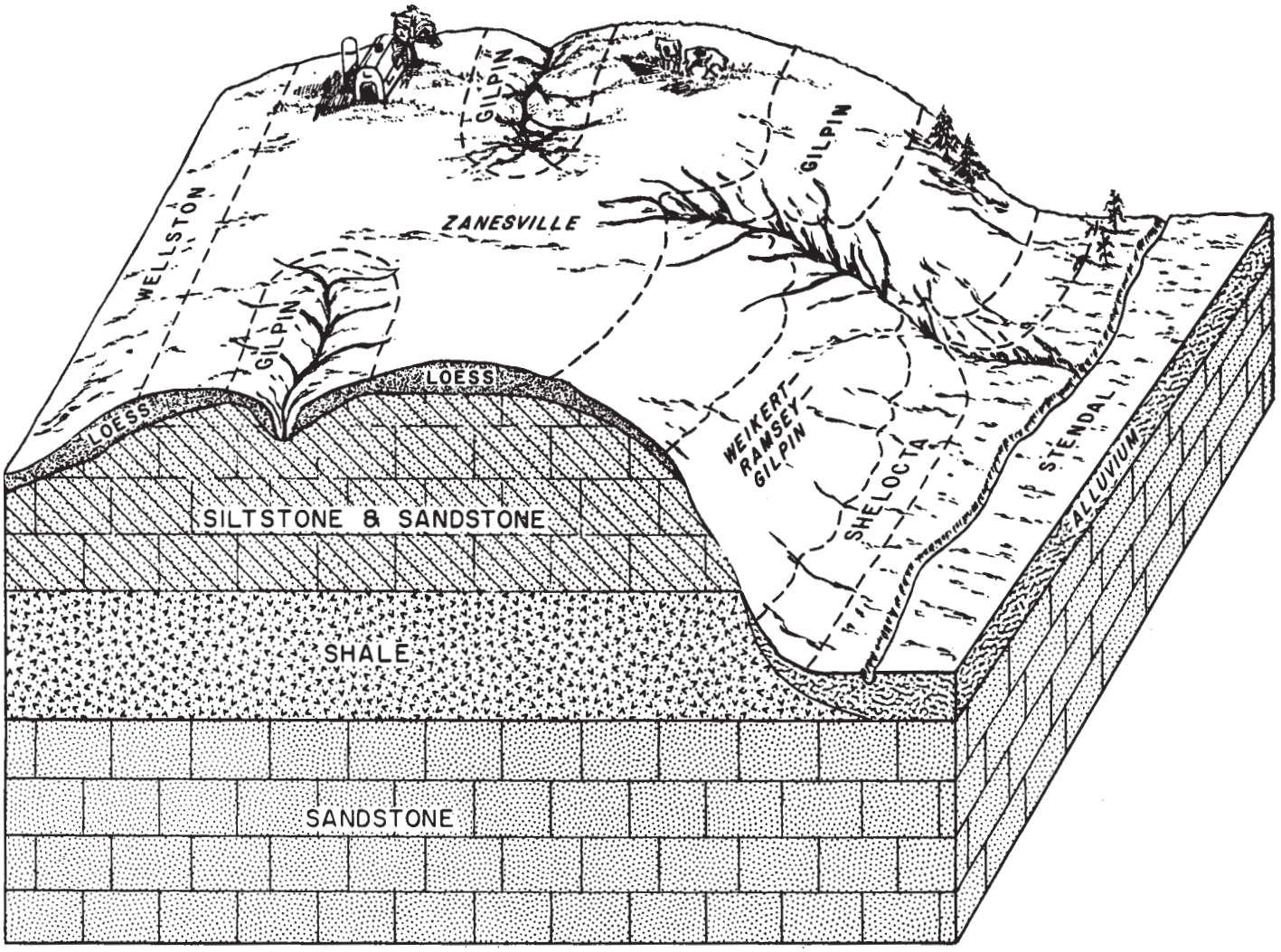

Figure 2.—**Relationship of soils to topography and underlying material in the Zanesville-Gilpin-Wellston-Weikert association.**

About 50 percent of the association, mostly the steep soils, is wooded. About 30 percent is in pasture and hay crops, and about 10 percent is in row crops, mainly on the ridgetops and in the valleys. About 10 percent is idle.

The soils in this association are used for building sites along the major highways. Special care should be taken in locating sewage disposal systems and wells for household water. The potential for recreation is good. Rough River Reservoir is adjacent to this association and provides excellent recreation facilities.

2. Caneyville-Weikert-Zanesville Association

Moderately deep and shallow, well-drained, dominantly stony and rocky, gently sloping to steep soils on side slopes and well drained to moderately well drained, sloping soils that have a fragipan, on ridgetops

This association consists of two irregularly shaped areas. The larger area extends in a narrow strip from Leitchfield southeasterly to Broad Ford on the Nolin River, and it also extends in a narrow strip parallel with the Nolin River from the Hardin County line to Dickeys Mill on the Edmonson County line. The smaller area lies to the north, southwest, and southeast of Short Creek. The landscape of this association is highly dissected and consists of relatively narrow ridgetops that break sharply to moderately steep to steep convex side slopes that descend to narrow valleys (fig. 3). Difference between high and low elevations ranges from about 250 to 350 feet. Throughout this association are small karst areas in which sinkholes and underground drains are common. The largest of these karst areas, called the sinks, is southeast of Short Creek.

This association makes up about 16 percent of the county. About 30 percent of this is Caneyville soils, 26 percent is Weikert soils, 14 percent is Zanesville soils, and the remaining 30 percent is minor soils. The minor soils in this association are in the Wellston, Gilpin, Christian, Mercer, Rarden, Nolin, Baxter, and Crider series.

The strongly sloping to steep Weikert soils are on side slopes, below the sloping Zanesville soils on the ridgetops and above the gently sloping to moderately steep Caneyville soils at the lower elevations. Common geologic faults change this pattern in a few places.

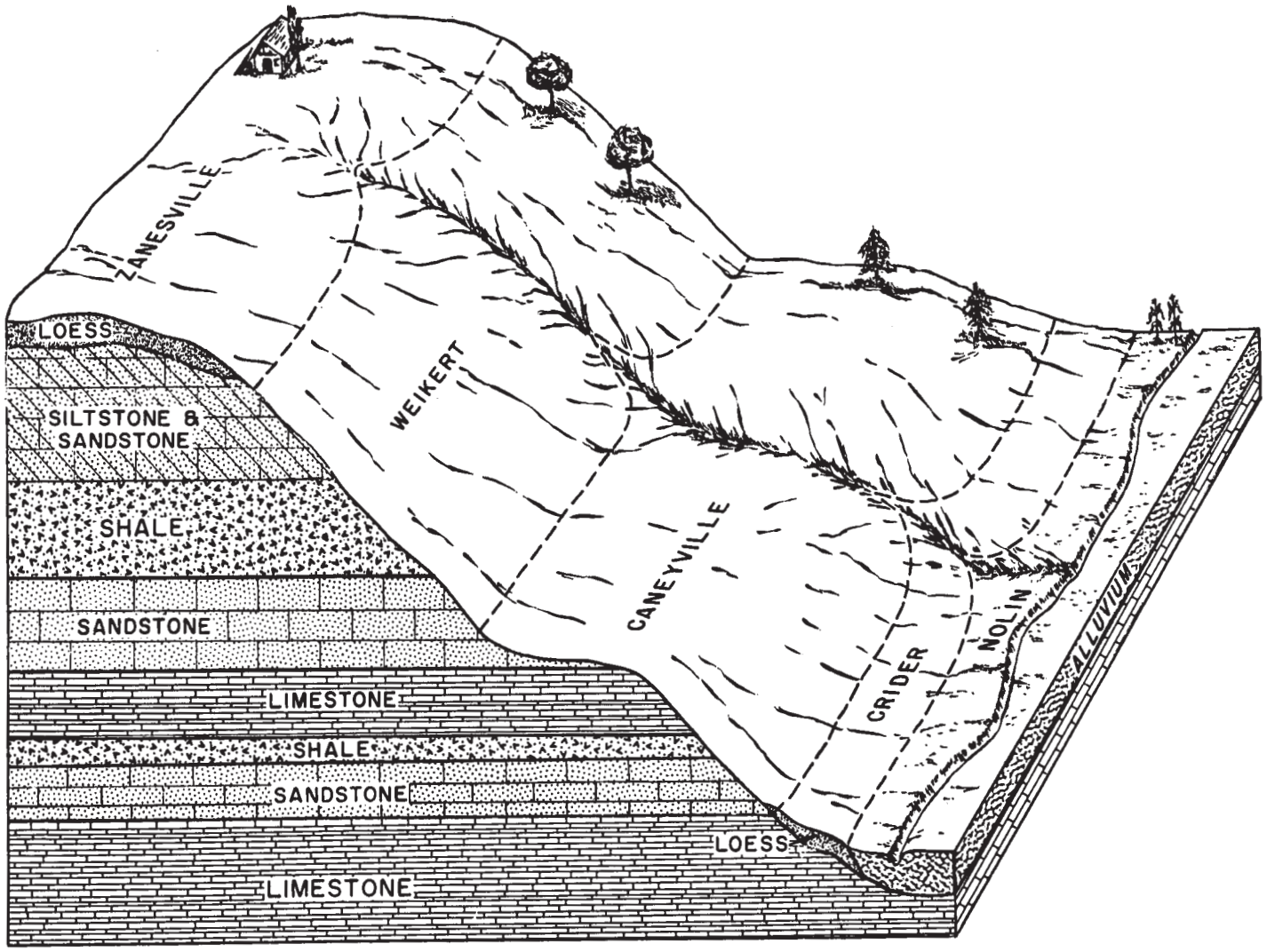

Figure 3.—Relationship of soils to topography and underlying material in the Caneyville-Weikert-Zanesville association.

Caneyville soils have a brown to yellowish-red clayey subsoil, are moderately deep to bedrock, and are well drained. The Weikert soils have a light yellowish-brown subsoil, are shallow to bedrock, and are well drained. Soils of both series are loamy, but the Weikert contains many coarse fragments. Zanesville soils are loamy, are moderately deep to a slowly permeable fragipan, are well drained to moderately well drained, and have a brown to strong-brown subsoil.

Most farms are operated by their owners and have small tobacco allotments. The average-sized farm is about 100 acres. The main limitation to use of the soils for row crops is hazard of erosion. About 40 percent of this association is in pasture and hay crops, about 30 percent is wooded, about 15 percent is in row crops, mainly corn and tobacco, and about 15 percent is idle. Much of the pasture is of low quality, especially that in areas of shallow soils where rock outcrops occur. Redcedar is naturally revegetating in some of the idle areas.

In this association the number of building sites is increasing along the major highways on the gently sloping to sloping soils. Special care should be taken in locating sewage disposal systems and wells for household water. Two limestone quarries in the association furnish farm limestone and road material. The potential for income-producing recreation is fair in this association. Nolin River Reservoir, which covers about 2,400 acres in this association, provides excellent recreation facilities.

3. Sadler-Zanesville-Wellston Association

Moderately well drained, nearly level to sloping soils that have a fragipan, on broad ridgetops and deep, dominantly well drained, sloping to strongly sloping soils on side slopes

This association is dominantly a nearly level plain that extends from Big Clifty near the Hardin County line on the northeast to Shrewsbury near the Edmonson County line on the southwest. It is deeply dissected by Clifty

Creek, which flows northwesterly through the area. The broadest part of the association lies to the northwest and southeast of the city of Clarkson. The landscape consists of broad ridgetops that gradually break to sloping and strongly sloping, convex side slopes that descend to narrow valleys (fig. 4). Difference between high and low elevations ranges from about 200 to 250 feet.

This association makes up about 16 percent of the county. About 40 percent of this is Sadler soils, 19 percent is Zanesville soils, 16 percent is Wellston soils, and the remaining 25 percent is minor soils. The minor soils in this association are in the Johnsburg, Gilpin, Weikert, Caneyville, Mercer, Crider, Stendal, and Steff series.

Normally, the sloping Zanesville soils are on side slopes below the Sadler soils on the ridgetops, and above the sloping to strongly sloping Wellston soils at the lower elevations.

Sadler soils have a yellowish-brown subsoil, are moderately deep to a slowly permeable fragipan, and are moderately well drained. The Zanesville soils have a brown to strong-brown subsoil, are moderately deep to a slowly permeable fragipan, and are well drained to moderately well drained. The Wellston soils have a brown to strong-brown subsoil, are deep, and are well drained.

The soils in this association are used mostly for general farming. Most of the farms are operated by their owners. The average-sized farm is about 160 acres. Most farms have small tobacco allotments. Several dairy farms are in the association. Some farms raise beef cattle or hogs. The main limitation to use of the soils in this association for row crops is hazard of erosion. About 50 percent of this association is in pasture and hay crops; about 30 percent is in row crops, mainly corn and tobacco; about 10 percent is wooded; and about 10 percent is idle.

Because the topography is smooth and good roads are numerous, many homes and farm buildings are located on these soils. Special care must be taken in locating sewage disposal systems and wells for household water because of the slowly permeable fragipan and the seasonal high water table of some soils.

Descriptions of the Soils

This section describes the soil series and mapping units of Grayson County. The approximate acreage and the proportionate extent of each mapping unit are given in table 1.

A detailed description of each soil series is given, and it is followed by brief descriptions of the mapping units

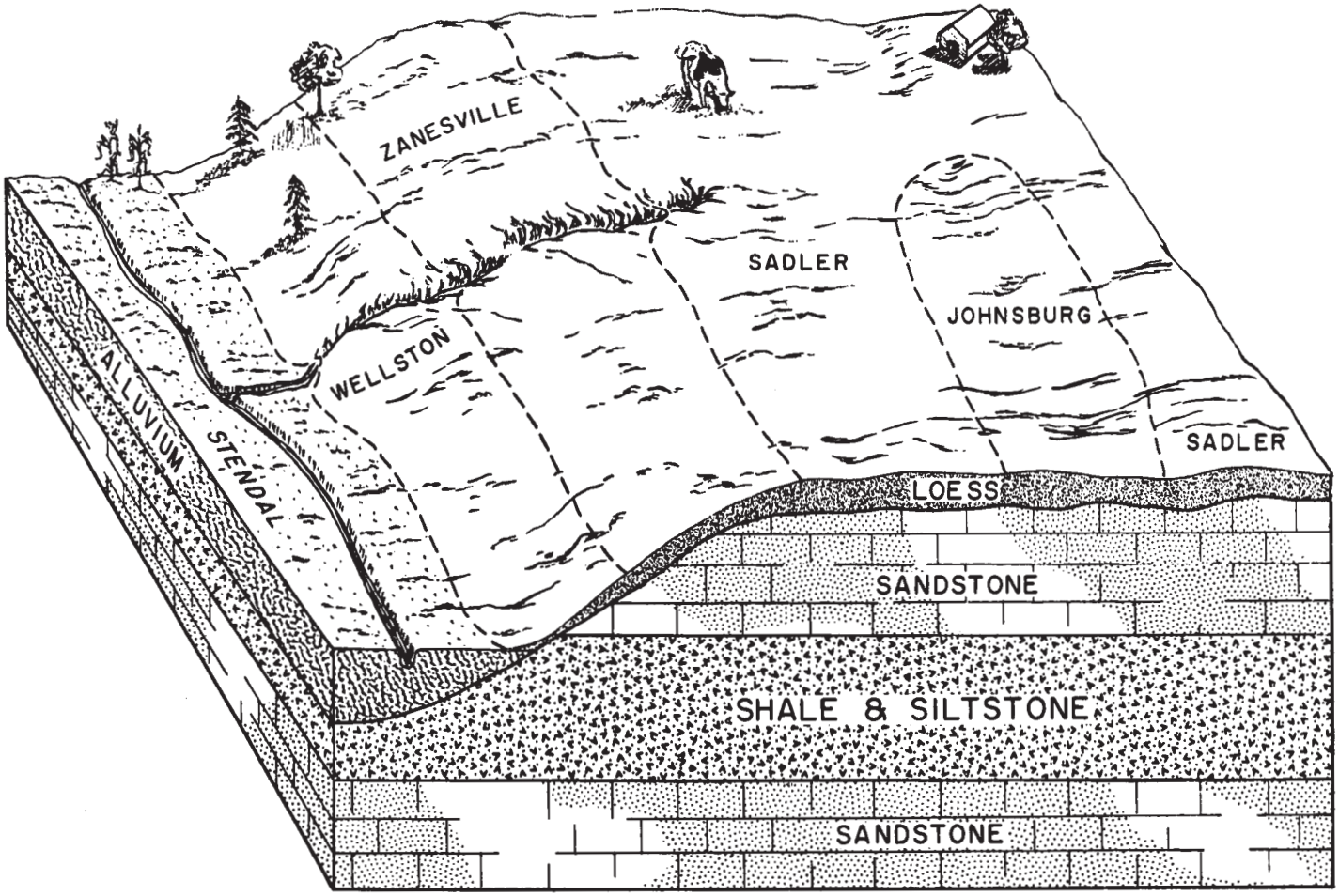

Figure 4.—Relationship of soils to topography and underlying material in the Sadler-Zanesville-Wellston association.

in that series. For full information on any one mapping unit, it is necessary to read the descriptions of the soil series as well as the description of the mapping unit.

An essential part of each soil series is the description of the soil profile, the sequence of layers beginning at the surface and continuing downward to the depths beyond which roots of most plants do not penetrate. Each soil series contains both a brief nontechnical and a detailed technical description of the soil profile. The nontechnical description will be useful to most readers. The detailed technical description is included for soil scientists, engineers, and others who need to make thorough and precise studies of soils.

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

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

Soil	Acres	Percent
Allegheny silt loam, 2 to 6 percent slopes	430	0.1
Allegheny silt loam, 6 to 12 percent slopes	370	.1
Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded	420	.1
Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded	650	.2
Bonnie silt loam	1,240	.4
Burgin silty clay loam	190	.1
Caneyville silty clay loam, 2 to 6 percent slopes	580	.2
Caneyville silty clay loam, 6 to 12 percent slopes	2,910	.9
Caneyville silty clay loam, 12 to 20 percent slopes	1,640	.5
Caneyville very rocky silty clay loam, 10 to 20 percent slopes	3,350	1.0
Caneyville very rocky silty clay loam, 20 to 40 percent slopes	2,700	.8
Caneyville silty clay, 6 to 20 percent slopes, severely eroded	5,040	1.5
Caneyville very rocky silty clay, 8 to 25 percent slopes, severely eroded	5,280	1.6
Caneyville-Rock outcrop complex	1,130	.3
Captina silt loam, 2 to 6 percent slopes	2,550	.8
Captina silt loam, 6 to 12 percent slopes	230	.1
Christian silt loam, 2 to 6 percent slopes	290	.1
Christian silt loam, 6 to 12 percent slopes	560	.2
Christian silty clay loam, 6 to 12 percent slopes, severely eroded	360	.1
Clifty gravelly silt loam	5,520	1.7
Crider silt loam, 2 to 6 percent slopes	1,560	.5
Crider silt loam, 6 to 12 percent slopes	910	.3
Crider silty clay loam, 6 to 12 percent slopes, severely eroded	690	.2
Cuba silt loam	3,720	1.1
Gilpin silt loam, 6 to 12 percent slopes	8,740	2.7
Gilpin silt loam, 12 to 20 percent slopes	14,350	4.4
Gilpin silt loam, 20 to 30 percent slopes	3,000	.9
Gilpin silty clay loam, 6 to 12 percent slopes, severely eroded	3,800	1.2
Gilpin silty clay loam, 12 to 20 percent slopes, severely eroded	15,320	4.6
Gilpin silty clay loam, 20 to 30 percent slopes, severely eroded	1,140	.3
Gullied land	3,540	1.1
Johnsburg silt loam	4,330	1.3
Lindside silt loam	1,900	.6
Mercer silt loam, 2 to 6 percent slopes	1,560	.5
Newark silt loam	1,420	.4
Nolin silt loam	2,910	.9
Ramsey loam, 10 to 20 percent slopes	1,710	.5
Ramsey loam, 10 to 30 percent slopes, severely eroded	870	.3
Rarden silt loam, 6 to 12 percent slopes	960	0.3
Rarden silt loam, 12 to 20 percent slopes	1,990	.6
Rarden silty clay loam, 6 to 12 percent slopes, severely eroded	650	.2
Rarden silty clay loam, 12 to 20 percent slopes, severely eroded	1,340	.4
Sadler silt loam, 0 to 2 percent slopes	6,800	2.1
Sadler silt loam, 2 to 6 percent slopes	30,360	9.2
Shelocta gravelly silt loam, 2 to 6 percent slopes	690	.2
Shelocta gravelly silt loam, 6 to 12 percent slopes	5,410	1.7
Shelocta gravelly silt loam, 12 to 20 percent slopes	1,120	.3
Shelocta gravelly silt loam, 12 to 20 percent slopes, severely eroded	300	.1
Steff silt loam	2,950	.9
Stendal silt loam	5,940	1.8
Weikert channery silt loam, 12 to 30 percent slopes	12,180	3.7
Weikert channery silt loam, 12 to 30 percent slopes, severely eroded	3,900	1.2
Weikert-Ramsey-Gilpin stony complex, 20 to 30 percent slopes	20,550	6.2
Weikert-Ramsey-Gilpin stony complex, 20 to 30 percent slopes, severely eroded	5,060	1.6
Weikert-Ramsey-Gilpin stony complex, 30 to 50 percent slopes	17,430	5.2
Wellston silt loam, 2 to 6 percent slopes	1,000	.3
Wellston silt loam, 6 to 12 percent slopes	17,290	5.3
Wellston silt loam, 12 to 20 percent slopes	2,270	.7
Wellston silty clay loam, 6 to 12 percent slopes, severely eroded	9,160	2.8
Wellston silty clay loam, 12 to 20 percent slopes, severely eroded	4,620	1.4
Wellston silt loam, clayey subsoil variant, 6 to 12 percent slopes	1,020	.3
Wellston silt loam, clayey subsoil variant, 12 to 20 percent slopes	400	.1
Wellston silty clay loam, clayey subsoil variant, 6 to 12 percent slopes, severely eroded	470	.1
Wellston silty clay loam, clayey subsoil variant, 12 to 20 percent slopes, severely eroded	590	.2
Zanesville silt loam, 2 to 6 percent slopes	36,070	10.9
Zanesville silt loam, 6 to 12 percent slopes	22,220	6.8
Zanesville silty clay loam, 6 to 12 percent slopes, severely eroded	4,280	1.3
Miscellaneous (borrow areas, quarries, mine spoil)	490	.1
Water	4,540	1.4
Total	328,960	100.0

Soil scientists, engineers, students, and others who are interested in how the soils formed and want to know about their classification in the nationwide system of soil classification should turn to the section "Formation and Classification of the Soils."

Many terms used in the soil descriptions and other sections are defined in the Glossary at the back of this survey and in the "Soil Survey Manual" (*17*)[1]. Unless stated otherwise, the colors given in each representative profile are for the soil when moist.

Allegheny Series

The Allegheny series consists of deep, well-drained soils that formed in alluvium washed from uplands underlain by siltstone, sandstone, shale, and limestone. These soils occur on stream terraces and are gently sloping to sloping. They are mostly adjacent to the flood plains along the Rough and Nolin Rivers.

In a typical profile the surface layer is brown silt loam about 7 inches thick. The upper part of the subsoil, to a depth of about 29 inches, is silt loam in the upper part and clay loam in the lower part. This part is brown and friable. The lower part of the subsoil extends to a depth of 39 inches. It and the substratum, to a depth of about 50 inches, are strong-brown, friable sandy clay loam.

The Allegheny soils have a deep root zone and are moderately permeable. They are strongly acid or very strongly acid in the surface layer unless limed and are moderately high in natural fertility. The available moisture capacity is high. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting, except for some small severely eroded areas where the subsoil is exposed.

Representative profile of Allegheny silt loam, 2 to 6 percent slopes (approximately one-fourth mile northeast of Spurrier and 400 feet west of the Nolin River):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; strongly acid; abrupt, smooth boundary.

B1—7 to 11 inches, brown (7.5YR 4/4) silt loam; weak, fine, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

B21t—11 to 29 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular and angular blocky structure; friable; few thin clay films; very strongly acid; gradual, smooth boundary.

B22t—29 to 39 inches, strong-brown (7.5YR 5/6) sandy clay loam; weak, fine, subangular blocky structure; friable; few thin clay films; few dark-brown concretions; very strongly acid; gradual, smooth boundary.

C—39 to 50 inches +, strong-brown (7.5YR 5/6) sandy clay loam; massive; friable; few dark-brown concretions; very strongly acid.

Bedrock is at a depth of 60 inches or more. The solum ranges from about 30 to 40 inches in thickness. Beds of gravel are at a depth below 3 feet in some places. The Ap horizon ranges from brown (10YR 4/3) to dark grayish brown (10YR 4/2). The B21t horizon ranges from brown (7.5YR 4/4) to strong brown (7.5YR 5/6) in color and is clay loam or heavy loam in texture. The B22t horizon ranges from sandy clay loam to silty clay loam or silt loam in some places. Stratified silt, sand, and clay commonly are at a depth below about 4 feet.

The Allegheny soils occur with the moderately well drained Captina soils and the somewhat poorly drained Johnsburg soils. Allegheny soils lack the fragipan of the Captina and the Johnsburg soils and have a redder subsoil. They are on stream terraces near the well drained Cuba soils, the moderately well drained Steff soils, and the somewhat poorly drained Stendal soils, all of which are on flood plains and are younger than the Allegheny soils.

Allegheny silt loam, 2 to 6 percent slopes (AeB).—This well-drained, gently sloping soil has convex slopes and occurs on benches at slightly higher elevations than the flood plains. Areas range from about 3 to 8 acres in size. A profile of this soil is described as typical for the series.

Included with this soil in mapping are a few areas of moderately eroded soils and a few areas of soils that are nearly level. Also included are areas of soils that contain more clay and less sand in the subsoil than this soil and some areas where the surface layer is loam.

The erosion hazard is moderate in cultivated areas. Plants respond well to applications of fertilizer and lime. Organic-matter content is medium.

This soil is used mostly for row crops, hay, and pasture. It has good potential for truck crops. (Capability unit IIe–1; woodland suitability group 3)

Allegheny silt loam, 6 to 12 percent slopes (AeC).—This well-drained, sloping soil is on relatively smooth benches at slightly higher elevations than the flood plains. Areas range from about 3 to 12 acres in size. The profile of this soil has a redder plow layer than that described as typical for the series. This layer consists partly of the original surface layer and partly of subsoil material.

Included with this soil in mapping are soils that contain more clay and less sand in the subsoil and some soils that have a loam surface layer. Also included are small areas that are only slightly eroded and small areas that are severely eroded.

Erosion is a severe hazard in cultivated areas. Plants respond well to applications of fertilizer and lime. The organic-matter content is medium.

This soil is used mostly for pasture and hay, but there is a small acreage in row crops. (Capability unit IIIe–1; woodland suitability group 3)

Baxter Series

The Baxter series consists of deep, well-drained soils that formed in residuum from cherty limestone. These soils are sloping to strongly sloping and are on karst uplands. They are mostly in the karst area of the county.

In a typical profile the surface layer is yellowish-red cherty silty clay loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is yellowish-red, firm cherty silty clay loam in the upper 4 inches and red and yellowish-red, very firm and plastic cherty clay to a depth of about 39 inches. The lower part of the subsoil is red, very firm and very hard clay that has common brown mottles.

Baxter soils have a deep root zone and are moderately permeable. They are moderate in natural fertility and are medium acid to very strongly acid in the surface layer unless limed. Available moisture capacity is moderate, and organic-matter content is very low.

Representative profile of Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded (500 yards southwest of State Route 54 and 50 feet northwest of State Route 631):

Ap—0 to 6 inches, yellowish-red (5YR 5/6) cherty silty clay loam; moderate, medium, subangular and angular

[1] Italic numbers in parentheses refer to Literature Cited, page 79.

blocky structure; friable; medium acid; clear, smooth boundary.

B21t—6 to 10 inches, yellowish-red (5YR 5/6) cherty silty clay loam; moderate, medium, subangular and angular blocky structure; firm; continuous clay films; very strongly acid; gradual, smooth boundary.

B22t—10 to 30 inches, red (2.5YR 4/6) cherty clay; moderate, medium, angular blocky structure; very firm when moist, sticky and plastic when wet; continuous clay films; very strongly acid; gradual, wavy boundary.

B31t—30 to 39 inches, yellowish-red (5YR 4/6) cherty clay that has common, medium, distinct variegations of strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; very firm when moist, sticky and plastic when wet, hard when dry; continuous clay films; very strongly acid; gradual, wavy boundary.

B32t—39 to 60 inches, red (2.5YR 4/6) clay that has common, medium, distinct variegations of strong brown (7.5YR 5/6) and light yellowish brown (2.5Y 6/4); strong, angular blocky structure; very firm when moist, sticky and plastic when wet, very hard when dry; nearly continuous clay films; very strongly acid.

The solum ranges from about 60 to 80 inches in thickness. Depth to limestone bedrock is 60 inches or more. The Ap horizon is brown (7.5YR 4/4) in some places. A strong-brown (7.5YR 5/6) or yellowish-red (5YR 4/6) cherty silty clay loam B1 horizon occurs in some areas. The B22t horizon ranges from heavy silty clay loam to clay. It ranges from 5YR to 2.5YR in hue. The chert content of the B21t and B22t horizons ranges from about 15 to 35 percent. The B31t horizon is 2.5YR to 5YR in hue and is silty clay or clay.

The Baxter soils occur with the Crider, Christian, and Caneyville soils but have a higher content of chert throughout the profile than those soils. The Baxter soils have redder and more clayey B horizons than the Crider soils, which are more friable and contain more silty loess. They typically contain less sand and are redder than the Christian soils throughout the profile. Baxter soils are deeper to bedrock than the Caneyville soils, which commonly have rock outcrops on the surface.

Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded (BcC3).—This well-drained, sloping soil is on convex side slopes in karst areas. Areas of this soil range from about 7 to 15 acres in size. The surface layer consists mostly of subsoil material that has been exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas of a soil that is less cherty in the lower part of the subsoil and some areas of a soil that is redder in the upper part of the subsoil than the Baxter soils. Also included is a small acreage of slightly eroded and of moderately eroded Baxter soils.

The erosion hazard is very severe where this soil is used for cultivated crops. Plants respond well to applications of fertilizer and lime. Tillage is somewhat difficult because of the chert and clay in the plow layer.

This soil is used mostly for pasture, but a few areas are in hay. A few idle areas are revegetating naturally and provide food and cover for wildlife. (Capability unit IVe–11; woodland suitability group 6)

Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded (BcD3).—This well-drained, strongly sloping soil is on side slopes in karst areas. Areas range from about 4 to 16 acres in size. A profile of this soil is described as typical for the series. The surface layer consists mostly of subsoil material that was exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are a few small areas of a soil that is less cherty in the lower part of the subsoil than this soil and some areas of a soil that is redder in the upper part of the subsoil. A small acreage of slightly eroded and moderately eroded Baxter soils is also included.

Because of past erosion and hazard of additional erosion, this soil is not suited to cultivation and should remain in a permanent plant cover. Plants respond well to applications of fertilizer and lime. Tillage is somewhat unfavorable because of the chert and clay in the surface layer.

This soil is used mostly for pasture and woods. A few idle areas are revegetating naturally and provide food and cover for wildlife. (Capability unit VIe–4; woodland suitability group 6)

Bonnie Series

The Bonnie series consists of deep, poorly drained soils that formed in alluvium washed from soils of the uplands that are underlain primarily by sandstone, siltstone, shale, and loess. These soils are nearly level and occur on flood plains along the streams in the sandstone and shale areas.

In a typical profile the surface layer, about 7 inches thick, is brown silt loam that has common, light brownish-gray mottles. The subsoil extends to a depth of 23 inches and is light brownish-gray, friable to firm silt loam that has common, yellowish-brown mottles. Below this, to a depth of 50 inches, is mottled light brownish-gray, yellowish-brown, and light olive-gray silt loam.

The Bonnie soils have a deep root zone and are moderately permeable. They are strongly acid or very strongly acid in the surface layer unless limed, and are moderate in natural fertility. The available moisture capacity is high, and organic-matter content is low. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Bonnie silt loam, (one-half mile east of Steff and 100 feet south of U.S. Highway No. 62):

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; common, medium, distinct mottles of light brownish gray (2.5Y 6/2); weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

Bg—7 to 23 inches, light brownish-gray (2.5Y 6/2) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/6); weak, fine, granular structure; friable to firm; very strongly acid; gradual, smooth boundary.

Cg—23 to 50 inches +, mottled light brownish-gray (2.5Y 6/2), yellowish-brown (10YR 5/6), and light olive-gray (5Y 6/2) silt loam; massive; firm; much black concretionary material; very strongly acid.

The alluvial deposit is more than 60 inches thick. Reaction is strongly acid or very strongly acid throughout the profile unless the soil has been limed. The Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). The Bg and Cg horizons include light brownish gray, pale olive, olive gray, olive, pale brown, dark yellowish brown, brown, gray, and light gray. The grayish colors are dominant. The Bg and Cg horizons are silt loam or light silty clay loam.

The Bonnie soils occur with the well drained Cuba soils, the moderately well drained Steff soils, and the somewhat poorly drained Stendal soils. Bonnie soils are lighter colored and more poorly drained than the Cuba, Steff, and Stendal soils and contain a higher percentage of grayish colors in the upper part of the subsoil.

Bonnie silt loam (Bo).—This poorly drained, nearly level soil is on flood plains. Areas of this soil range from about 5 to 30 acres in size. Slopes range from 0 to 2 percent in most places.

Included with this soil in mapping are a few areas of Stendal soils and of soils that have a loam surface layer. Also included are areas of soils that have a stratified profile.

Erosion is not a hazard on this soil. Planting crops in spring is delayed by a seasonal high water table that rises to the surface during rainy periods. Where outlets are available, artificial drainage decreases wetness. These soils are subject to flooding during winter and spring. Scouring and deposition are slight hazards. Crops respond well to applications of fertilizer and lime.

This soil is used mostly for hay and pasture. A small acreage is in row crops, and a small acreage is in trees. (Capability unit IIIw–5; woodland suitability group 2)

Burgin Series

The Burgin series consists of deep, very poorly drained, dark soils that formed in material weathered from limestone. They are nearly level and depressional and are mostly in the Mulberry Flats area.

In a typical profile the surface layer, about 10 inches thick, is black silty clay loam. The upper part of the subsoil, to a depth of about 16 inches, is a very dark gray, firm, sticky and plastic silty clay. The lower part of the subsoil extends to a depth of about 28 inches and is mottled light olive-brown, dark grayish-brown, and yellowish-brown, very firm clay that is sticky when wet and hard when dry. The underlying material is mottled gray, light olive-brown, and strong-brown, firm silty clay that is sticky when wet and hard when dry. Limestone bedrock is at a depth of about 39 inches.

Burgin soils have a deep root zone and high available moisture capacity. They are high in natural fertility and are neutral in the surface layer. Organic-matter content is high. Permeability is slow.

Representative profile of Burgin silty clay loam (2 miles northeast of Leitchfield, 75 feet west of Salt River Road, in cornfield):

Ap—0 to 10 inches, black (10YR 2/1) silty clay loam; moderate, fine and medium, granular structure; friable to firm; neutral; clear, smooth boundary.

B1tg—10 to 16 inches, very dark gray (10YR 3/1) silty clay that has common, medium, distinct mottles of light olive brown (2.5Y 5/4); moderate, fine, angular blocky structure; firm when moist, sticky and plastic when wet; few clay films on ped surfaces; common, black and dark reddish-brown concretions; neutral; gradual, smooth boundary.

B2tg—16 to 28 inches, mottled light olive-brown (2.6Y 5/4), dark grayish-brown (2.5Y 4/2), and yellowish-brown (10YR 5/6) clay; weak to moderate, fine, angular blocky structure; very firm when moist, sticky and plastic when wet, hard when dry; few clay films on ped surfaces; common black and dark reddish-brown concretions; neutral; gradual, smooth boundary.

Cg—28 to 39 inches, mottled gray (5Y 5/1), light olive-brown (2.5Y 5/4), and strong-brown (7.5YR 5/6) silty clay; massive; firm when moist, sticky and plastic when wet, hard when dry; common black and dark reddish-brown concretions; mildly alkaline.

R—39 inches +, limestone bedrock.

Depth to bedrock ranges from about 36 to 60 inches or more. The solum ranges from about 20 to 36 inches in thickness. The B1tg horizon is mottled with dark yellowish brown (10YR 4/4) in some places. It ranges from silty clay loam to silty clay in some areas. In some places the B2tg horizon has a dominant color of gray (10YR 5/1) to dark gray (10YR 4/1) and the texture ranges from silty clay loam to clay. Mottled colors of the Cg horizon include yellowish brown, reddish brown, light brownish gray, and olive gray. The Cg horizon is silty clay to clay.

The Burgin soils occur with the Caneyville, Mercer, and Johnsburg soils. Burgin soils have a darker surface layer and are more poorly drained than any of those associated soils. They are deeper to bedrock and lack the irregularly mixed parent material of the Caneyville soils. The Burgin soils are more clayey and grayer in the upper part of the B horizon than the moderately well drained Mercer soils. They lack the fragipan of the somewhat poorly drained Johnsburg soils, which formed in silty loess overlying residuum from sandstone and shale.

Burgin silty clay loam (Bu).—This very poorly drained, nearly level soil occurs in depressions of the uplands. Areas range from about 3 to 15 acres in size. In most places slopes range from 0 to 2 percent.

Included with this soil in mapping are a few areas of somewhat poorly drained and poorly drained soils that have a dark grayish-brown surface layer.

Erosion is not a hazard on this soil, but water tends to collect on the surface during rainy periods. Artificial drainage improves crop growth and is feasible if suitable outlets are available. This soil is slightly difficult to till because of the clay in the plow layer. Plants respond well to applications of fertilizer. Most crops do not need additions of lime.

This soil is used mostly for row crops, hay, and pasture. (Capability unit IIIw–5; woodland suitability group 2)

Caneyville Series

The Caneyville series consists of moderately deep, well-drained soils that formed in residuum from mixed limestone, sandstone, and shale. These soils are gently sloping to steep and are on uplands.

In a typical profile the surface layer, about 5 inches thick, is very dark grayish-brown silty clay loam. The subsoil extends to a depth of about 18 inches and is silty clay that is firm when moist and sticky and plastic when wet. The subsoil is brown in the upper part and yellowish red in the lower part. The underlying material extends to a depth of about 24 inches and is brown clay that is plastic when wet, very firm when moist, and very hard when dry. Limestone bedrock is at a depth of about 24 inches.

The Caneyville soils have a moderately deep root zone and moderately slow permeability. These soils have moderate natural fertility and are medium acid in the surface layer unless limed.

Representative profile of Caneyville silty clay loam, 12 to 20 percent slopes (4 miles northwest of Leitchfield, one-half mile north of State Route 737, on west roadbank of Hanging Rock Road):

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) silty clay loam; weak, fine, granular structure; friable; few small fragments of sandstone; few fine roots; neutral; abrupt, smooth boundary.

B21t—5 to 9 inches, brown (7.5YR 4/4) silty clay; moderate, medium, angular blocky structure; firm when moist, sticky and plastic when wet, and hard when dry; patchy, thin clay films; medium acid; clear, smooth boundary.

B22t—9 to 18 inches, yellowish-red (5YR 4/6) silty clay; moderate, medium, angular blocky structure; very firm when moist, sticky and plastic when wet, and hard

when dry; patchy, thin clay films; medium acid; clear, wavy boundary.

C—18 to 24 inches, brown (7.5YR 4/2) clay; massive; very firm when moist, sticky and plastic when wet, and very hard when dry; much dark-brown concretionary material; medium acid.

R—24 inches +, limestone bedrock.

The solum ranges from about 12 to 24 inches in thickness. Depth to bedrock generally ranges from about 20 to 40 inches, though rock crops out in many places, especially on the steep slopes. Very rocky phases were mapped where rock outcrops comprise about 8 to 30 percent of the surface. The A horizon is silty clay loam or silty clay in most places. The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2) in some areas. In some places there is a thin B1 horizon, generally silty clay loam, that ranges from 7.5YR to 5YR in hue. The B21t horizon is yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), or yellowish red (5YR 4/6) in some places. It is silty clay loam or silty clay. In some places the profile does not have a B22t horizon. Variegated colors of the B22t horizon are olive (5Y 5/3), light olive brown (2.5Y 5/4), or strong brown (7.5YR 5/6). The B22t horizon ranges from heavy silty clay loam to clay. In some places the profile has a B3 horizon. The C horizon ranges from about 4 to 20 inches in thickness. Its colors include red, strong brown, yellowish brown, and light olive brown.

The Caneyville soils occur with the Christian, Mercer, Weikert, Ramsey, and Rarden soils. Caneyville soils have thinner and less acid B horizons than the Christian soils and are more shallow to bedrock. They are more shallow to bedrock and have redder B horizons than the moderately well drained Mercer soils. Caneyville soils have thicker, redder, and finer textured B horizons and have less coarse fragments than the Weikert and Ramsey soils and are deeper to bedrock. They are redder in hue and less acid in the B horizons than the Rarden soils.

Caneyville silty clay loam, 2 to 6 percent slopes (CcB).—This well-drained, gently sloping soil is on narrow ridgetops. Areas range from about 3 to 10 acres in size. Plowing has mixed some of the subsoil material with the surface layer.

Included with this soil in mapping are areas of severely eroded Caneyville soils and a few areas of a soil that has a thinner subsoil than this Caneyville soil. Also included are a few small areas of Christian and Mercer soils.

Erosion is a severe hazard in cultivated areas. The available moisture capacity is moderate, and the organic-matter content is low. Plants respond fairly well to applications of fertilizer and lime. This soil is fairly easy to till, except in areas where the clayey subsoil has been exposed by erosion.

This soil is used mostly for pasture and hay, but a few areas are in row crops. (Capability unit IIIe–14; woodland suitability group 5)

Caneyville silty clay loam, 6 to 12 percent slopes (CcC).—This well-drained, sloping soil is on smooth side slopes and ridgetops. Areas of this soil range from about 5 to 15 acres in size. Plowing has mixed some of the subsoil material with the surface layer.

Included with this soil in mapping are a few areas of a soil that has a thinner subsoil than this Caneyville soil and has a few rock outcrops on the surface. Also included are a few small areas of Mercer and Christian soils.

Erosion is a very severe hazard in cultivated areas. The available moisture capacity is moderate, and organic-matter content is low. Plants respond fairly well to applications of fertilizer and lime. This soil is fairly easy to till, except in areas where the clayey subsoil has been exposed by erosion.

This soil is used mostly for pasture and hay, but a small acreage is in row crops. A few areas are wooded, and a few areas are idle. (Capability unit IVe–6; woodland suitability group 5)

Caneyville silty clay loam, 12 to 20 percent slopes (CcD).—This well-drained, strongly sloping soil is on slightly convex side slopes. Areas range from about 5 to 25 acres in size. A profile of this soil is described as typical for the series. Plowing has mixed some of the subsoil material with the surface layer.

Included with this soil in mapping are a few areas of a soil that has a thinner subsoil than in this Caneyville soil and has a few rock outcrops on the surface. Also included are areas of Christian soils.

This soil is not suited to cultivation, because it is strongly sloping and susceptible to erosion. The available moisture capacity is moderate to low, organic-matter content is low, and the root zone is limited by bedrock at a depth of about 20 to 40 inches. Plants respond fairly well to applications of fertilizer and lime. This soil is fairly easy to till, except in areas where the clayey subsoil has been exposed by erosion. It is used mostly for pasture and trees. (Capability unit VIe–7; woodland suitability group 5)

Caneyville very rocky silty clay loam, 10 to 20 percent slopes (CeD).—This well-drained, strongly sloping soil is on side slopes in the uplands. Areas range from about 5 to 22 acres in size. Rock outcrops comprise about 8 to 30 percent of the areas.

Included with this soil in mapping are a few areas of a soil that has a thinner subsoil than in this Caneyville soil. Also included is a soil that has a redder subsoil and formed entirely from limestone.

Rockiness and the hazard of erosion make this soil unsuited to cultivated crops. The available moisture capacity is moderate to low, and organic-matter content is medium.

This soil is suited to pasture that can be grazed for only a short time, but pasture is difficult to establish and maintain. Most areas are wooded, but a small acreage is in pasture. (Capability unit VIs–1; woodland suitability group 5)

Caneyville very rocky silty clay loam, 20 to 40 percent slopes (CeF).—This well-drained, moderately steep to steep soil is on side slopes in the uplands. Areas range from about 6 to 25 acres in size. Rock outcrops make up about 8 to 30 percent of the areas.

Included with this soil in mapping are a few areas of a soil that has a thinner subsoil than in this Caneyville soil. Also included are areas of nonrocky soils and a few small areas of Weikert and Gilpin soils.

Rockiness, steepness, and droughtiness make this soil unsuited to cultivation, and use for pasture is limited. This soil is used mostly for trees, but a few small areas are in pasture. (Capability unit VIIs–1; woodland suitability group 5)

Caneyville silty clay, 6 to 20 percent slopes, severely eroded (ClD3).—This well-drained, sloping to strongly sloping soil is on side slopes and ridgetops in the uplands. Areas of this soil range from about 4 to 18 acres in size. The profile of this soil differs from the one described as typical for the series in that the plow layer, which consists mostly of subsoil material exposed by erosion, is redder and more clayey. Some areas have rills and shallow gullies.

Included with this soil in mapping are a few areas of a soil that has a thinner subsoil than in this Caneyville soil and that has a few rock outcrops on the surface. Also included are a few small areas of Christian and Mercer soils.

A severe erosion hazard and moderately deep root zone make this soil unsuited to culivated crops and necessitate a permanent vegetative cover. Plants respond fairly well to applications of fertilizer and lime. Available moisture capacity is moderate to low, and organic-matter content is very low. Tillage is difficult because of the clayey plow layer.

This soil is used mostly for pasture, but a few areas are in hay. A moderate acreage is idle, is being revegetated naturally, and is providing food and cover for wildlife. (Capability unit VIe–4; woodland suitability group 7)

Caneyville very rocky silty clay, 8 to 25 percent slopes, severely eroded (CnD3).—This well-drained, sloping to moderately steep soil is on side slopes in the uplands. Areas range from about 5 to 25 acres in size. The profile of this soil has a redder, more clayey plow layer than the profile described as typical for the series. This is because erosion has removed most of the original surface layer, and the plow layer is mostly subsoil material. Rock outcrops make up about 8 to 30 percent of the areas. Some areas have rills and shallow gullies.

Included with this soil in mapping are areas of a soil that has a thinner subsoil than this Caneyville soil and a few areas where the soil formed entirely from limestone and has a redder subsoil. Also included are some areas of Weikert and Gilpin soils.

Because of erosion, rockiness, and droughtiness, this soil is not suited to cultivated crops and is very poorly suited to pasture (fig. 5). Organic-matter content is very low. This soil is used mostly for trees and pasture of low quality. Although a large acreage is idle, it is revegetating naturally and is providing food and cover for wildlife. (Capability unit VIIs–3; woodland suitability group 7)

Figure 5.—**Pasture on Caneyville very rocky silty clay, 8 to 25 percent slopes, severly eroded. Rocks make moving and renovating of pasture very difficult.**

Caneyville-Rock outcrop complex (Co).—This is a complex of Caneyville soils and rock outcrops that are intermingled in such an intricate pattern that mapping them separately was not practical. Outcrops of bedrock are prominent. The rocks are mostly limestone, but there are a few areas of sandstone. Rock outcrops cover from 30 to 70 percent of the mapped areas and average about 45 percent of the total acreage. Caneyville soils are dominant between the rocks and make up about 55 percent of the complex. Slopes range from about 15 to 90 percent, but the average slope is about 35 percent. Mapped areas range from about 3 to 10 acres in size.

Included with this complex in mapping are small areas of Christian, Rarden, and Gilpin soils and some soils that are more shallow to bedrock than the Caneyville soils in this mapping unit.

This complex is too rocky for cultivation. In some areas where rock outcrops are fewest, it can be used for pasture that is grazed for only a short time. Most areas, however, are suited only to trees and providing food and cover for wildlife. (Capability unit VIIs–3; woodland suitability group 7)

Captina Series

The Captina series consists of moderately well drained soils that have a fragipan. These soils developed in alluvium washed from soils of the uplands that are underlain by siltstone, sandstone, shale, and, in a few areas, limestone. They are gently sloping to sloping and are on terraces adjacent to flood plains of the major streams.

In a typical profile the surface layer, about 7 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 24 inches and is yellowish-brown, friable silt loam. The lower part of the subsoil (fragipan) extends to a depth of 36 inches and is mottled yellowish-brown and light brownish-gray silty clay loam that is very firm, brittle, and compact. Underlying the subsoil is mottled light olive-gray and yellowish-brown silt loam.

Captina soils are moderately deep to a fragipan that slows water movement and restricts root growth. These soils are strongly acid or very strongly acid in the surface layer unless limed, and they are moderate in natural fertility. The available moisture capacity is moderate, and organic-matter content is low. The soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Captina silt loam, 2 to 6 percent slopes (approximately 2 miles south of Caneyville, 220 yards north of Macedonia Church, 110 yards southwest of State Route 185, on a south roadbank):

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

B21t—7 to 15 inches. yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable; thin, patchy clay films on ped surfaces; very strongly acid; clear, smooth boundary.

B22t—15 to 24 inches, yellowish-brown (10YR 5/4) silt loam; few, fine, faint mottles of light brownish gray (10YR 6/2) in the lower part; moderate, medium, subangular and angular blocky structure; friable; few clay films in pores; very strongly acid; gradual, smooth boundary.

Bx—24 to 36 inches, mottled yellowish-brown (10YR 5/6) and light brownish-gray (2.5Y 6/2) silty clay loam; moderate, medium, angular blocky structure; very

firm, brittle, and compact; very strongly acid; gradual, irregular boundary.

Cx—36 to 49 inches +, mottled light olive-gray (5Y 6/2) and yellowish-brown (10YR 5/6) silt loam; massive; very firm, brittle, and compact; many black concretions; very strongly acid.

The solum ranges from about 30 to 48 inches in thickness. The depth to the fragipan ranges from about 18 to 26 inches. Depth to bedrock is more than 60 inches. In some areas the upper 15 inches of the profile has a high silt content because of influence from loess. In places the Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 4/3), or dark yellowish brown (10YR 4/4). In some places the profile has a B1 horizon that is silt loam and ranges from 4 to 6 inches in thickness. Dominant colors of the B21t and B22t horizons include light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6). These horizons are heavy silt loam or light silty clay loam. Mottled colors in the fragipan include light gray, pale brown, and strong brown. Stratified silt, sand, and clay are at depths below 4 feet.

The Captina soils occur with the well-drained Allegheny and the somewhat poorly drained Johnsburg soils. They have a fragipan, whereas the Allegheny soils lack a fragipan and are of redder hue in the upper B horizons. The Captina soils are better drained and contain fewer low-chroma mottles in the subsoil than the Johnsburg soils. They are associated with the following soils of the flood plains: the well drained Cuba, moderately well drained Steff, and the somewhat poorly drained Stendal soils. The Captina soils have drainage similar to the Mercer and Sadler soils but are underlain by stratified horizons, which are lacking in those soils.

Captina silt loam, 2 to 6 percent slopes (CpB).—This moderately well drained, gently sloping soil is on benches at slightly higher elevations than the flood plains. Areas range from about 5 to 20 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are a few areas of moderately eroded Captina soils and small areas of Steff and Stendal soils.

Erosion is a moderate hazard if cultivated crops are grown. Permeability is slow in the fragipan. Plants respond well to applications of fertilizer and lime.

This soil is used mostly for row crops, hay, and pasture. (Capability unit IIe–7; woodland suitability group 4)

Captina silt loam, 6 to 12 percent slopes (CpC).—This moderately well-drained, sloping soil is on side slopes of benches at slightly higher elevations than the flood plains. Areas range from about 4 to 10 acres in size. This soil differs from the profile described as representative of the series in that the surface layer is more yellow. Plowing has mixed some of the subsoil material with the original surface layer. Included with this soil in mapping are small areas of Captina soils that are only slightly eroded.

Erosion is a severe hazard if cultivated crops are grown. Permeability is slow in the fragipan. Plants respond well to applications of fertilizer and lime. This soil is easy to till and can be worked through a wide range of moisture content without clodding or crusting, except in spots where the moderately fine textured subsoil is exposed.

This soil is used mostly for pasture and woods. (Capability unit IIIe–2; woodland suitability group 4)

Christian Series

The Christian series consists of deep, well-drained soils that formed in residuum from irregularly mixed limestone, sandstone, and shale. These soils are gently sloping to sloping and are on smooth uplands.

In a typical profile the surface layer, about 6 inches thick, is brown silt loam. The upper part of the subsoil is brown, friable silty clay loam that grades to yellowish-red silty clay at a depth of 12 inches. The lower part of the subsoil, below a depth of about 28 inches, is yellowish-red, very firm clay that has common olive variegations. This layer is plastic when wet and hard when dry. Below a depth of about 40 inches is variegated yellowish-red and olive, very firm, plastic, and very hard clay.

The Christian soils have a deep root zone and moderately slow permeability. They are moderate in natural fertility and strongly acid or very strongly acid in the surface layer unless limed. The available moisture capacity is high.

Representative profile of Christian silt loam, 6 to 12 percent slopes (near Wax, one-eighth mile northeast of State Route 88, on old abandoned State Route 479, southeast roadbank):

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; weak, fine granular structure; very friable; few, small sandstone fragments 2 to 10 millimeters in size; few weathered quartz pebbles; slightly acid; abrupt, smooth boundary.

B1t—6 to 12 inches, brown (7.5YR 4/4) silty clay loam; weak, fine, subangular blocky structure; friable, few thin clay films; very strongly acid; clear, smooth boundary.

B2t—12 to 28 inches, yellowish-red (5YR 5/6) silty clay; moderate, medium, angular blocky structure; firm; common continuous clay films; few sandstone fragments 5 to 15 millimeters in size; few dark-brown concretions; very strongly acid; gradual, smooth boundary.

B3—28 to 40 inches, yellowish-red (5YR 5/6) clay; common, medium, distinct variegations of olive (5Y 5/4); weak, coarse, angular blocky structure; very firm when moist, plastic when wet, hard when dry; common sandstone fragments 5 to 15 millimeters in size; very strongly acid; clear, wavy boundary.

C—40 to 49 inches +, variegated yellowish-red (5YR 5/6) and olive (5Y 5/4) clay; massive; very firm when moist, plastic when wet, very hard when dry; common sandstone fragments 5 to 15 millimeters in size; very strongly acid.

The solum ranges from about 24 to 42 inches in thickness. Depth to bedrock commonly ranges from 40 to 60 inches. The Ap horizon is silty clay loam in severely eroded soils. The Ap horizon is dark grayish brown (10YR 4/2) or dark yellowish brown (10YR 4/4) in some areas. In some places the profile does not have a B1t horizon. The B2t horizon ranges in hue from 7.5YR to 5YR, in value from 4 to 5, and in chroma from 4 to 6. It ranges from heavy silty clay loam to clay. The B3 and C horizons vary in the relative proportion of limestone, sandstone, and shale from place to place, commonly within short distances, giving rise to variations in color, texture, and consistence.

The Christian soils occur with the Caneyville, Mercer, Crider, Baxter, and Rarden soils. They differ from the Caneyville soils in having thicker, more developed, and more acid B horizons and fewer rock outcrops. The Christian soils have redder B horizons and are better drained than the Mercer soils. They have more sand and clay and less components of silty loess than the Crider soils. The Christian soils have much less chert and more sand than the Baxter soils and normally are less red throughout the profile. They are similar in texture to the Rarden soils but are redder in hue and deeper to bedrock.

Christian silt loam, 2 to 6 percent slopes (CrB).—This well-drained, gently sloping soil is in convex areas on narrow ridgetops in the uplands. Areas range from about 3 to 15 acres in size.

Included with this soil in mapping are a few areas of a moderately eroded Christian soil and small areas of Baxter soils. Also included are some areas of Christian soils that have a loam surface layer.

Erosion is a moderate hazard where this soil is used for cultivated crops. Plants respond well to applications of fertilizer and lime. Organic-matter content is low. This soil is easy to till and can be worked through a wide range of moisture content without clodding or crusting.

This soil is used mostly for row crops, hay, and pasture. (Capability unit IIe–1; woodland suitability group 3)

Christian silt loam, 6 to 12 percent slopes (CrC).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 4 to 12 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are a few areas of moderately eroded Christian soils, some Christian soils that have a loam surface layer, and some areas of Caneyville and Rarden soils.

Erosion is a severe hazard if this soil is used for cultivated crops. Plants respond well to applications of fertilizer and lime. Organic-matter content is low. This soil is easy to till and can be worked through a wide range of moisture content without clodding and crusting, except in spots where the clayey subsoil is exposed.

This soil is used mostly for pasture and hay, but some areas are in row crops. A few areas are in woods. (Capability unit IIIe–1; woodland suitability group 3)

Christian silty clay loam, 6 to 12 percent slopes, severely eroded (CsC3).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 4 to 12 acres in size. This soil differs from the one described as representative of the series in that the surface layer is redder, contains more clay, and consists mostly of subsoil material exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas of Caneyville and Rarden soils and a few areas of strongly sloping Christian soils.

Erosion is a very severe hazard where this soil is used for cultivated crops. Plants respond well to applications of fertilizer and lime. Organic-matter content is very low. This soil is somewhat difficult to till because of the high clay content in the surface layer.

This soil is used mostly for pasture, but a few areas are in hay. A few areas are idle and are revegetating naturally. (Capability unit IVe–11; woodland suitability group 6)

Clifty Series

The Clifty series consists of deep, well-drained soils that formed in gravelly alluvium washed from soils of the uplands that are underlain primarily by sandstone, siltstone, and shale. Clifty soils are nearly level and are on flood plains, mostly in narrow bands along small streams.

In a typical profile the surface layer, about 8 inches thick, is brown gravelly silt loam. The subsoil extends to a depth of about 30 inches and is brown, very friable gravelly silt loam. Below this, to a depth of 60 inches or more, is brown, friable gravelly loam.

The Clifty soils have a deep root zone and moderately rapid permeability. These soils are strongly acid or very strongly acid in the surface layer unless limed, and they are moderately high in natural fertility. The available moisture capacity is moderate, and the organic-matter content is medium.

Representative profile of Clifty gravelly silt loam (1½ miles southwest of Shrewsbury, 650 yards south of State Route 411, and 10 feet west of Sunfish Creek):

Ap—0 to 8 inches, brown (10YR 4/3) gravelly silt loam; weak, fine, granular structure; very friable; many fine roots; 25 percent coarse fragments; strongly acid; clear, smooth boundary.

B2—8 to 30 inches, brown (10YR 4/3) gravelly silt loam; weak, fine, granular structure; very friable; common fine roots; 30 percent coarse fragments; few dark-brown concretions; very strongly acid; gradual, wavy boundary.

C—30 to 60 inches +, brown (10YR 4/3) gravelly loam; massive; friable; 30 percent coarse fragments; few dark-brown concretions; strongly acid.

The alluvial deposit ranges from 48 to 60 inches or more in thickness. The solum ranges from about 24 to 40 inches in thickness. Coarse fragments throughout the profile range from about 15 to 35 percent by volume, and the fine-earth fraction is heavy silt loam or loam. Reaction is strongly acid or very strongly acid throughout the profile. The Ap horizon ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/3). The B and C horizons range from brown (10YR 5/3) to dark yellowish brown (10YR 4/4).

The Clifty soils occur with the Cuba, Steff, Stendal, and Shelocta soils. They contain more coarse fragments throughout the profile than the Cuba, Steff, and Stendal soils. The Clifty soils have amounts of coarse fragments similar to those in Shelocta soils, but they are on flood plains rather than foot slopes, and they lack the Bt horizon of the Shelocta soils.

Clifty gravelly silt loam (Ct).—This well-drained, nearly level soil is on flood plains. Areas range from about 7 to 49 acres in size. Slopes range mostly from 0 to 2 percent, but some range up to 4 percent.

Included with this soil in mapping are small areas of soils that have a gravelly loam surface layer and some areas of soils that have thin stratified layers throughout the profile.

Erosion is not a hazard on this soil. Occasional flooding occurs during winter and spring, but the overflow is not detrimental to the commonly grown crops. Plants respond well to applications of fertilizer and lime. Tillage is somewhat unfavorable due to the high gravel content in the surface layer.

This soil is used mostly for hay and pasture, but a small acreage is in row crops. (Capability unit IIs–1; woodland suitability group 1)

Crider Series

The Crider series consists of deep, well-drained soils that formed in 2 to 4 feet of loess and in underlying material weathered from limestone. These soils are gently sloping to sloping and are on uplands. Most slopes are convex. Crider soils are widely distributed over the county.

In a typical profile the surface layer, about 6 inches thick, is brown silt loam. The subsoil, to a depth of about 29 inches, is brown and reddish-brown, friable silty clay loam. Between depths of 29 to 45 inches, the subsoil is yellowish-red, friable or firm silty clay loam. Below this, to a depth of 60 inches or more, is yellowish-red, firm silty clay.

The Crider soils have a deep root zone and are moderately permeable. They are moderately high in natural fertility and are medium acid or strongly acid in the surface layer unless limed. These soils are easy to till and can be worked through a wide range of moisture content without

clodding or crusting, except where severe erosion has exposed the silty clay loam subsoil.

Representative profile of Crider silt loam, 2 to 6 percent slopes (50 yards east of the junction of State Route 79 and State Route 110, on a north roadbank):

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B21t—6 to 19 inches, brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; friable; continuous clay films; strongly acid; gradual, smooth boundary.

B22t—19 to 29 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular and angular blocky structure; friable; continuous clay films; few streaks of black concretionary material; strongly acid; clear, smooth boundary.

B23t—29 to 40 inches, yellowish-red (5YR 4/6) silty clay loam; moderate, medium, angular blocky structure; friable; continuous clay films; common black concretionary stains; strongly acid; clear, smooth boundary.

B3t—40 to 45 inches, yellowish-red (5YR 4/6) silty clay loam; light-gray (10YR 7/2) silt coatings on ped surfaces; moderate, medium, angular blocky structure; firm; continuous clay films; many black concretions; strongly acid; clear, smooth boundary.

IIB2tb—45 to 60 inches +, yellowish-red (5YR 4/6) silty clay; few, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, angular blocky structure; firm; patchy clay films; common black concretions; strongly acid.

The solum ranges from 60 to 90 inches in thickness. Depth to bedrock is 60 inches or more. Colors of the Ap horizon include dark grayish brown (10YR 4/2) and brown (7.5YR 4/4). The Ap horizon is silty clay loam where the soil is severely eroded. In a few places there is a heavy silt loam B1 horizon ranging from brown (7.5YR 4/4) to yellowish red (5YR 4/6). The B21t horizon is brown (7.5YR 4/4) or reddish brown (5YR 4/4) and is heavy silt loam or light silty clay loam. The B22t horizon ranges from brown (7.5YR 4/4) to yellowish red (5YR 4/6) and is heavy silt loam or silty clay loam. The B23t horizon is reddish brown (5YR 4/4) or yellowish red (5YR 4/6). The IIB2tb horizon ranges from dark reddish brown (2.5YR 3/4) to yellowish red (5YR 4/6) and has mottles of yellowish brown, strong brown, or brown. It is silty clay or clay.

The Crider soils occur with the Baxter, Christian, and Caneyville soils. To a lesser extent, they are adjacent to the Wellston soils. They lack the high chert content and normally are less red in the B horizon than the Baxter soils. Crider soils contain less sand and clay and more silt in the B horizon than the Christian soils. They are deeper to bedrock and are less clayey in the B horizon than the Caneyville soils. The Crider soils have a thicker solum and are redder in the lower part of the profile than the Wellston soils.

Crider silt loam, 2 to 6 percent slopes (CuB).—This well-drained, gently sloping soil is on smooth ridgetops. Areas range from 3 to 15 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are some areas of soils that have a more clayey subsoil than the Crider soils and of a few soils that are yellowish brown in the upper part of the subsoil. A few areas of moderately eroded Crider soils and small areas of a soil that ranges from 40 to 60 inches to bedrock are included. Also included are a few areas of soils that have a chert content of 20 to 30 percent below a depth of 30 inches.

Erosion is a moderate hazard where this soil is used for cultivation. Plants respond well to applications of fertilizer and lime. The available moisture capacity is high, and organic-matter content is medium.

This soil is used mostly for row crops, hay, and pasture. It has a high potential for growing horticultural crops and nursery stock. (Capability unit IIe–1; woodland suitability group 3)

Crider silt loam, 6 to 12 percent slopes (CuC).—This well-drained, sloping soil is on relatively short side slopes of convex shape. Areas range from about 4 to 12 acres in size. This soil has a redder surface layer than the one described as representative of the series. Plowing has mixed some of the subsoil material with the original surface layer.

Included with this soil in mapping are some areas of soils that have a more clayey subsoil than the Crider soils and of a few soils that are yellowish brown in the upper part of the subsoil. A few areas of slightly eroded Crider soils and a few areas of strongly sloping Crider soils are included. Also included are small areas of a soil that ranges from 40 to 60 inches to bedrock and a few areas of soils that have a chert content of 20 to 30 percent below a depth of 30 inches.

Erosion is a severe hazard where this soil is used for cultivated crops. Plants respond well to applications of fertilizer and lime. The available moisture capacity is high, and the organic-matter content is low.

This soil is used mostly for pasture and hay, but a significant acreage is in row crops. (Capability unit IIIe–1; woodland suitability group 3)

Crider silty clay loam, 6 to 12 percent slopes, severely eroded (CvC3).—This well-drained, sloping soil is on side slopes of convex shape. Areas range from about 5 to 20 acres in size. This soil differs from the one described as representative of the series in that the surface layer is redder, contains more clay, and consists mostly of subsoil material exposed by erosion. Rills and shallow gullies are in some areas.

Included with this soil in mapping are some areas of soils that have a more clayey subsoil than the Crider soils and of a few soils that are yellowish brown in the upper part of the subsoil. Small areas of a soil that range from 40 to 60 inches to bedrock and a few strongly sloping Crider soils are included. Also included are a few areas of soils that have a chert content of 20 to 30 percent below a depth of 30 inches.

Effects of past erosion and risk of damage by additional erosion limit the use of this soil for row crops. Plants respond well to applications of fertilizer and lime. The available moisture capacity is high, and organic-matter content is very low.

This soil is used mostly for pasture and hay. A few areas are idle and are revegetating naturally. (Capability unit IVe–11; woodland suitability group 6)

Cuba Series

The Cuba series consists of deep, well-drained soils that formed in alluvium washed from soils of uplands that are underlain primarily by sandstone, siltstone, shale, and loess. Cuba soils are nearly level and are on flood plains. They occur in narrow bands along streams in areas where the soils are underlain by sandstone and shale.

In a typical profile the surface layer, about 8 inches thick, is brown silt loam. The subsoil extends to a depth of 28 inches and is brown, friable silt loam. Below this,

to a depth of 50 inches or more, is yellowish-brown silt loam.

The Cuba soils have a deep root zone and are moderately permeable. These soils are strongly acid or very strongly acid in the surface layer unless limed, and they are high in natural fertility. The available moisture capacity is high, and organic-matter content is medium.

Representative profile of Cuba silt loam (150 feet east of Brushy Pond Road, at the bridge across Caney Creek):

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

B—8 to 28 inches, brown (10YR 4/3) silt loam; weak, medium, granular structure; friable; very strongly acid; gradual, smooth boundary.

C—28 to 50 inches +, yellowish-brown (10YR 5/4) silt loam; massive; friable; very strongly acid.

The alluvial deposit is more than 60 inches thick. Reaction is strongly acid or very strongly acid throughout the profile unless the soil has been limed. The Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 4/3). The B horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4). The C horizon includes brown (10YR 4/3) and dark yellowish brown (10YR 4/4). In some places sandstone fragments, 2 to 10 millimeters in diameter, constitute 5 to 10 percent of the volume, and in some places mottles occur below a depth of 3 feet.

The Cuba soils occur with Steff, Stendal, and Bonnie soils. The Cuba soils have a B horizon that is brown and free of mottles, whereas the moderately well drained Steff soils have gray mottles in the B horizon starting at a depth of less than 24 inches. Cuba soils are better drained and less gray throughout their profile than the somewhat poorly drained Stendal soils and the poorly drained Bonnie soils. They have drainage and color similar to the Nolin soils, but are more acid.

Cuba silt loam (Cw).—This well-drained, nearly level soil is on flood plains. Areas range from about 5 to 35 acres in size. Slopes mostly range from 0 to 2 percent, but some range up to 4 percent.

Included with this soil is mapping are small areas of soils that have sandstone fragments and higher sand content than the representative profile, small areas of soils that have thin strata of silt loam and fine sandy loam, and areas of soils that have extremely acid horizons in the lower part of the profile.

Erosion is not a hazard on this soil. Occasional flooding occurs during winter and spring, but overflow is not detrimental to the commonly grown crops. Most areas benefit from the deposition of the fertile sediments. Plants respond well to applications of fertilizer and lime. This soil is easy to till and can be worked through a wide range of moisture content without clodding or crusting.

This soil is used mostly for row crops, hay, and pasture. It has good potential for truck crops. (Capability unit I–1; woodland suitability group 1)

Gilpin Series

The Gilpin series consists of moderately deep, well-drained soils that formed in 10 to 20 inches of loess and in underlying residuum from acid siltstone, sandstone, and shale. These soils are sloping to steep and are on uplands.

In a typical profile the surface layer, about 6 inches thick, is brown silt loam. The subsoil extends to a depth of about 19 inches; it is brown, friable silty clay loam. Below this, the substratum is strong-brown channery loam. Sandstone bedrock is at a depth of about 27 inches.

Gilpin soils are moderately low in natural fertility and are strongly acid or very strongly acid in the surface layer unless limed. They have a moderately deep root zone, are moderately permeable, and have a moderate available moisture capacity. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting, except in areas where severe erosion has exposed the moderately fine textured subsoil.

Representative profile of Gilpin silt loam, 6 to 12 percent slopes (7½ miles north of Leitchfield on State Route 259, at junction of Everleigh Church Road, northeast roadbank):

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; neutral; abrupt, smooth boundary.

Bt—6 to 19 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular and angular blocky structure; friable; thin patchy clay films on ped surfaces; very strongly acid; clear, smooth boundary.

IIC—19 to 27 inches, strong-brown (7.5YR 5/6) channery loam; single grain; loose; 30 percent sandstone fragments 5 to 40 millimeters in size; very strongly acid.

R—27 inches +, sandstone bedrock.

The solum ranges from about 16 to 24 inches in thickness. Depth to bedrock ranges from about 20 to 40 inches. The A horizon is dominantly silt loam, but it is silty clay loam in severely eroded areas. The Ap horizon includes grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4). In wooded areas the A1 horizon generally is very dark grayish brown (10YR 3/2) and ranges from 1 to 3 inches in thickness. It is underlain by a brown (10YR 5/3) A2 horizon about 4 inches thick. In some places the B1 horizon is reddish-brown (5YR 4/4) silt loam. The B horizon ranges from about 10 to 18 inches in thickness. The Bt horizon ranges from brown (7.5YR 4/4) to strong brown (7.5YR 5/6) and is silt loam or silty clay loam. The IIC horizon includes channery or gravelly silt loam, sandy clay loam, and fine sandy loam. Coarse fragments range from about 15 to 35 percent in volume.

The Gilpin soils occur with the Wellston, Zanesville, Weikert, and Ramsey soils. Gilpin soils have thinner B horizons and are more shallow to bedrock than the Wellston soils. They lack the fragipan of the Zanesville soils. Gilpin soils have thicker B horizons, are deeper to bedrock, and contain fewer coarse fragments than the Weikert soils. They are deeper to bedrock and contain less sand throughout the profile than the Ramsey soils.

Gilpin silt loam, 6 to 12 percent slopes (GlC).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 4 to 20 acres in size. A few sandstone outcrops are in some areas. A profile of this soil is described as typical for the series.

Included with this soil in mapping are soils that have a higher sand content throughout the profile than the Gilpin soils and areas of moderately eroded Gilpin soils. Included also are a few areas of Wellston, Zanesville, and Weikert soils.

Erosion is a severe hazard when this soil is used for cultivated crops. This soil has a moderately deep root zone and therefore is slightly droughty in some years. Plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for pasture and hay, but some acreage is in corn and tobacco and a few areas are in woods. (Capability unit IIIe–7; woodland suitability group 3)

Gilpin silt loam, 12 to 20 percent slopes (GlD).—This well-drained, strongly sloping soil is on side slopes in

the uplands. Areas range from about 5 to 20 acres in size. A few sandstone outcrops are in some areas.

Included with this soil in mapping are soils that have a higher sand content throughout the profile than the Gilpin soil and areas of moderately eroded Gilpin soils. Included also are a few areas of Wellston, Zanesville, and Weikert soils.

Erosion is a very severe hazard when this soil is used for cultivated crops. This soil has a moderately deep root zone and therefore is slightly droughty in some years. Plants respond well to fertilizer and lime. Organic-matter content is low.

This soil is used mostly for pasture and woods, but a few areas are in hay. (Capability unit IVe–4; woodland suitability group 3)

Gilpin silt loam, 20 to 30 percent slopes (GlE).—This well-drained, moderately steep soil of the uplands is on side slopes that are dissected by small drains. Areas range from about 6 to 40 acres in size. A few sandstone outcrops are in some areas.

Included with this soil in mapping are soils that have a higher sand content throughout the profile than the Gilpin soils and a few areas of moderately eroded Gilpin soils. Included also are a few areas of Wellston, Weikert, and Shelocta soils.

Steepness of slope and hazard of erosion make this soil unsuited to cultivated crops. This soil has a moderately deep root zone and therefore is droughty in some years. This slows the growth of pasture plants. Plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for woods and pasture. (Capability unit VIe–7; woodland suitability group 3)

Gilpin silty clay loam, 6 to 12 percent slopes, severely eroded (GpC3).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 5 to 15 acres in size. A few sandstone outcrops are in some areas. This soil differs from the one described as representative of the series in that its surface layer is redder, contains more clay, and consists mostly of subsoil material exposed by erosion. In addition, the soil is more shallow to bedrock. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas that have a higher sand content throughout the soil profile than the Gilpin soils, and a few areas of moderately eroded Gilpin soils. Included also are areas of Wellston, Zanesville, and Weikert soils.

Erosion is a very severe hazard when this soil is cultivated. This soil has a moderately deep root zone, and therefore it is droughty in some years. Plants respond well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture and hay. A few idle areas are revegetating naturally, providing food and cover for wildlife. (Capability unit IVe–14; woodland suitability group 6)

Gilpin silty clay loam, 12 to 20 percent slopes, severely eroded (GpD3).—This well-drained, strongly sloping soil is on side slopes in the uplands. Areas range from about 5 to 25 acres in size. A few sandstone outcrops are in some areas. This soil differs from the one described as representative of the series in that its surface layer is redder, contains more clay, and consists mostly of subsoil material exposed by erosion. Also, the soil is more shallow to bedrock. Some areas have rills and shallow gullies.

Included with this soil in mapping are soils having higher sand content throughout the profile than the Gilpin soils. Included also are a few areas of Wellston, Zanesville, and Weikert soils.

The erosion hazard and effects of past erosion make this soil unsuitable for cultivation, and therefore it should remain in permanent vegetation. This soil is droughty in some years. Plants respond well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture and woods (fig. 6). A few idle areas are revegetating naturally, providing food and cover for wildlife. (Capability unit VIe–4; woodland suitability group 6)

Gilpin silty clay loam, 20 to 30 percent slopes, severely eroded (GpE3).—This well-drained, moderately steep soil is on side slopes in uplands that are dissected by many small drains. Areas range from about 4 to 18 acres in size. A few sandstone outcrops are in some areas. The profile of this soil differs from the one described as representative of the series in that the surface layer is redder, contains more clay, and consists mostly of subsoil exposed by erosion. In addition, the soil is more shallow to bedrock. Some areas have rills and shallow gullies.

Included with this soil in mapping are soils having a higher content of sand throughout the profile than the Gilpin soils. Also included are a few areas of Wellston and Weikert soils.

This soil is not suited to cultivation and is poorly suited to pasture because of steepness and hazard of erosion. This soil is droughtly in some years. Plants respond fairly well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for woods and pasture. A considerable acreage is idle and is revegetating naturally. (Capability unit VIIe–3; woodland suitability group 6)

Gullied Land

Gullied land (Gu) consists of soils of the uplands that are so severely damaged by erosion that, in most places, they cannot be identified. Moderately deep and deep gullies make up more than 20 percent of the areas. A few patches of the original surface soil remain between the gullies (fig. 7). Since the soils cannot be identified, Gullied land is classified as a land type. Slopes vary widely but in most places are between 6 and 20 percent. Areas range from about 4 to 12 acres in size.

Generally, the soil material is poor and supports only wild grass, weeds, bushes, and scrubby trees. In most areas farming has been abandoned. Pine trees have been planted in some areas. A few areas could be reclaimed and used to a limited extent for pasture, but reclamation is very difficult and costly. (Capability unit VIIe–4; woodland suitability group 10)

Johnsburg Series

The Johnsburg series consists of somewhat poorly drained soils that have a fragipan. These soils developed in 2 to 4 feet of loess and in the underlying residuum from acid siltstone, sandstone, and shale. They are nearly level

Figure 6.—**Permanent pasture on Gilpin silty clay loam, 12 to 20 percent slopes, severely eroded. Beef cattle are grazing in grassed waterway.**

and have a smooth surface. These soils are mostly in the east-central portion of the county.

In a typical profile the surface layer, about 6 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 12 inches and is light yellowish-brown, friable silt loam that has common, light brownish-gray mottles. The lower part of the subsoil is a fragipan that extends to a depth of about 36 inches and is mottled gray and brown silt loam. The fragipan is very firm, brittle, and compact. The underlying material extends to a depth of 50 inches or more and is mottled gray and brown silty clay loam.

Johnsburg soils are shallow to a fragipan that slows water movement and restricts root growth. They are very strongly acid in the surface layer unless limed, and they are moderately low in natural fertility. The available moisture capacity is moderate to low, and organic-matter content is low. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Johnsburg silt loam (three-fourths mile southeast of Clarkson, 225 yards southwest of State Route 224, on gravel road adjacent to Western Kentucky Parkway, north roadbank):

Ap—0 to 6 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

B1—6 to 12 inches, light yellowish-brown (10YR 6/4) silt loam; common, medium, distinct mottles of light brownish gray (2.5Y 6/2); weak, medium, subangular blocky structure; friable; extremely acid; clear, wavy boundary.

Bx—12 to 36 inches, mottled light-gray (2.5Y 7/2), light yellowish-brown (10YR 6/4), and yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; very firm, brittle, and compact; patchy clay films; common, dark-brown concretionary material; extremely acid; gradual, smooth boundary.

IICx—36 to 50 inches +, mottled light gray (5Y 6/1) and yellowish-brown (10YR 5/6) silty clay loam; massive; very firm, brittle, and compact; extremely acid.

Depth to bedrock ranges from about 48 to 60 inches or more. Depth to fragipan ranges from about 11 to 18 inches. Reaction below the Ap horizon is very strongly acid or extremely acid. The Ap horizon is brown (10YR 4/3) to dark grayish brown (10YR 4/2). The B1 horizon ranges from light yellowish brown (10YR 6/4) to brown (10YR 5/3). It is silt loam or light silty

Figure 7.—**Gullied land on 12 to 20 percent slopes. This land was used for row crops before it became so severely eroded. Permanent vegetation will control this kind of erosion.**

clay loam. In some places the profile has a B2 horizon that is mottled olive-yellow (2.5Y 6/6), pale-yellow (5Y7/3), and yellowish-brown (10YR 5/6) silty clay loam. Mottled colors in the Bx and IICx horizons include light brownish gray (10YR 6/2), light olive gray (5Y 6/2), pale yellow (5Y 7/3), and brown (7.5YR 4/4). These horizons are silt loam or silty clay loam.

The Johnsburg soils occur with the Zanesville, Sadler, Stendal, and Captina soils. They are less well drained and contain a higher percent of gray mottles than the Zanesville, Sadler, or Captina soils. Johnsburg soils have drainage similar to that of the Stendal soils on flood plains, but Stendal soils do not have a fragipan.

Johnsburg silt loam (Jo).—This somewhat poorly drained, nearly level soil has a smooth surface. Areas range from about 5 to 40 acres in size. Slopes range from 0 to 2 percent in most places.

Included with this soil in mapping are small areas of Stendal soils and a few areas of a soil that has a clayey layer in the lower part of the subsoil and lacks a fragipan.

Erosion is not a hazard, but this soil becomes slightly waterlogged above the slowly permeable fragipan in winter and spring. Water tends to collect in the level areas. Artificial drainage, where outlets are available, shortens the waterlogged period and thereby increases the suitability for crops. Plants respond well to applications of fertilizer and lime.

This soil is used mostly for pasture, corn, and hay. A few areas are in trees. (Capability unit IIIw–1; woodland suitability group 2)

Lindside Series

The Lindside series consists of deep, moderately well drained soils that developed in alluvium washed primarily from soils of the uplands that are underlain by limestone but contain some material from sandstone, siltstone, shale, and loess. Lindside soils are nearly level and are on flood plains along the streams in areas where the soils are underlain by limestone.

In a typical profile the surface layer, about 8 inches thick, is brown silt loam. The subsoil extends to a depth of about 26 inches and is a brown, friable silt loam that has few faint mottles of light brownish gray and dark yellowish brown in the lower part. The underlying material extends to a depth of 50 inches or more and is light brownish-gray, friable or firm silt loam that has common mottles of yellowish brown and brown.

The Lindside soils have a deep root zone and are moderately permeable. These soils are medium acid to neutral in the surface layer and high in natural fertility. Organic-matter content is medium, and available moisture capacity is high. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Lindside silt loam (approximately 2 miles south of Leitchfield, 500 feet east of State Route 259, and 300 feet west of Bear Creek):

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; slightly acid; clear, smooth boundary.

B21—8 to 17 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; slightly acid; clear, smooth boundary.

B22—17 to 26 inches, brown (10YR 5/3) silt loam; few, fine, faint mottles of light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4); weak, fine, granular structure; friable; few dark-brown concretions; medium acid; gradual, wavy boundary.

C—26 to 50 inches +, light brownish-gray (2.5Y 6/2) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/6) and brown (7.5YR 4/4); massive; friable or firm; much dark-brown concretionary material; medium acid.

The alluvial deposit is more than 60 inches thick. Reaction ranges from medium acid to neutral throughout the profile, but in most places the profile is slightly acid. In some places the lower B and C horizons contain a few pebbles ranging from 2 to 10 millimeters in size. The Ap horizon is brown (10YR 4/3) to dark grayish brown (10YR 4/2). The B21 horizon is dark yellowish brown (10YR 4/4) in some places. In most places the profile is mottled at a depth above 24 inches. Mottled colors in the C horizon include pale brown, gray, light brownish gray, and olive.

The Lindside soils occur with the well-drained Nolin soils and the somewhat poorly drained Newark soils. They have a lighter colored material at less depth and a higher percent of gray mottles in the lower part of the B horizon than the Nolin soils. They are less gray and less mottled in the subsoil than the Newark soils. Lindside soils have drainage similar to the Steff soils, but are less acid.

Lindside silt loam (ld).—This moderately well drained, nearly level soil is on flood plains. Areas range from about 5 to 40 acres in size. Slopes range from 0 to 3 percent in most places.

Included with this soil in mapping are a few areas of a soil that has a loam surface layer and some areas of soils that are stratified throughout the profile.

Erosion is not a hazard on this soil. A seasonal high water table that rises to within 1½ to 2 feet of the surface during rainy periods delays planting of spring crops in some years unless the soil is artificially drained. Occasional flooding occurs during winter and early in spring, but damage is minor and overflow is not detrimental to the commonly grown crops. Most areas benefit from the deposition of the fertile sediments. Plants respond well to applications of fertilizer. Most areas do not need lime for the commonly grown farm crops.

This soil is used mostly for row crops, hay, and pasture. It has good potential for truck crops. (Capability unit I–2; woodland suitability group 1)

Mercer Series

The Mercer series consists of moderately well drained soils that have a fragipan. These soils developed in a thin layer of loess and in the underlying residuum from irregularly mixed limestone, sandstone, and shale. They are gently sloping and are on smooth uplands.

In a typical profile the surface layer, about 6 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 23 inches and is yellowish-brown, friable silty clay loam that has common mottles of pale brown and strong brown in the lower 5 inches. The lower part of the subsoil is a fragipan that extends to a depth of about 34 inches and is mottled light yellowish-brown, light brownish-gray, and strong-brown silty clay loam. This fragipan is very firm, brittle, and compact. The underlying material extends to a depth of 52 inches or more and is mottled grayish-brown, strong-brown, and brown silty clay that is very firm and plastic.

The Mercer soils are moderately deep to a fragipan that slows water movement and restricts root growth. They are moderate in natural fertility and are strongly acid or very strongly acid in the surface layer unless limed. The available moisture capacity is moderate, and organic-matter content is low.

Representative profile of Mercer silt loam, 2 to 6 percent slopes (1½ miles southeast of Clarkson, and one-fourth mile northeast of State Route 224):

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

B21t—6 to 18 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular and angular blocky structure; friable; common patchy clay films; very strongly acid; clear, smooth boundary.

B22t—18 to 23 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, distinct mottles of pale brown (10YR 6/3) and strong brown (7.5YR 5/6); moderate, medium, subangular and angular blocky structure; friable; continuous clay films; very strongly acid; clear, wavy boundary.

Bx—23 to 34 inches, mottled light yellowish-brown (10YR 6/4), light brownish-gray (10YR 6/2), and strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, angular blocky structure; very firm, brittle, and compact; patchy clay films; very strongly acid; gradual, wavy boundary.

IIC—34 to 52 inches +, mottled grayish-brown (2.5Y 5/2), strong-brown (7.5YR 5/6), and brown (7.5YR 4/4) silty clay; moderate, medium and coarse, angular blocky structure; very firm, plastic, hard; patchy clay films; medium acid to strongly acid.

The solum ranges from about 30 to 55 inches in thickness. Depth to the fragipan ranges from about 17 to 25 inches. Depth to bedrock ranges from about 48 to 72 inches or more. The loess component generally ranges from about 25 to 36 inches in thickness. The Ap horizon is brown (10YR 4/3) to dark grayish brown (10YR 4/2). In some places the profile has a B1 horizon that is yellowish-brown (10YR 5/4) silt loam. The B21t horizon ranges from 10YR to 7.5YR in hue. The B2 horizons are heavy silt loam or light silty clay loam. The IIC horizon contains a few fragments of sandstone, limestone, or shale in some places.

The Mercer soils occur with the Christian and Caneyville soils. They differ from the Christian soils in having a fragipan, and they are more yellow in hue and less well drained. The Mercer soils are deeper to bedrock, have less clayey and more yellow B horizons, and are less well drained than the Caneyville soils. They have drainage similar to the Sadler soils, but have a thinner fragipan that is underlain by clayey horizons. They have drainage similar to the Captina soils, which are underlain by stratified horizons.

Mercer silt loam, 2 to 6 percent slopes (MtB).—This moderately well drained, gently sloping soil is on ridge tops. Areas range from about 5 to 18 acres in size.

Included with this soil in mapping are a few areas of moderately eroded Mercer soils and some areas of Mercer soils that have 0 to 2 percent slopes. Also, there are a few inclusions of Mercer soils that have a loam surface layer and a few that are extremely acid in the lower horizons.

The erosion hazard is moderate if this soil is used for cultivated crops. Permeability is slow in the fragipan. Plants respond well to applications of fertilizer and lime. This soil is easy to till and can be worked through a wide range of moisture content without clodding or crusting.

This soil is used mostly for row crops, hay, and pasture. (Capability unit IIe–7; woodland suitability group 4)

Newark Series

The Newark series consists of deep, somewhat poorly drained soils that developed in alluvium washed primarily from soils of the uplands that are underlain by limestone, but contain some components from loess, sandstone, siltstone, and shale. Newark soils are nearly level and are on flood plains along the streams, mostly in areas where the soils are underlain by limestone.

The surface layer, about 7 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 12 inches and is brown, very friable silt loam that has a few mottles of pale brown and light brownish gray. The lower part of the subsoil extends to a depth of 50 inches or more and is light brownish-gray, friable or firm silt loam that has many mottles of dark yellowish brown and very dark grayish brown.

Newark soils have a deep root zone and are moderately permeable. They are medium acid to neutral in the surface layer and moderately high in natural fertility. The available moisture capacity is high, and organic-matter content is medium. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Newark silt loam (2½ miles south of State Route 259, on Bear Creek Road, and 200 feet east of Bear Creek):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; slightly acid; clear, smooth boundary.

B21—7 to 12 inches, brown (10YR 5/3) silt loam; few, fine, faint mottles of pale brown (10YR 6/3) and light brownish gray (2.5Y 6/2); weak, fine, granular structure; very friable; common, dark-brown concretionary material; slightly acid; gradual, smooth boundary.

B22g—12 to 50 inches +, light brownish-gray (2.5Y 6/2) silt loam; many, medium, distinct mottles of dark yellowish brown (10YR 4/4) and bands of very dark grayish brown (10YR 3/2); weak, fine, granular structure; friable or firm; common, dark-brown concretionary material; slightly acid.

The alluvial deposit is 60 inches thick or more. Reaction ranges from medium acid to neutral throughout the profile, but in most places the profile is slightly acid. The Ap horizon ranges from brown (10YR 4/3) to dark grayish brown (10YR

4/2). The B horizon is dominantly heavy silt loam but ranges to light silty clay loam. Mottled colors of the B22g horizon include dark gray (5Y 4/1) and pale brown (10YR 6/3). The depth to the B22g horizon ranges from 10 to 20 inches.

Newark soils occur with the well drained Nolin soils and the moderately well drained Lindside soils. They contain a higher percent of gray colors and are more mottled throughout the profile than the Nolin and Lindside soils. The Newark soils have drainage and color similar to the Stendal soils, but they are less acid.

Newark silt loam (Ne).—This somewhat poorly drained, nearly level soil is on flood plains. Areas range from about 6 to 36 acres in size. Slopes range mostly from 0 to 2 percent, but some range up to 4 percent.

Included with this soil in mapping are a few areas of poorly drained soils and some areas of Newark soils that have a loam surface layer. Also included are some soils that are stratified with thin silty layers throughout the profile.

Erosion is not a hazard on this Newark soil. A seasonal high water table rises to within ½ to 1½ feet of the surface during rainy periods and delays planting of spring crops unless the soil is artificially drained. This soil is subject to occasional flooding during the winter and early in spring. Scouring and deposition are slight problems in some areas. Crops respond well to applications of fertilizer. Most areas do not need lime for the commonly grown farm crops.

This soil is used mostly for row crops, hay, and pasture. A small acreage is in trees. (Capability unit IIw–4; woodland suitability group 2)

Nolin Series

The Nolin series consists of deep, well-drained soils that formed in alluvium washed primarily from soils of the uplands that are underlain by limestone, but contain some components of loess and soil material from sandstone, siltstone, and shale. Nolin soils are nearly level and are on flood plains. They are in narrow bands along the streams in the areas where the soils are underlain by limestone.

In a typical profile the surface layer, about 8 inches thick, is brown silt loam. The subsoil extends to a depth of 52 inches or more and is brown, friable or firm silt loam.

The Nolin soils have a deep root zone and are moderately permeable. They are neutral to medium acid in the surface layer and are high in natural fertility. Organic-matter content is medium, and the available moisture capacity is high. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Nolin silt loam (one-fourth mile northwest of Tousey, one-half mile south of State Route 54, and 100 feet northeast of bridge across Spring Fork):

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many fine roots; medium acid; clear, smooth boundary.

B21—8 to 28 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; common fine roots; medium acid; gradual, smooth boundary.

B22—28 to 52 inches +, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable or firm; few black concretions; slightly acid.

The alluvial deposit is more than 60 inches thick. Reaction ranges from medium acid to neutral throughout the profile, but most areas are slightly acid. In some places the profile contains pebbles up to 1 inch across, but these make up less than 10 percent of the volume. In some places the profile, at depths below 24 inches, has few to common, gray mottles that have chromas of 2 or less. The Ap horizon is brown (10YR 4/3) to dark grayish brown (10YR 4/2). The B horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4). It is dominantly silt loam but ranges to light silty clay loam. In some places the depth to the C horizon ranges only from 3 to 4 feet. The C horizon is brown (10YR 4/3) or dark yellowish-brown (10YR 4/4) silt loam or loam and is massive.

The Nolin soils occur with the moderately well drained Lindside soils and the somewhat poorly drained Newark soils. They are less mottled and are browner to a greater depth than the Lindside soils. They contain a lower percentage of gray colors throughout the profile than the Newark soils. The Nolin soils have drainage and color similar to the Cuba soils, but they are less acid.

Nolin silt loam (No).—This well-drained, nearly level soil is on flood plains. Areas range from about 7 to 45 acres in size. Slopes range mostly from 0 to 2 percent, but some range up to 4 percent.

Included with this soil in mapping are a few areas of soils that are stratified and some areas of Nolin soils that have a surface layer of loam or fine sandy loam.

Erosion is not a hazard on this soil. Occasional flooding occurs during winter and early in spring, but the damage is minor and overflow is not detrimental to the commonly grown crops. Most areas benefit from the deposition of the fertile sediments. Plants respond well to applications of fertilizer. Lime is not needed for most of the commonly grown crops.

This soil is used mostly for row crops, hay, and pasture. It has good potential for truck crops. (Capability unit I–1; woodland suitability group 1)

Ramsey Series

The Ramsey series consists of shallow, somewhat excessively drained soils that formed in residuum from acid, interbedded sandstone and siltstone. These soils are strongly sloping to steep and are on uplands.

In a typical profile the surface layer, about 6 inches thick, is very dark grayish-brown and brown loam. The subsoil extends to a depth of about 11 inches and is a yellowish-brown, friable fine sandy loam. Below this, to a depth of about 18 inches, is a layer of yellowish-brown, loose fine sand. Sandstone bedrock is at a depth of about 18 inches.

The Ramsey soils are very strongly acid in the surface layer unless limed, and they are low in natural fertility. They have a shallow root zone. Permeability is moderately rapid in the upper 11 inches and rapid below that depth. Tillage is hindered by sandstone or siltstone fragments in some places.

Representative profile of Ramsey loam, 10 to 20 percent slopes (1 mile southeast of State Route 224, on Royal and Loan Oak Church Road, on a north roadbank):

A1—0 to 1 inch, very dark grayish-brown (2.5Y 3/2) loam; medium, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

A2—1 to 6 inches, brown (10YR 5/3) loam; weak, fine, granular structure; very friable; very strongly acid; clear, smooth boundary.

B—6 to 11 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, subangular blocky structure; friable; very strongly acid; gradual, smooth boundary.

C—11 to 18 inches, yellowish-brown (10YR 5/4), fine sand; massive; loose; many, partially weathered, soft sandstone fragments; very strongly acid.

R—18 inches +, sandstone bedrock.

Depth to bedrock ranges from about 10 to 20 inches. In some places the profile contains about 10 to 15 percent coarse frag-

ments throughout. In cleared areas there is a brown (10YR 5/3) Ap horizon. The B horizon has a hue that ranges from 10YR to 7.5YR, a value of 5 or 6, and a chroma that ranges from 4 to 6. The B horizon ranges from about 4 to 8 inches in thickness and is fine sandy loam to loam. Reaction is strongly acid or very strongly acid. The C horizon ranges from loam to fine sand.

The Ramsey soils occur with the Weikert, Gilpin, Shelocta, and Caneyville soils. They contain more sand and fewer coarse fragments throughout the profile than the Weikert soils, but they are similar in depth to the Weikert soils. The Ramsey soils are more shallow to bedrock and contain more sand throughout the profile than the Gilpin soils. They are more shallow to bedrock and more sandy throughout than the Shelocta soils, which are on foot slopes. They lack the clayey B horizons of the Caneyville soils and are more shallow to bedrock than those soils.

Ramsey loam, 10 to 20 percent slopes (RaD).—This somewhat excessively drained, strongly sloping soil is on convex side slopes that are dissected by many small drains. Areas range from about 5 to 20 acres in size. There are a few rock outcrops. A profile of this soil is described as representative of the series.

Included with this soil in mapping are small areas of moderately eroded Ramsey soils, a few areas of moderately steep Ramsey soils, and a few areas of Ramsey soils that have a surface layer of fine sandy loam or channery loam. Included also are a few areas of a soil that has a thicker subsoil and is deeper to bedrock and a soil that is extremely acid in the lower horizons. Some areas of Weikert soils are also included.

A shallow root zone, droughtiness, and severe erosion hazard make this soil unsuitable for cultivation and somewhat limit its use for pasture. The available moisture capacity and organic-matter content are low.

This soil is used mostly for woods. (Capability unit VIe–7; woodland suitability group 8)

Ramsey loam, 10 to 30 percent slopes, severely eroded (RaE3).—This somewhat excessively drained, strongly sloping to moderately steep soil is on uplands that are highly dissected by small drains. Areas range from about 5 to 15 acres in size. A few sandstone outcrops are in some areas. The profile of this soil differs from the one described as representative of the series in that the surface layer is yellowish-brown fine sandy loam. Also, the soil is more shallow to bedrock. The surface layer consists mostly of subsoil material that has been exposed by erosion. There are rills and shallow gullies in places.

Included with this soil in mapping are a few acres of Weikert soils and some Ramsey soils that have a fine sandy loam or channery loam surface layer. Included also are a few areas of a soil that is extremely acid in the lower horizons.

Effects of past erosion and hazard of additional erosion make this soil unsuitable for cultivation. It has very low potential for pasture use. The available moisture capacity and organic-matter content are very low.

This soil is used mostly for woods. A few areas are idle. (Capability unit VIIe–3; woodland suitability group 9)

Rarden Series

The Rarden series consists of moderately deep, well drained to moderately well drained soils that formed in residuum from acid shale. These soils are sloping to strongly sloping and are on smooth uplands.

In a typical profile the surface layer, about 5 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 17 inches and is yellowish-brown, friable or firm silty clay loam. The middle part extends to a depth of about 29 inches and is a strong-brown, firm silty clay. The lower part of the subsoil is variegated pale-brown, yellowish-brown and greenish-gray, firm sandy clay. Soft shale bedrock is at a depth of about 37 inches.

The Rarden soils have a moderately deep root zone and are moderately slow in permeability. They are moderately low in natural fertility and very strongly acid in the surface layer unless limed. The available moisture capacity is moderate.

Representative profile of Rarden silt loam, 12 to 20 percent slopes (200 yards north of U.S. Highway No. 62, 350 feet west of Richland Creek, at the site of Floodwater Retarding Structure No. 12, Caney Creek watershed):

Ap—0 to 5 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

B21t—5 to 17 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable or firm; thin patchy clay films; common sandstone and shale fragments 2 to 5 millimeters in size; very strongly acid; clear, smooth boundary.

B22t—17 to 29 inches, strong-brown (7.5YR 5/6) silty clay; common, medium, distinct variegations of yellowish brown (10YR 5/6), yellowish red (5YR 4/6), and pale olive (5Y 6/3); moderate, medium, angular blocky structure; firm, sticky, slightly plastic; few, thin, patchy clay films; common sandstone and shale fragments 2 to 15 millimeters in size; very strongly acid; gradual, smooth boundary.

B3—29 to 37 inches, variegated pale-brown (10YR 6/3), yellowish-brown (10YR 5/6), and greenish-gray (5GY 6/1) sandy clay; weak, medium, angular blocky structure; firm, sticky, slightly plastic; many sandstone and shale fragments 5 to 20 millimeters in size; very strongly acid.

R—37 inches +, soft shale bedrock.

The solum ranges from about 18 to 40 inches in thickness. Depth to bedrock ranges from about 24 to 40 inches. The loess component, where present, is less than 20 inches thick. The Ap horizon ranges from brown (10YR 5/3) to dark yellowish brown (10YR 4/4) and is silty clay loam in severely eroded areas. The B1 horizon is yellowish-brown (10YR 5/4) or dark yellowish-brown (10YR 4/4) silt loam in some places. The B21t horizon includes strong brown (7.5YR 5/6) and brown (7.5YR 4/4) and is silty clay loam or silty clay. The B22t horizon includes variegations of light yellowish brown (10YR 6/4), light olive brown (2.5Y 5/4), and brownish yellow (10YR 6/6). The B22t horizon is silty clay or clay. The B3 horizon is silty clay in some places. In some places there is a C horizon of variegated pale-yellow, pale-olive, and olive-gray clay.

These soils are not within the defined range for the series in that they lack gray mottles in the upper 24 inches of the B horizon, but this does not alter their usefulness and behavior.

The Rarden soils occur with the Wellston, Gilpin, Christian, and Caneyville soils. Rarden soils have a finer textured B horizon and are more influenced by shale than the Wellston or Gilpin soils, which contain components of silty loess. They are more shallow to bedrock and less red in the B horizon than the Christian soils. Rarden soils are more acid and less red in the B horizon than the Caneyville soils.

Rarden silt loam, 6 to 12 percent slopes (RdC).—This well-drained, sloping soil is on narrow tops and side slopes in the uplands. Areas range from about 4 to 12 acres in size. Plowing has mixed some of the subsoil material with the surface layer.

Included with this soil in mapping are a few areas of soils that have a redder subsoil than the Rarden soils and

a few areas of Rarden soils that have a surface layer of loam. Also included are small areas of Mercer soils.

Erosion is a severe hazard in cultivated areas. Plants respond well to applications of fertilizer and lime. Organic-matter content is low. This soil is fairly easy to till, except in areas where the clayey subsoil has been exposed by erosion.

This soil is used mostly for pasture and hay, but a few areas are in row crops. A small acreage is in woods. (Capability unit IIIe–14; woodland suitability group 5)

Rarden silt loam, 12 to 20 percent slopes (RdD).—This well-drained, strongly sloping soil is on uplands that are dissected by many small drains. Areas range from about 6 to 22 acres in size. A profile of this soil is described as representative of the series. Plowing has mixed some of the subsoil material with the surface layer.

Included with this soil in mapping are a few areas of soils that have a redder subsoil than the Rarden soils and a few areas of Rarden soils that have a surface layer of loam. Also included are a few areas that are moderately steep.

A very severe hazard of erosion limits the use of this soil for cultivated crops. Plants respond well to applications of fertilizer and lime. Organic-matter content is low. This soil is fairly easy to till, except in areas where the clayey subsoil has been exposed by erosion.

This soil is used mostly for pasture and woods, but a small acreage is in hay. (Capability unit IVe–6; woodland suitability group 5)

Rarden silty clay loam, 6 to 12 percent slopes, severely eroded (ReC3).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops. Areas range from about 5 to 12 acres in size. The profile of this soil differs from the one described as representative of the series in that the present surface layer is yellowish-brown silty clay loam and consists mostly of subsoil material exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are a few areas of soils that have a redder subsoil than the Rarden soils. Also included are small areas of Mercer soils.

Erosion is a very severe hazard in cultivated areas. Plants respond fairly well to applications of fertilizer and lime. Organic-matter content is very low. This soil is somewhat difficult to till because of the high clay content in the surface layer.

This soil is used mostly for pasture but a small acreage is in hay. A few idle areas are revegetating naturally, providing food and cover for wildlife. (Capability unit IVe–14; woodland suitability group 7)

Rarden silty clay loam, 12 to 20 percent slopes, severely eroded (ReD3).—This well-drained, strongly sloping soil of the uplands is on side slopes that are dissected by small drains. Areas range from about 5 to 20 acres in size. The profile of this soil differs from the one described as representative of the series in that the surface layer is yellowish-brown silty clay loam and consists mostly of subsoil material exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are a few areas of Rarden soils that are moderately steep and small areas of soils that have a redder subsoil than the Rarden soils.

Past erosion and the hazard of additional erosion make the soil unsuitable for cultivation, and it should remain in permanent vegetation. Plants respond fairly well to applications of fertilizer and lime. Organic-matter content is very low. This soil is somewhat difficult to till because of the high clay content in the surface layer.

This soil is used mostly for pasture. A moderate acreage is idle and is revegetating naturally, providing food and cover for wildlife. (Capability unit VIe–4; woodland suitability group 7)

Sadler Series

The Sadler series consists of moderately well drained soils that have a fragipan. These soils formed in 2 to 4 feet of loess and in the underlying residuum from acid siltstone, sandstone, shale, and, in a few places, limestone. They are nearly level to gently sloping and are on smooth uplands.

In a typical profile the surface layer, about 7 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 20 inches and is a yellowish-brown, friable silt loam. Next is a 4-inch layer of light yellowish-brown friable silt loam. Underlying this, to a depth of about 48 inches, is a mottled brown and gray silt loam fragipan that is firm, brittle, and compact. This overlies a light olive-brown clay loam layer about 14 inches thick. The substratum is a mottled gray and yellowish-brown loam in the upper part and is sandstone and shale fragments that are mixed with clay loam and sandy clay in the lower part. Sandstone bedrock is at a depth of about 94 inches.

The Sadler soils are moderately deep to a fragipan that slows water movement and restricts root growth. They are very strongly acid in the surface layer unless limed, and they are moderate in natural fertility. The available moisture capacity is moderate, and the organic-matter content is low. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting, except in areas where the subsoil has been exposed by erosion.

Representative profile [2] of Sadler silt loam, 2 to 6 percent slopes (approximately 2 miles south of Caneyville, one-half mile southeast of State Route 185, 430 feet northwest of a farmhouse):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular and weak, medium, platy structure; very friable; many roots; medium and fine pores; some worm casts; common specks of dark-brown concretions; slightly acid; abrupt, smooth boundary.

B1—7 to 13 inches, yellowish-brown (10YR 5/6) to strong-brown (7.5YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; many roots; common medium pores; common specks of very dark brown concretions; very strongly acid; gradual, smooth boundary.

B2t—13 to 20 inches, yellowish-brown (10YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; many roots; few patchy clay films on ped surfaces and in some pores; common specks of very dark brown concretions; very strongly acid; clear, smooth boundary.

A'2—20 to 24 inches, light yellowish-brown (10YR 6/4) silt loam; common, fine, faint mottles of yellowish brown (10YR 5/8), strong brown (7.5YR 5/6), and light brownish gray (2.5Y 6/2); weak, fine and medium, granular structure; friable; common roots; many

[2] This profile was sampled for chemical, physical, and mineralogical characteristics. Results of laboratory analysis are given in the section "Laboratory Analyses," sample number S63Ky43–13.

medium pores; many specks of very dark brown concretions; very strongly acid; clear, irregular boundary.

IIBx1—24 to 38 inches, mottled yellowish-brown (10YR 5/6), dark-brown (10YR 3/3), and grayish-brown (2.5Y 5/2) silt loam; coarse, prismatic structure; gray clay flows on vertical faces; firm, very brittle; few roots in cracks between prisms; few medium pores; gray silty clay loam tongues, 1 to 3 inches across; some horizontal clay flows; very strongly acid; diffuse, wavy boundary.

IIBx2—38 to 48 inches, brown (10YR 5/3) silt loam; few, medium, distinct mottles of light brownish gray (10YR 6/2); weak, coarse, prismatic structure, massive when broken; firm, compact, brittle; thick, gray clay flows on vertical faces; gray, vertical, silty clay loam tongues, one-half to 1 inch across; common dark-brown concretions; very strongly acid; diffuse, wavy boundary.

IIB3t—48 to 62 inches, light olive-brown (2.5Y 5/4) clay loam; few, fine, faint mottles of grayish brown (10YR 5/2); weak, medium, angular blocky structure; firm; gray clay films on vertical faces; noticeable amount of very fine sand; few small sandstone fragments, one-fourth to one-half inch across; common dark-brown concretions; very strongly acid; clear, smooth boundary.

IIC1—62 to 76 inches, mottled gray (5Y 6/1), yellowish-brown (10YR 5/8), and gray (N 6/0) loam; massive; firm; few, very dark brown concretions; some black manganese staining; very strongly acid; gradual, wavy boundary.

IIC2—76 to 94 inches, thin-bedded, highly weathered sandstone and shale that have clay loam and sandy clay interstitial material ranging from yellowish brown to gray; very strongly acid.

R—94 inches +, sandstone bedrock.

The solum ranges from 40 to 70 inches in thickness. Depth to the fragipan ranges from about 18 to 26 inches. Depth to bedrock is 50 inches or more. The Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). The B2t horizon ranges from yellowish brown (10YR 5/4) to brownish yellow (10YR 6/6). It ranges from silt loam to silty clay loam. The Bx horizon includes mottled colors of light yellowish brown, pale olive, pale brown, and light gray. The Bx horizon is silt loam or light silty clay loam.

The Sadler soils occur with the Wellston, Zanesville, and Johnsburg soils. The Sadler soils have a fragipan that is lacking in Wellston soils, and they are more yellow in hue and less well drained than those soils. They are intermediate in drainage between the well drained to moderately well drained Zanesville soils and the somewhat poorly drained Johnsburg soils. The Sadler soils have a slightly less red hue in the subsoil and a fragipan that is generally closer to the surface than the Zanesville soils. They contain a lower percentage of gray mottles than the Johnsburg soils. The Sadler soils are similar to the Captina soils of the stream terraces, which are underlain by stratified silt, sand, and clay. They are similar in drainage to the Mercer soils, but they have a thicker fragipan and contain less clay in the underlying horizons than those soils.

Sadler silt loam, 0 to 2 percent slopes (SaA).—This moderately well drained, nearly level soil is in broad areas on the uplands. Areas range from about 10 to 40 acres in size.

Included with this soil in mapping are small areas of Johnsburg and Stendal soils. Also included are a few areas of moderately eroded Sadler soils.

Erosion is not a hazard on this soil. The soil becomes slightly waterlogged above the slowly permeable fragipan in winter and early in spring, and there is a tendency for water to collect in the level areas. Surface drainage of some level areas will improve the suitability for some farm crops. Alfalfa tends to die out within two years on this soil. Plants respond well to fertilizer and lime.

This soil is used mostly for row crops, pasture, and hay, but a few areas are in woods. It has fairly good potential for truck and horticultural crops. (Capability unit IIw–2; woodland suitability group 4)

Sadler silt loam, 2 to 6 percent slopes (SaB).—This moderately well drained, gently sloping soil is on broad ridgetops. Areas range from about 5 to 30 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are a few areas of moderately eroded and severely eroded Sadler soils and some areas that have silty clay or clay underlying the fragipan. Also included are small areas of Zanesville, Johnsburg, and Stendal soils.

Erosion is a moderate hazard in cultivated areas. Plants respond well to applications of fertilizer and lime. The slowly permeable fragipan in the lower part of the subsoil slows water movement and restricts root growth of some plants.

This soil is used mostly for row crops, pasture, and hay, but a few areas are in woods. It has good potential for truck and horticultural crops. (Capability unit IIe–7; woodland suitability group 4)

Shelocta Series

The Shelocta series consists of deep, well-drained soils that formed on foot slopes in local alluvium that was washed from soils of the uplands that are of acid siltstone, sandstone, and shale origin. Shelocta soils are gently sloping to strongly sloping.

In a typical profile the surface layer, about 7 inches thick, is dark grayish-brown and brown gravelly silt loam. The upper part of the subsoil extends to a depth of about 13 inches and is yellowish-brown, friable gravelly silt loam. The lower part of the subsoil extends to a depth of 52 inches or more; it is strong-brown, friable or firm gravelly silty clay loam.

Shelocta soils have a moderate to high available moisture capacity and are medium acid to very strongly acid in the surface layer unless limed. They have a deep root zone and moderate permeability. These soils are somewhat unfavorable for tillage because of the gravel content in the surface layer.

Representative profile of Shelocta gravelly silt loam, 12 to 20 percent slopes (2 miles south of Leitchfield, and 250 yards west of State Route 259):

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; weak, fine, granular structure; very friable; 20 percent coarse fragments; medium acid; abrupt, smooth boundary.

A2—2 to 7 inches, brown (10YR 5/3) gravelly silt loam; weak, fine, granular structure; very friable; 20 percent coarse fragments; very strongly acid; clear, smooth boundary.

B1—7 to 13 inches, yellowish-brown (10YR 5/6) gravelly silt loam; weak, medium, subangular blocky structure; friable; 25 percent coarse fragments; very strongly acid; clear, smooth boundary.

B2t—13 to 52 inches +, strong-brown (7.5YR 5/6) gravelly silty clay loam; moderate, medium, subangular blocky structure; friable or firm; patchy clay films; 30 percent coarse fragments; few dark-brown concretions; very strongly acid.

The solum ranges from about 40 to 60 inches in thickness. Depth to bedrock ranges from about 48 to 60 inches or more. In cultivated areas the Ap horizon generally is brown (10YR

4/3 or 10YR 5/3). The B1 horizon ranges from yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4). The B2t horizon is heavy silt loam to silty clay loam. The entire B horizon ranges from about 18 to 35 percent in clay content. The A and B horizons range from about 10 to 35 percent, by volume, in content of coarse fragments. In some places the profile has mottling below a depth of 30 inches.

The Shelocta soils occur with the Weikert, Ramsey, Gilpin, and Allegheny soils. The Shelocta soils are deeper to bedrock and finer textured in the B horizon than the Weikert and Ramsey soils, and they occupy foot slopes instead of uplands. They are deeper to bedrock than the Gilpin soils. The Shelocta soils have less sand but more coarse fragments in the solum than the Allegheny soils. They occur, to a lesser extent, with the well-drained Cuba soils, which are on flood plains and have a less developed profile.

Shelocta gravelly silt loam, 2 to 6 percent slopes (ShB).—This well-drained, gently sloping soil is on narrow foot slopes below soils on uplands that are underlain by siltstone, sandstone, and shale. Areas range from about 3 to 10 acres in size.

Included with this soil in mapping are a few moderately eroded Shelocta soils and some areas of a soil that is not gravelly in the surface layer or the subsoil. Also included are a few small areas of a soil that contains more sand throughout the profile than the Shelocta soils.

Erosion is a moderate hazard in cultivated areas. This soil is moderate in natural fertility, but plants respond well to fertilizer and lime. Organic-matter content is low.

This soil is used mostly for row crops, hay, and pasture. (Capability unit IIe–1; woodland suitability group 3)

Shelocta gravelly silt loam, 6 to 12 percent slopes (ShC).—This well-drained, sloping soil is on narrow foot slopes below soils on uplands that are derived mostly from siltstone, sandstone, and shale. Areas range from about 4 to 11 acres in size.

Included with this soil in mapping are a few areas of moderately eroded Shelocta soils and some areas of soils that are nongravelly throughout the profile. Also included are a few small areas of a soil that contains more sand throughout than the Shelocta soils.

Erosion is a severe hazard in cultivated areas. This soil is moderate in natural fertility, but plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for row crops, hay, and pasture, but a few areas are in woods. (Capability unit IIIe–7; woodland suitability group 3)

Shelocta gravelly silt loam, 12 to 20 percent slopes (ShD).—This well-drained, strongly sloping soil is on foot slopes below soils on uplands that are derived mostly from siltstone, sandstone, and shale. Areas range from about 4 to 16 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are a few areas of moderately eroded Shelocta soils and some soils that are nongravelly throughout the profile. Also included are a few small areas of a soil that contains more sand throughout than the Shelocta soils.

Erosion is a very severe hazard in cultivated areas. This soil is moderate in natural fertility, but plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for woods and pasture, but a few areas are in row crops and hay. (Capability unit IVe–4; woodland suitability group 3)

Shelocta gravelly silt loam, 12 to 20 percent slopes, severely eroded (ShD3).—This well-drained, strongly sloping soil is on foot slopes below soils and uplands that are derived mostly from siltstone, sandstone, and shale. Areas range from about 4 to 12 acres in size. This soil differs from the one described as representative of the series in that the surface layer is yellowish brown and consists mostly of subsoil material exposed by erosion. There are rills and shallow gullies in some places.

Included with this soil in mapping are a few areas of Shelocta soils that have slopes ranging from 6 to 12 percent.

The hazard of erosion and effects of past erosion make this soil unsuited to cultivation and necessitate a permanent vegetative cover. The soil is moderately low in natural fertility, but plants respond well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture and woods. A few idle areas are revegetating naturally and provide food and cover for wildlife. (Capability unit VIe–4; woodland suitability group 6)

Steff Series

The Steff series consists of deep, moderately well drained soils that formed in alluvium washed from soils on uplands that are underlain primarily by sandstone, siltstone, shale, and loess. They are nearly level and are on flood plains along streams in areas underlain by sandstone, siltstone, and shale.

In a typical profile the surface layer, about 7 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 23 inches and is brown, friable silt loam that has a few, light brownish-gray and pale-brown mottles. The lower part, to a depth of 52 inches or more, is light brownish-gray, friable or firm silt loam that has common mottles of dark yellowish brown and yellowish brown.

The Steff soils have a deep root zone and are moderately permeable. These soils are strongly acid or very strongly acid in the surface layer unless limed, and are moderately high in natural fertility. Organic-matter content is medium, and the available moisture capacity is high. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Steff silt loam (1½ miles southeast of Steff, three-fourths mile south of U.S. Highway No. 62, 150 yards south of Caney Creek):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many fine roots; medium acid; clear, smooth boundary.

B21—7 to 23 inches, brown (10YR 4/3) silt loam; few, fine, faint mottles of light brownish gray (10YR 6/2) and pale brown (10YR 6/3); weak, fine, granular structure; friable; many fine roots; common, medium, dark-brown and black concretions; very strongly acid; clear, wavy boundary.

B22g—23 to 52 inches +, light brownish-gray (2.5Y 6/2) silt loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); weak, fine, granular structure; friable or firm; common dark-brown and black concretions; very strongly acid.

The alluvial deposit is 48 to 60 inches or more thick. A few sandstone or shale fragments, 2 to 10 millimeters across, are in some places but make up less than 10 percent of the volume.

Reaction is strongly acid or very strongly acid throughout the profile unless the soil has been limed. The Ap horizon ranges from brown (10YR 4/3) to dark grayish brown (10YR 4/2). In some places the matrix color of the B21 horizon ranges from brown (10YR 4/3) to dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/4). The B21 horizon includes mottled colors of grayish brown, pale olive, and strong brown. It is dominantly silt loam but ranges to light silty clay loam. The matrix color of the B22g horizon ranges from light brownish gray (10YR 6/2) to olive gray (5YR 5/2). The B22g horizon includes mottled colors of brown, strong brown, and pale yellow. It is silt loam or light silty clay loam. In some places the profile has a Cg horizon below a depth of 24 to 34 inches that is gray, contains a few high-chroma mottles, and is massive.

The Steff soils occur with the Cuba, Stendal, and Bonnie soils. They are mottled with gray colors at more shallow depths than the well-drained Cuba soils. Steff soils are better drained and are less gray in the upper part of the B horizon than the somewhat poorly drained Stendal soils and the poorly drained Bonnie soils. They have drainage and colors similar to the Lindside soils but are more acid.

Steff silt loam (Ss).—This moderately well drained, nearly level soil is on flood plains. Areas range from about 7 to 35 acres in size. Slopes range mostly from 0 to 2 percent, but some range up to 4 percent.

Included with this soil in mapping are a few areas of Steff soils that have a loam surface layer and some areas of soils that are stratified.

Erosion is not a hazard on this soil. A seasonal high water table that rises to within 1½ to 2 feet of the surface during rainy periods delays planting of spring crops in some years unless the soil is artificially drained. Occasional flooding occurs during winter and early in spring, but damage is minor and overflow is not detrimental to the commonly grown crops. Most areas benefit from the deposition of fertile sediments. Plants respond well to applications of fertilizer and lime.

This soil is used mostly for row crops, hay, and pasture. It has good potential for truck crops. (Capability unit I–2; woodland suitability group 1)

Stendal Series

The Stendal series consists of deep, somewhat poorly drained soils that formed in alluvium from soils on uplands underlain by sandstone, siltstone, shale, and loess. They are nearly level and are on flood plains along streams in areas where the soils are underlain by sandstone, siltstone, and shale.

In a typical profile the surface layer, about 7 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 18 inches and is grayish-brown, friable silt loam that has many mottles of pale brown and light brownish gray. The lower part of the subsoil, to a depth of about 32 inches, is light brownish-gray, friable silt loam that has common mottles of dark yellowish brown. The underlying material extends to a depth of 50 inches or more. It is light brownish-gray, friable silt loam that has common mottles of brown.

The Stendal soils have a deep root zone and are moderately permeable. They are strongly or very strongly acid in the surface layer unless limed, and they are moderate in natural fertility. The available moisture capacity is high, and organic-matter content is medium. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Stendal silt loam (160 feet west of State Route 79, 300 feet south of Illinois Central Railroad, at Caneyville):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

B21—7 to 18 inches, grayish-brown (10YR 5/2) silt loam; many, fine, faint mottles of pale brown (10YR 6/3) and light brownish gray (10YR 6/2); weak, fine, granular structure; friable; very strongly acid; clear, smooth boundary.

B22g—18 to 32 inches, light brownish-gray (2.5Y 6/2) silt loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); weak, fine, granular structure; friable; common dark-brown concretions; very strongly acid; gradual, smooth boundary.

Cg—32 to 50 inches +, light brownish-gray (2.5Y 6/2) silt loam; common, medium, distinct mottles of brown (7.5YR 4/4); massive; friable; common dark-brown concretions; very strongly acid.

The alluvial deposit is more than 60 inches thick. Reaction is strongly acid or very strongly acid throughout the profile unless the soil has been limed. The Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 4/3). The matrix color of the B21 horizon ranges from brown (10YR 5/3) to dark grayish brown (2.5Y 4/2). It includes mottled colors that range from dark gray (10YR 4/1) to light brownish gray (2.5Y 6/2). The B21 horizon is silt loam or light silty clay loam. The B22g and Cg horizons include mottled colors of pale brown, grayish brown, and light gray. They are silt loam or light silty clay loam.

The Stendal soils occur with the Cuba, Steff, and Bonnie soils. Stendal soils are more poorly drained and grayer at more shallow depths than the Cuba or Steff soils. They are better drained and less gray in the upper part of the B horizon than the poorly drained Bonnie soils. They have drainage and color similar to the Newark soils but are more acid.

Stendal silt loam (St).—This somewhat poorly drained, nearly level soil is on flood plains. Areas range from about 5 to 40 acres in size. Slopes range mostly from 0 to 2 percent, but some range up to 4 percent.

Included with this soil in mapping are a few areas of Stendal soils that have a loam surface layer, and some areas of soils that are stratified.

Erosion is not a hazard on this soil. A seasonal high water table that rises to within ½ to 1½ feet of the surface during rainy periods delays planting of spring crops unless the soil is artificially drained. Occasional flooding occurs during winter and spring. Scouring and deposition are slight hazards in some areas. Crops respond well to applications of fertilizer and lime.

This soil is used mostly for row crops, hay, and pasture, but a small acreage is in trees. (Capability unit IIw–4; woodland suitability group 2)

Weikert Series

The Weikert series consists of shallow, well-drained soils that formed in residuum from acid interbedded sandstone, siltstone, and shale. These soils are strongly sloping to steep and are on uplands.

In a typical profile the surface layer, about 6 inches thick, is channery silt loam. It is very dark grayish brown in the upper 2 inches and pale brown in the lower 4 inches. The subsoil is light yellowish-brown, friable channery silt loam overlying loose very channery silt loam that extends to bedrock at a depth of about 17 inches.

The Weikert soils have a shallow root zone and are moderately rapid in permeability. They are medium acid to

very strongly acid throughout the profile unless limed, and they are low in natural fertility. They are very droughty in dry periods. Tillage is hindered by a high content of coarse fragments in the soil.

Representative profile of Weikert channery silt loam, 12 to 30 percent slopes (100 feet west of Duff Road, and approximately 350 feet south of Stones View Church):

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) channery silt loam; weak, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

A2—2 to 6 inches, pale-brown (10YR 6/3) channery silt loam; weak, fine, granular structure; very friable; strongly acid; clear, smooth boundary.

B—6 to 12 inches, light yellowish-brown (10YR 6/4) channery silt loam; weak, fine, subangular blocky structure; friable; 40 to 50 percent siltstone fragments 2 to 10 millimeters in size; very strongly acid; gradual, wavy boundary.

C—12 to 17 inches, light yellowish-brown (10YR 6/4) very channery silt loam; massive; loose; 50 to 65 percent small siltstone fragments 2 to 10 millimeters in size; very strongly acid.

R—17 inches+, partially disintegrated siltstone and sandstone.

The depth to bedrock ranges from about 8 to 20 inches. Coarse fragments comprise 35 to 65 percent of the volume througout the profile. Stony phases, which have 1 to 15 percent of their surface covered with stones, have been mapped in a complex with Ramsey and Gilpin soils. In cultivated areas there is an Ap horizon ranging in color from dark grayish brown (10YR 4/2) to brown (10YR 5/3). The A2 horizon ranges in color from pale brown (10YR 6/3) to yellowish brown (10YR 5/4). The B horizon colors include yelowish brown (10YR 5/4 and 5/6) and strong brown (7.5YR 5/6). The B horizon ranges from about 3 to 14 inches in thickness. The fine fraction in the C horizon ranges from silt loam to fine sandy loam.

The Weikert soils occur with the Gilpin, Ramsey, Shelocta, and Caneyville soils. The Weikert soils are more shallow to bedrock and contain more coarse fragments than the Gilpin soils. They contain less sand and more coarse fragments than the Ramsey soils. The Weikert soils are much more shallow to bedrock and are coarser textured in the B horizon than the Shelocta soils. They have less clay in the B horizon than the Caneyville soils and are more shallow to bedrock.

Weikert channery silt loam, 12 to 30 percent slopes (WcE).—This well-drained, strongly sloping to moderately steep soil is on long, convex side slopes in the uplands. Areas range from about 10 to 40 acres in size. There are a few rock outcrops. A profile of this soil is described as representative of the series.

Included with this soil in mapping are small areas of moderately eroded Weikert soils, a few areas of a soil that has a thicker subsoil and is deeper to bedrock than the Weikert soils, and some areas of soils that are underlain by clay shale. Also included are areas of Weikert soils that have a surface layer of shaly silt loam and areas of a soil that is extremely acid in the subsoil.

The shallow root zone, steepness of slope, and severe erosion hazard make this soil unsuited to cultivation and limit its use for pasture. The available moisture capacity and organic-matter content are low.

This soil is used mostly for woods, but a few areas are in low-quality pasture. (Capability unit VIIe–1; woodland suitability group 8)

Weikert channery silt loam, 12 to 30 percent slopes, severely eroded (WcE3).—This well-drained, strongly sloping to moderately steep soil is on long, convex side slopes in the uplands. Areas range from about 5 to 25 acres in size. There are a few rock outcrops. This soil differs from the one described as representative of the series in that the surface layer consists mostly of subsoil material exposed by erosion and is brown or yellowish brown. In addition, the depth to bedrock is less. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas of a soil that has a thicker subsoil and is deeper to bedrock than the Weikert soils. Also included are a few areas of a soil that is underlain by clay shale, a soil that has a surface layer that is shaly silt loam, and a soil that is extremely acid in the subsoil.

The effects of past erosion and the hazard of additional erosion make this soil unsuited to cultivation and poorly suited to use for pasture. The available moisture capacity and organic matter content are very low.

This soil is used mostly for woods, but a few areas are in low-quality pasture. A moderate acreage is idle and revegetating naturally; this provides food and cover for wildlife. (Capability unit VIIe–3; woodland suitability group 9)

Weikert-Ramsey-Gilpin stony complex, 20 to 30 percent slopes (WgE).—This is a complex of soils that are stony and are intermingled in such intricate patterns that separation of the different series is not practical. Stones cover from about 1 to 15 percent of the surface. Weikert soils constitute about 50 percent of the complex; Ramsey soils, about 20 percent; Gilpin soils, about 15 percent; and minor soils, about 15 percent. These excessively drained to well-drained, moderately steep stony soils are in close association on hillsides in highly dissected uplands. Areas range from about 10 to 40 acres in size. These soils have profiles that differ from the ones described as representative of the Weikert, Ramsey, and Gilpin series in that the surface layer is stony.

Included with these soils in mapping are small areas of moderately eroded soils and a few areas of soils having slopes of 12 to 20 percent. Also included are small areas of the minor Caneyville, Rarden, and Shelocta soils.

The soils that make up this complex are not suited to cultivation, because of stoniness, shallowness, and a very severe erosion hazard. Stones and steepness of slope limit the use of farm machinery.

These soils are used mostly for woods, but a few areas are in low-quality pasture. (Capability unit VIIs–1; woodland suitability group 8)

Weikert-Ramsey-Gilpin stony complex, 20 to 30 percent slopes, severely eroded (WgE3).—This is a complex of soils that are stony and are intermingled in such intricate patterns that separation of the different series is not practical. Stones cover from about 1 to 15 percent of the surface. Weikert soils constitute about 50 percent of the complex; Ramsey soils, about 20 percent; Gilpin soils, about 15 percent; and minor soils, about 15 percent. These excessively drained to well-drained, moderately steep stony soils are in close association on hillsides in highly dissected uplands. Areas range from about 8 to 50 acres in size. These soils have profiles that differ from the ones described as representative of the Weikert, Ramsey, and Gilpin series in that the surface layer is stony and consists mostly of subsoil material. Also, these soils are more shallow to bedrock.

Included with these soils in mapping are a few small areas of soils that have slopes of 12 to 20 percent. Also in-

cluded are small areas of the minor Caneyville, Rarden, and Shelocta soils.

The soils of this complex are not suited to cultivation, because of stoniness, shallowness, and a very severe erosion hazard. They have very low potential for pasture. Stones and steepness of slope limit the use of farm machinery.

These soils are used mostly for woods, but a small acreage is in very low quality pasture. A few idle areas are revegetating naturally and are providing food and cover for wildlife. (Capability unit VIIs–3; woodland suitability group 9)

Weikert-Ramsey-Gilpin stony complex, 30 to 50 percent slopes (WgF).—These stony soils are in areas intermingled in such intricate patterns that separation of the different series is not practical. Stones cover from about 1 to 15 percent of the surface. Weikert soils constitute about 50 percent of the complex; Ramsey soils, about 20 percent; Gilpin soils, about 15 percent; and minor soils, about 15 percent. These excessively drained to well-drained, steep soils are in close association on long hillsides in highly dissected uplands. Areas range from about 15 to 50 acres in size. These soils have profiles that differ from the ones described as representative of the Weikert, Ramsey, and Gilpin series in that the surface layer is stony.

Included with these soils in mapping are a few areas of severely eroded soils. Also included are small areas of the minor Caneyville, Rarden, and Shelocta soils.

The soils of this complex are not suited to cultivation, because of stoniness, shallowness, and a very severe erosion hazard. Stones and steepness of slope prohibit the use of farm machinery.

These soils are used mostly for woods. (Capability unit VIIs–1; woodland suitability group 8)

Wellston Series

The Wellston series consists of deep, well-drained soils that formed in 2 to 4 feet of loess and the underlying residuum from acid siltstone, sandstone, and shale. These soils are gently sloping to strongly sloping and are on uplands.

In a typical profile the surface layer, about 6 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 31 inches and is brown and strong-brown, friable silty clay loam. The lower part of the subsoil is strong-brown, friable gravelly clay loam and sandy clay loam that is variegated with shades of brown and red. Sandstone bedrock is at a depth of about 47 inches.

Wellston soils are moderately permeable. Roots and moisture penetrate the subsoil easily enough and deeply enough for good plant growth. These soils are very strongly acid or strongly acid in the surface layer unless limed, and they are moderate in natural fertility. The available moisture capacity is high. Except in severely eroded spots where the moderately fine textured subsoil is exposed, these soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Representative profile of Wellston silt loam, 6 to 12 percent slopes (1⅛ miles northwest of Leitchfield, 75 feet north of junction of Sun Beam Road and Boston Hill Road, on an east roadbank):

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

B21t—6 to 16 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable; continuous thin clay films; strongly acid; gradual, smooth boundary.

B22t—16 to 31 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular and angular blocky structure; friable; continuous thin clay films; very strongly acid; clear, wavy boundary.

IIB23t—31 to 39 inches, strong-brown (7.5YR 5/6) gravelly clay loam; weak, medium, subangular blocky structure; friable; few, thin, patchy clay films; about 30 percent sandstone fragments 5 to 20 millimeters in diameter; very strongly acid; clear, smooth boundary.

IIB24t—39 to 47 inches, variegated yellowish-brown (10YR 5/6), yellowish-red (5YR 5/6), and light yellowish-brown (10YR 6/4) sandy clay loam; moderate, medium, angular blocky structure; firm; common clay films; about 18 percent soft fragments of yellowish-red sandstone 5 to 30 millimeters in diameter; very strongly acid.

R—47 inches +, sandstone bedrock.

The solum ranges from about 25 to 48 inches in thickness. Depth to bedrock ranges from about 40 to 60 inches or more. Coarse fragments and sand coarser than very fine make up less than 15 percent of the upper 20 inches of the B horizon. Reaction is strongly acid or very strongly acid in horizons below the Ap horizon. The Ap horizon is silty clay loam in severely eroded areas and ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/2). In wooded areas these soils have a very dark grayish-brown (10YR 3/2) to dark-brown (10YR 3/3) A1 horizon that is 1 to 3 inches thick and is underlain by a brown (10YR 5/3) to dark yellowish-brown (10YR 4/4) A2 horizon 3 to 6 inches thick. In some places there is a silt loam B1 horizon, 4 to 6 inches thick, that ranges from yellowish brown (10YR 5/4) to reddish brown (5YR 4/4). The B21t and B22t horizons are fine silt loam or silty clay loam. The B22t horizon ranges from strong brown (7.5YR 5/6) to yellowish brown (10YR 5/6). The IIB horizon ranges from loam to clay loam or sandy clay loam and contains coarse fragments that make up from 2 to 35 percent of the volume. In some places there is a C horizon between the B horizon and bedrock.

The Wellston soils occur with the well drained to moderately well drained Zanesville soils, the moderately well drained Sadler soils, and the somewhat poorly drained Johnsburg soils. They lack the fragipan of the Zanesville, Sadler, and Johnsburg soils and have a redder B horizon than the Sadler and Johnsburg soils. Also, the Wellston soils occur with the moderately deep Gilpin soils, the shallow Weikert and Ramsey soils, and the Rarden soils, which have clayey B horizons.

Wellston silt loam, 2 to 6 percent slopes (WlB).—This well-drained, gently sloping soil is on narrow ridgetops. Areas range from about 5 to 10 acres in size.

Included with this soil in mapping are small areas of Wellston soils, clayey subsoil variant, and small areas of Zanesville and Gilpin soils. Also included are areas of a soil that has a higher sand content throughout the surface layer and subsoil than the Wellston soils, some areas of a soil that is extremely acid in the lower horizons, and a few areas of moderately eroded Wellston soils.

Erosion is a moderate hazard where row crops are grown. Plants respond well to applications of fertilizer and lime. Organic-matter content is medium to low.

This soil is used mostly for row crops, hay, and pasture. It has good potential for truck and horticultural crops. (Capability unit IIe–1; woodland suitability group 3)

Wellston silt loam, 6 to 12 percent slopes (WlC).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 5 to 20 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are small areas of a soil that has a higher sand content throughout the surface layer and subsoil than the Wellston soils and areas of a soil that is extremely acid in the lower horizons. Also included are areas of moderately eroded Wellston soils and small areas of Zanesville and Gilpin soils.

Erosion is a severe hazard in cultivated areas. Plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for pasture and hay, but some acreage is used for corn, tobacco, and small grain. A few areas are in woods. (Capability unit IIIe–1; woodland suitability group 3)

Wellston silt loam, 12 to 20 percent slopes (WlD).—This well-drained, strongly sloping soil is on side slopes in the uplands. Areas range from about 6 to 20 acres in size.

Included with this soil in mapping are small areas of a soil having a higher sand content than the Wellston soils and areas of a soil that is extremely acid in the lower horizons. Also included are a few areas of Zanesville and Gilpin soils and some areas of moderately eroded Wellston soils.

Erosion is a very severe hazard when row crops are grown. Plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for pasture and woods. (Capability unit IVe–4; woodland suitability group 3)

Wellston silty clay loam, 6 to 12 percent slopes, severely eroded (WnC3).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 4 to 16 acres in size. The profile of this soil differs from the one described as representative of the series in that the surface layer is redder, contains more clay, and consists mostly of subsoil material that is exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas of a soil that has a higher sand content throughout the surface layer and subsoil than the Wellston soils and some areas of a soil that is extremely acid in the lower horizons. Also included are small areas of Zanesville and Gilpin soils.

Effects of past erosion and the hazard of additional erosion make this soil suitable only for occasional growing of row crops. Plants respond well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture, but a few areas are in hay. A few idle areas are revegetating naturally and are providing food and cover for wildlife. (Capability unit IVe–11; woodland suitability group 6)

Wellston silty clay loam, 12 to 20 percent slopes, severely eroded (WnD3).—This well-drained, strongly sloping soil is on side slopes in the uplands. Areas range from about 4 to 15 acres in size. This soil has a profile that differs from the one described as representative of the series in that the surface layer is redder, contains more clay, and consists mostly of subsoil material that is exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas of a soil that has a higher sand content throughout the surface layer and subsoil than the Wellston soils and some areas of a soil that is extremely acid in the lower horizons. Also included are small areas of Zanesville and Gilpin soils.

Effects of past erosion and the hazard of additional erosion make this soil unsuited to cultivation and necessitate a permanent vegetation. Plants respond well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture and woods. A few idle areas that are revegetating naturally provide food and cover for wildlife. (Capability unit VIe–4; woodland suitability group 6)

Wellston Series, Clayey Subsoil Variant

The Wellston series, clayey subsoil variant, consists of deep, well-drained soils that formed in 20 to 40 inches of loess and in material weathered from underlying acid shale. They are sloping and strongly sloping soils and are on uplands.

In a typical profile the surface layer, about 8 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 22 inches and is brown and yellowish-red, firm silty clay loam. The lower part of the subsoil is silty clay that extends to a depth of 51 inches. It is mostly variegated reddish brown, yellowish brown, gray, and strong brown. Below this is weathered shale.

Wellston soils, clayey subsoil variant, are moderately slow in permeability and have a deep root zone. These soils are moderate in natural fertility and very strongly acid in the surface layer unless limed. They can be worked through a wide range in moisture content without clodding or crusting, except in severely eroded areas where the more clayey subsoil is exposed.

Representative profile [3] of Wellston silt loam, clayey subsoil variant, 12 to 20 percent slopes (2 miles south of Caneyville, 240 feet northeast of woods):

Ap—0 to 8 inches, brown (7.5YR 4/4) silt loam; weak, medium, granular structure; friable; abundant roots; medium and small pores; common, small, dark-brown concretions; very strongly acid; clear, smooth boundary.

B1t—8 to 12 inches, brown (7.5YR 4/4) silty clay loam; weak, medium, subangular blocky structure; firm; few patchy clay films on some ped surfaces; abundant roots; common medium and small pores; very strongly acid; clear, wavy boundary.

B21t—12 to 22 inches, yellowish-red (5YR 4/6) silty clay loam; reddish-brown (5YR 5/4) ped interiors; moderate, medium, subangular blocky structure; firm; nearly continuous clay films on ped surfaces; many roots; few fine pores; some pale-brown silt coatings; few very dark brown concretions; very strongly acid; clear, wavy boundary.

IIB22tb—22 to 33 inches, reddish-brown (5YR 4/4) silty clay; few, fine, distinct variegations of light olive brown (2.5Y 5/4); weak, medium, prismatic structure breaking to moderate, medium, subangular blocky and fine, angular blocky structure; very firm when moist, plastic when wet, hard when dry; continuous yellowish-red (5YR 4/6) clay films; few roots; 5 to 10 percent sandstone and shale fragments one-half to 1 inch across; very strongly acid; gradual, wavy boundary.

IIB23tb—33 to 44 inches, variegated yellowish-brown (10YR 5/6), gray (5Y 6/1), and light yellowish-brown (2.5Y 6/4) silty clay; weak, medium, prismatic structure breaking to moderate, medium, angular blocky structure; very firm when moist, very plastic when wet, very hard when dry; nearly continuous clay films on most ped surfaces; few small sandstone and shale

[3] This profile was sampled for chemical, physical, and mineralogical characteristics. Results of laboratory analysis are given in the section "Laboratory Analyses," sample number S63Ky–43–12.

fragments; very strongly acid; gradual, wavy boundary.

IIB3b—44 to 51 inches, variegated strong-brown (7.5YR 5/6) and greenish-gray (5GY 6/1) silty clay; few specks of yellowish red (5YR 5/6) and red (2.5YR 4/6); weak, medium, prismatic structure breaking to weak, medium, angular blocky structure; firm when moist, plastic when wet; common bits of weathered shale; very strongly acid; gradual, wavy boundary.

IIC—51 to 70 inches +, variegated reddish-brown, brown, and olive-gray, highly weathered shale; crushes easily to heavy silty clay loam; abundance of black stains on cleavage planes; thick clay flows on vertical faces of crevices; very strongly acid.

The solum ranges from about 40 to 60 inches in thickness. Depth to bedrock ranges from about 40 to 60 inches or more. Reaction below the Ap horizon ranges from strongly acid to extremely acid. The Ap horizon generally is silt loam, but it is silty clay loam in severely eroded areas. It ranges from brown (7.5YR 4/4) to dark grayish brown (10YR 4/2) or brown (10YR 5/3). The B1t horizon ranges from strong brown (7.5YR 5/6) to reddish brown (5YR 4/4) and is firm to friable fine silt loam or silty clay loam. The B21t horizon ranges from yellowish red (5YR 4/8) to yellowish brown (10YR 5/4). The IIB horizon is silty clay or clay and is at a depth of 20 to 36 inches. Colors in the IIB horizons include strong brown (7.5YR 5/6), pale olive (5Y 6/3), pale brown (10YR 6/3), and light olive brown (2.5Y 5/4).

The Wellston soils, clayey subsoil variant, occur with the Wellston, Zanesville, Sadler, Johnsburg, and Rarden soils. The Wellston soils, clayey subsoil variant, are more clayey in the lower part of the subsoil than the Wellston soils. They lack the fragipan of the Zanesville, Sadler, and Johnsburg soils and are redder in the subsoil than the Sadler and Johnsburg soils. They are less clayey in the upper part of the subsoil and are deeper to bedrock than the Rarden soils.

Wellston silt loam, clayey subsoil variant, 6 to 12 percent slopes (WoC).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 4 to 20 acres in size.

Included with this soil in mapping are some moderately eroded areas and small areas of Rarden and Zanesville soils.

Erosion is a severe hazard in cultivated areas. Plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for pasture and hay, but a small acreage is in row crops. A few areas are in woods. (Capability unit IIIe–7; woodland suitability group 5)

Wellston silt loam, clayey subsoil variant, 12 to 20 percent slopes (WoD).—This well-drained, sloping soil is on side slopes in the uplands. Areas range from about 6 to 18 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are some moderately eroded soils and small areas of Rarden and Gilpin soils.

Erosion is a very severe hazard when row crops are grown. Plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for pasture and woods. (Capability unit IVe–4; woodland suitability group 5)

Wellston silty clay loam, clayey subsoil variant, 6 to 12 percent slopes, severely eroded (WsC3).—This well-drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 3 to 12 acres in size. The profile of this soil differs from the one described as representative of the series in that the surface layer contains more clay and consists mostly of subsoil material that is exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas of Rarden and Zanesville soils.

Erosion is a very severe hazard in cultivated areas. Plants respond fairly well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture, but a small acreage is in hay. A few idle areas are revegetating naturally and are providing food and cover for wildlife. (Capability unit IVe–14; woodland suitability group 6)

Wellston silty clay loam, clayey subsoil variant, 12 to 20 percent slopes, severely eroded (WsD3).—This well-drained, strongly sloping soil is on side slopes in the uplands. Areas range from about 3 to 15 acres in size. The profile of this soil differs from the one described as representative of the series in that the surface layer contains more clay and consists mostly of subsoil material that is exposed by erosion. Some areas have rills and shallow gullies.

Included with this soil in mapping are small areas of Rarden and Gilpin soils and of moderately eroded soils.

Effects of past erosion and the hazard of additional erosion make this soil unsuited to cultivation and necessitate a permanent vegetation. Plants respond fairly well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture and woods. A few idle areas are revegetating naturally, and these provide food and cover for wildlife. (Capability unit VIe–4; woodland suitability group 6)

Zanesville Series

The Zanesville series consists of well drained to moderately well drained soils that have a fragipan. These soils formed in 2 to 4 feet of loess and in the underlying residuum from acid siltstone, sandstone, and shale. They are gently sloping to sloping and are on smooth uplands.

In a typical profile the surface layer, about 7 inches thick, is brown silt loam. The upper part of the subsoil extends to a depth of about 28 inches. It is brown, friable silt loam and strong-brown and yellowish-brown, friable or firm silty clay loam. The lower part of the subsoil extends to a depth of about 45 inches and is a mottled light brownish-gray, yellowish-brown, and dark yellowish-brown fragipan that is very firm, brittle, and compact. The fragipan is silt loam in the upper part and silty clay loam in the lower part. Below this is yellowish-brown sandy clay loam. Sandstone bedrock is at a depth of about 60 inches.

Zanesville soils are moderately deep to a fragipan that slows water movement and restricts root growth. They have a moderate available moisture capacity and are medium acid to very strongly acid in the surface layer unless limed. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting, except in areas where severe erosion has exposed the moderately fine textured subsoil.

Representative profile of Zanesville silt loam, 2 to 6 percent slopes (200 yards southeast of junction of State Routes 1133 and 187, on State Route 1133, on a southwest roadbank):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; neutral; abrupt, smooth boundary.

B1—7 to 11 inches, brown (7.5YR 4/4) silt loam; weak, fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—11 to 19 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable or firm; thin patchy clay films on ped surfaces; very strongly acid; clear, smooth boundary.

B22t—19 to 28 inches, yellowish-brown (10YR 5/6) silty clay loam; few, fine, faint mottles of light yellowish brown (2.5Y 6/4) in the lower part; moderate, medium, subangular and angular blocky structure; friable or firm; thin patchy clay films on ped surfaces; very strongly acid; clear, wavy boundary.

Bx1—28 to 37 inches, mottled light brownish-gray (2.5Y 6/2), yellowish-brown (10YR 5/6), and dark yellowish-brown (10YR 4/4) silt loam; weak, medium, blocky structure; very firm, brittle, and compact; thick continuous clay films; very strongly acid; gradual, smooth boundary.

IIBx2—37 to 45 inches, mottled light olive-gray (5Y 6/2), yellowish-brown (10YR 5/6), and dark yellowish-brown (10YR 4/4) silty clay loam; weak, coarse, prismatic structure; very firm, brittle, and compact; thick continuous clay films; few sandstone fragments 2 to 10 millimeters in size; very strongly acid; clear, wavy boundary.

IIC—45 to 60 inches, yellowish-brown (10YR 5/6) sandy clay loam; common, medium, distinct mottles of light brownish gray (2.5Y 6/2) and yellowish red (5YR 4/6); massive; firm; common soft sandstone fragments 5 to 20 millimeters in size; very strongly acid.

R—60 inches +, sandstone bedrock.

The solum ranges from 34 to 72 inches in thickness. The depth to bedrock ranges from about 42 to 60 inches or more. The depth to the fragipan ranges from about 24 to 32 inches. The Ap horizon is brown (10YR 4/3) to dark grayish brown (10YR 4/2). It is silty clay loam where the soil is severely eroded. In some places the profile does not have a B1 horizon. Where it occurs, the B1 horizon ranges from slightly acid to very strongly acid. The B21t horizon ranges from brown (7.5YR 4/4) to strong brown (7.5YR 5/6) and is heavy silt loam or silty clay loam. The B22t horizon ranges from strong brown (7.5YR 5/6) to yellowish brown (10YR 5/6). The Bx1 and IIBx2 horizons include mottles of brown (7.5YR 5/4), light olive brown (2.5Y 5/4), and pale brown (10YR 6/3). In some places there is a yellowish-brown to red IIB3 horizon that ranges from about 7 to 11 inches in thickness. In places that are underlain by shale instead of sandstone or siltstone, the IIC horizon is silty clay or clay.

The Zanesville soils occur with the Wellston, Sadler, and Johnsburg soils. The Zanesville soils have a fragipan, which is missing in the Wellston soils, and are less well drained than those soils. They have a redder hue in the upper part of the B horizon and generally are deeper to the fragipan than Sadler soils. They are better drained than the Johnsburg soils and generally contain no gray mottles in the upper part of the B horizon.

Zanesville silt loam, 2 to 6 percent slopes (ZaB).—This well drained to moderately well drained, gently sloping soil is on ridgetops. Areas range from about 6 to 18 acres in size. A profile of this soil is described as representative of the series.

Included with this soil in mapping are a few moderately eroded and severely eroded soils. Also included are some areas of Wellston and Sadler soils.

Erosion is a moderate hazard where row crops are grown. This soil is moderate in natural fertility, but plants respond well to applications of fertilizer and lime. Organic-matter content is low to medium.

This soil is used mostly for row crops, pasture, and hay (fig. 8). It has good potential for truck and horticultural crops. (Capability unit IIe–10; woodland suitability group 3)

Zanesville silt loam, 6 to 12 percent slopes (ZaC).—This well drained to moderately well drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 6 to 22 acres in size. This soil differs from the one described as representative of the series in that the surface layer is redder and consists partly of subsoil material.

Included with this soil in mapping are a few uneroded areas of Zanesville soils and small areas of Sadler and Wellston soils.

Erosion is a severe hazard where row crops are grown. This soil is moderate in natural fertility, but plants respond well to applications of fertilizer and lime. Organic-matter content is low.

This soil is used mostly for pasture and hay, but some acreage is in row crops. A few areas are in woods. (Capability unit IIIe–2; woodland suitability group 3)

Zanesville silty clay loam, 6 to 12 percent slopes, severely eroded (ZcC3).—This well drained to moderately well drained, sloping soil is on relatively smooth side slopes and ridgetops in the uplands. Areas range from about 4 to 18 acres in size. This soil differs from the one described as representative of the series in that the surface layer is redder, contains more clay, and consists mostly of subsoil material that is exposed by erosion. Also, the depth to the fragipan is less than in the representative profile. Some areas have rills and shallow gullies.

Included with this soil in mapping are a few areas of Sadler and Wellston soils.

Erosion is a very severe hazard if row crops are grown, and this soil is suitable for only occasional cultivation. It is moderately low in natural fertility, but plants respond well to applications of fertilizer and lime. Organic-matter content is very low.

This soil is used mostly for pasture, but a small acreage is in hay. A few idle areas that are revegetating naturally provide food and cover for wildlife. (Capability unit IVe–14; woodland suitability group 6)

Use and Management of the Soils

This section is designed to help the landowner understand how soils behave and how they can be used. In it are discussed the use and management of soils for crops and pastures, for woodland, for wildlife, for engineering works, and for town and country planning. Specific management is not suggested in this section for each soil. Some suggestions that affect the management of each soil are given in the section "Descriptions of the Soils."

Use of Soils for Crops and Pasture [4]

This section is a guide to the suitability and management of the soils for crops and pasture. It has four main parts. In the first part some general principles of soil management are discussed. Capability classification is explained in the second part. In the third part the capability units, or groups of soils, are described and use suitability and management requirements for each unit are discussed. Estimates of yields for suitable crops are given in the fourth part for each of the soils.

[4] WALTER J. GUERNSEY, conservation agronomist, Soil Conservation Service, assisted in preparing this section.

Figure 8.—Zanesville silt loam, 2 to 6 percent slopes, used for burley tobacco and meadow grown in contour strips.

General principles of soil management

Some principles of management are general enough to apply to all the soils in the county that are suitable for farm crops and pasture, though individual soils or groups of soils may require different kinds and degrees of management.

The Gilpin, Sadler, and a few other soils in the county are naturally low in content of organic matter. Increasing the amount of organic matter content in these soils is important. This can be done by adding farm manure, by leaving plant residue on the surface, and by growing sod crops, cover crops, and green-manure crops.

On Newark silt loam and other wet soils in the county, growth of cultivated crops can be improved by removing excess water through tile or through ditches.

The local office of the Soil Conservation Service can assist in selecting and planning a suitable combination of practices for soils.

Capability groups of soils

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

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

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

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

Class I soils have few limitations that restrict their use.

420-789—72——3

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, require special conservation practices, or both.

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Grayson County.)

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

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

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (None in Grayson County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Grayson County, shows that the chief limitation is climate that is too cold or too dry.

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

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–7 or IIIe–2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass. The capability classification of soils in Grayson County is part of a statewide system, and all of the capability units in the system do not occur in the county. Consequently, capability unit numbers are not consecutive.

Management of soils by capability units

The capability units are described in the pages that follow. Suitable crops and management for the soils in the unit are suggested.

The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series appear in the unit. To find the names of all the soils and the capability unit in which each soil has been placed, refer to the "Guide to Mapping Units" at the back of this survey.

All of the cultivated soils in Grayson County that are gently sloping or steeper are subject to erosion and to loss of organic matter and plant nutrients from the plow layer. Because most runoff and erosion occur when the cultivated crop is growing or soon after the crop has been harvested, a cropping system should be used, in combination with erosion control practices, that prevents excessive runoff and soil loss. As used in this soil survey, cropping system refers to the sequence of crops grown in combination with cultural and management measures that include minimum tillage, mulch planting, use of crop residue, growing cover and green-manure crops, and use of lime and fertilizer. Erosion control practices are contour cultivation, terracing, contour stripcropping, and use of diversions and grassed waterways. The effectiveness of a particular combination of these measures varies among the different kinds of soils, but different combinations may be equally effective on the same soil. For example, a corn-meadow-meadow crop sequence and proper application of fertilizer, but without erosion control practices, keeps soil loss within permissible limits on Wellston silt loam having a slope of 5 percent that is 200 feet long. If a crop sequence having more years of row crop, such as corn-corn-meadow is desired, contour cultivation or some other erosion control practice is needed.

The local office of the Soil Conservation Service will assist farm owners and operators in selecting the proper combination of practices that effectively control erosion on the soils on their farms.

CAPABILITY UNIT I–1

This unit consists of well-drained, nearly level soils on flood plains. The plow layer and subsoil are friable silt loam. The soils in this unit are in the Cuba and Nolin series. They have a deep root zone, high available moisture capacity, high natural fertility, moderate permeability, and medium content of organic matter. They are neutral to very strongly acid in the plow layer. Crops respond well to fertilizer. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting. Some areas are subject to flooding.

The soils in this unit are well suited to all of the row crops and hay and pasture plants that are grown in the county. Tobacco, corn, or small grain can be grown continuously if the level of management is high.

Erosion is not a hazard on these soils.

CAPABILITY UNIT I–2

This unit consists of moderately well drained, nearly level soils on flood plains. The plow layer and subsoil are friable silt loam. These soils are in the Steff and Lindside series. They have a deep root zone, high available

moisture capacity, and moderately high to high natural fertility. They are medium in organic-matter content, moderate in permeability, and neutral to very strongly acid in the plow layer. A seasonal high water table rises to within about 18 to 24 inches of the surface during winter and spring unless these soils are drained. Some areas are subject to flooding. Crops respond well to fertilizer. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

These soils are well suited to all of the row crops and most hay and pasture plants that are grown in the county. Tobacco and corn can be grown year after year in the same area if the level of management is high. Flooding is a slight hazard where alfalfa or small grain are grown on these soils.

Erosion is not a hazard on these soils.

CAPABILITY UNIT IIe-1

This unit consists of gently sloping, well-drained soils of the uplands, stream terraces, and foot slopes These soils are in the Allegheny, Christian, Crider, Shelocta and Wellston series. They have a deep root zone, moderate to moderately high natural fertility, and high to moderate available moisture capacity. They are medium to low in organic-matter content and, unless limed, are medium acid to very strongly acid in the plow layer. Crops respond well to fertilizer and lime. Except for the Shelocta soil, which has a high content of gravel in the surface layer, these soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting. The soils in this unit, except the moderately slowly permeable Christian soil, are moderate in permeability.

The soils of this unit are suited to all crops and pasture plants that are grown in the county. They are well suited to corn, tobacco, and small grain. Some of the suitable pasture and meadow plants are Kentucky bluegrass, smooth bromegrass, Kentucky 31 tall fescue, orchardgrass, timothy, alfalfa, red clover, Ladino clover, white clover and Korean lespedeza.

The erosion hazard on these soils is moderate in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT IIe-7

This unit consists of gently sloping, moderately well drained soils on uplands and stream terraces. These soils are in the Captina, Mercer, and Sadler series. At a depth of about 17 to 26 inches, they have a fragipan that slows water movement and restricts root growth. Permeability in the fragipan is slow, and the root zone is moderately deep. Natural fertility and available moisture capacity are moderate. Unless limed, these soils are strongly acid or very strongly acid in the root zone. Crops respond well to fertilizer and lime. The soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

The soils of this unit are suited to most of the row crops and pasture plants that are grown in the county. They are well suited to corn, tobacco, and small grain. Some of the suitable pasture and meadow plants are Kentucky 31 tall fescue, orchardgrass, Ladino clover, alfalfa, red clover, timothy, sericea lespedeza, and Korean lespedeza. Because water saturates the root zone during wet periods, alfalfa and some other perennials are short lived.

The erosion hazard on these soils is moderate in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT IIe-10

Zanesville silt loam, 2 to 6 percent slopes, is the only soil in this unit. This soil occurs on uplands and is well drained to moderately well drained. At a depth of about 24 to 32 inches, it has a fragipan that slows water movement and restricts root growth. Permeability is slow in the fragipan, and the root zone is moderately deep. Natural fertility and available moisture capacity are moderate. This soil is low to medium in organic-matter content and, unless limed, is medium acid to very strongly acid in the plow layer. Crops respond well to fertilizer and lime. This soil is easy to till and can be worked through a wide range of moisture content without clodding or crusting.

The soil in this unit is suited to most row crops that are grown in the county. It is well suited to corn (fig. 9), tobacco, and small grain. Some of the suitable pasture and meadow plants are Kentucky bluegrass, smooth bromegrass, Kentucky 31 tall fescue, orchardgrass, timothy, alfalfa, red clover, Ladino clover, white clover, and Korean lespedeza.

The erosion hazard is moderate in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT IIw-2

Sadler silt loam, 0 to 2 percent slopes, is the only soil in this unit. It occurs on uplands and is nearly level and moderately well drained. At a depth of about 18 to 26 inches, it has a fragipan that slows water movement and restricts root growth. The root zone is moderately deep and natural fertility and available moisture capacity are moderate. This soil is low in organic-matter content and, unless limed, is very strongly acid in the plow layer. It is slightly waterlogged above the slowly permeable fragipan in winter and spring, and water tends to collect

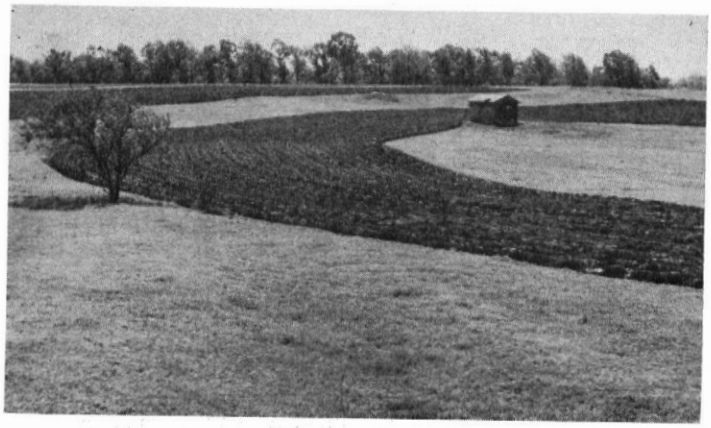

Figure 9.—**Zanesville silt loam, 2 to 6 percent slopes, plow-planted on the contour to corn. Meadow strips in the foreground and background. This soil is in capability unit IIe-10.**

on the surface in some areas. Crops respond well to fertilizer and lime.

The soil in this unit is suited to most of the row crops and pasture plants that are grown in this county. Corn can be grown continuously on this soil if the level of management is high. The hazard of erosion is slight.

Plants that withstand slight wetness are well suited to this soil. Some of these are Kentucky 31 tall fescue, redtop, red clover, alsike clover, Ladino clover, Korean lespedeza, Kobe lespedeza, and reed canarygrass. Alfalfa and orchardgrass stands tend to thin out after about 2 years.

CAPABILITY UNIT IIw–4

This unit consists of nearly level, somewhat poorly drained soils on flood plains. These soils are in the Newark and Stendal series. These soils have a deep root zone, moderate to moderately high natural fertility, moderate permeability, and high available moisture capacity. They are medium in organic-matter content and are neutral to very strongly acid in the plow layer. A seasonal high water table rises to within about 6 to 18 inches of the surface during winter and spring unless these soils are drained. Most areas are subject to flooding after intensive rains. Crops respond well to fertilizer and, on the acid Stendal soil, to lime. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Where adequately drained, these soils are suited to most of the row crops and pasture plants that are grown in the county. Tobacco and corn can be grown continuously if the level of management is high. Erosion is not a hazard, but damage by flooding is.

Plants that withstand wetness are well suited to these soils. Some of these are Kentucky 31 tall fescue, redtop, red clover, alsike clover, Ladino clover, Korean lespedeza, Kobe lespedeza, and reed canarygrass. Alfalfa and orchardgrass are not well suited to the soils in this unit.

CAPABILITY UNIT IIs–1

Clifty gravelly silt loam is the only soil in this unit. This soil occurs on flood plains and is nearly level and well drained. It has a deep root zone, moderately high natural fertility, moderate available moisture capacity, and moderately rapid permeability. It is medium in organic-matter content and, unless limed, is strongly acid or very strongly acid in the plow layer. Gravel and small fragments of shale occur throughout the profile. Crops respond well to fairly well to fertilizer and lime. The soil is subject to flooding. The high content of gravel makes tillage somewhat difficult and reduces available moisture capacity.

The soils in this unit are suited to all of the row crops and pasture and hay plants that are grown in the county. Tobacco or corn can be grown continuously if the level of management is high. The erosion hazard is slight on this soil.

CAPABILITY UNIT IIIe–1

This unit consists of sloping, well-drained soils on uplands and stream terraces. These soils are in the Allegheny, Christian, Crider, and Wellston series. They have a deep root zone, moderate to moderately high natural fertility, high available moisture capacity, and moderate to moderately slow permeability. They are low to medium in organic-matter content and, unless limed, are medium acid to very strongly acid in the plow layer. Crops respond well to fertilizer and lime. These soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

The soils of this unit are suited to most of the row crops and pasture plants that are grown in the county. They are moderately well suited to corn, tobacco, and small grain. Some of the suitable pasture and meadow plants are Kentucky bluegrass, smooth bromegrass, Kentucky 31 tall fescue, orchardgrass, timothy, alfalfa, red clover, Ladino clover, white clover, Korean lespedeza, and sericea lespedeza (fig. 10).

The erosion hazard on these soils is severe in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT IIIe–2

This unit consists of sloping, well drained to moderately well drained soils on uplands and stream terraces. These soils are in the Captina and Zanesville series. At a depth of about 18 to 32 inches, these soils have a fragipan that slows water movement and restricts root growth. They have a moderately deep root zone, slow permeability in the fragipan, and moderate natural fertility and available moisture capacity. These soils are low in organic-matter content and, unless limed, are medium acid to very strongly acid in the plow layer. Crops respond well to fertilizer and lime. They are easy to till and can be worked through a wide range of moisture content without clodding or crusting.

The soils in this unit are suited to the row crops and pasture plants grown in the county. They are moderately well suited to corn, tobacco, and small grain. Some of the suitable pasture and meadow plants are Kentucky bluegrass, smooth bromegrass, Kentucky 31 tall fescue, orchardgrass, timothy, red clover, Ladino clover, white clover, and Korean lespedeza. Alfalfa lives longer on the Zanesville soil than on the Captina soil.

Figure 10.—Dairy cows grazing in a pasture of Kentucky 31 tall fescue and Ladino clover on Wellston silt loam, 6 to 12 percent slopes. This soil is in capability unit IIIe–1.

The erosion hazard is severe where these soils are cultivated. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and control erosion.

CAPABILITY UNIT IIIe–7

This unit consists of sloping, well-drained soils on uplands and foot slopes. These soils are in the Gilpin, Shelocta, and Wellston series. They have a moderately deep to deep root zone, moderate to moderately low natural fertility, moderate permeability, and moderate to high available moisture capacity. They are low in organic-matter content and, unless limed, are medium acid to very strongly acid in the plow layer. Crops respond well to fertilizer and lime. Except for the Shelocta soil, these soils are easy to till and can be worked through a wide range of moisture content without clodding or crusting. The Shelocta soil is somewhat difficult to till because of the gravel in the surface layer.

The soils of this unit are suited to most of the row crops and pasture plants that are grown in the county. They are moderately well suited to corn, tobacco, and small grain. Some of the suitable pasture and meadow plants are Kentucky bluegrass, smooth bromegrass, Kentucky 31 tall fescue, orchardgrass, timothy, alfalfa, red clover, Ladino clover, white clover, and Korean lespedeza.

The erosion hazard on these soils is severe in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT IIIe–14

This unit consists of well drained to moderately well drained, gently sloping and sloping soils on uplands. These soils are in the Caneyville and Rarden series. In the subsoil they have clayey layers that are moderately slow in permeability. These soils have a moderately deep root zone, moderate to moderately low natural fertility, and moderate available moisture capacity. They are low in organic-matter content and, unless limed, are medium acid to very strongly acid in the plow layer. Crops respond fairly well to fertilizer and lime. The Rarden soil is easy to till and can be worked through a wide range of moisture without clodding or crusting. The Caneyville soil is somewhat difficult to till because the plow layer is moderately clayey.

These soils are suited to most row crops and pasture and hay plants that are grown in the county. Some of the suitable pasture and hay plants are orchardgrass, Kentucky bluegrass, Kentucky 31 tall fescue, timothy, alfalfa, Ladino clover, red clover, Kobe lespedeza, Korean lespedeza, and sericea lespedeza.

The erosion hazard on these soils is severe in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow runoff and reduce erosion.

CAPABILITY UNIT IIIw–1

Johnsburg silt loam is the only soil in this unit. This soil occurs on uplands and stream terraces and is nearly level and somewhat poorly drained. At a depth of about 11 to 18 inches, it has a fragipan that slows water movement and restricts root growth. This soil has a shallow root zone, moderately low natural fertility, slow permeability in the fragipan, and moderate to low available moisture capacity. It is low in organic-matter content and, unless limed, is very strongly acid in the plow layer. The soil in this unit has a seasonal high water table that rises to within 6 to 12 inches of the surface during winter and spring. Wetness is difficult to correct by drainage because the fragipan is at a shallow depth and suitable outlets are missing in some areas. Plants that are tolerant of excessive moisture respond well to fertilizer and lime. This soil is easy to till and can be worked through a wide range of moisture content without clodding or crusting.

Unless it is drained, this soil is poorly suited to most row crops and pasture plants that are grown in the county. Erosion is not a hazard.

Suitable plants are those that withstand slight to moderate wetness. Among these plants are Kentucky 31 tall fescue, redtop, red clover, alsike clover, Ladino clover, Korean lespedeza, Kobe lespedeza, and reed canarygrass.

CAPABILITY UNIT IIIw–5

This unit consists of nearly level, poorly drained and very poorly drained soils on flood plains and stream terraces. These soils are in the Bonnie and Burgin series. The Burgin soil is dark colored, is neutral, and has a clayey, slowly permeable subsoil. This soil is high in organic-matter content, but it is somewhat difficult to till because the plow layer is silty clay loam. The Bonnie soil is silt loam throughout the profile. It is moderately permeable, is low in organic-matter content, and unless limed, is strongly acid or very strongly acid in the plow layer.

The soils in this unit have a seasonal water table at or near the surface in the winter and spring. Except for excess water, these soils have a deep root zone. The available moisture capacity is high. Wetness is the main limiting feature, but it can be reduced by drainage where suitable outlets are available. After the soils are drained, crops respond fairly well to well to fertilizer. The Bonnie soil responds well to liming, but lime generally is not needed on the Burgin soil. The Bonnie soil is subject to flooding.

Unless drained, the soils in this unit are poorly suited to row crops and pasture plants that are grown in the county. They are poorly suited to tobacco and alfalfa. If the level of management is high, these soils can be cultivated continuously to corn without damage to the soil tilth and structure. Erosion is not a hazard.

Grasses and legumes are suitable if the soils are drained. Some of the suitable plants are timothy, Korean lespedeza, Kobe lespedeza, Kentucky 31 tall fescue, redtop, reed canarygrass, alsike clover, and Ladino clover.

CAPABILITY UNIT IVe–4

This unit consists of strongly sloping, well-drained soils on uplands and foot slopes. These soils are in the Gilpin, Shelocta, and Wellston series. Except for the Shelocta soil, they have a silt loam plow layer. The Shelocta soil has a gravelly silt loam plow layer. The soils of this unit are low in organic-matter content and are moderate to moderately low in natural fertility. They have a deep to moderately deep root zone, moderate permeability, and moderate to high available moisture capacity. Unless limed, they are medium acid to very strongly acid in the plow layer. Crops respond well to fertilizer and lime. Except for the Shelocta soil, these soils are easy to till and can be worked under a wide range of moisture content without clodding or crust-

ing. The Shelocta soil is somewhat difficult to till because of the gravel in the surface layer.

The soils of this unit are suited to most row crops and pasture plants that are grown in the county. Suitable plants are Ladino clover, Kentucky 31 tall fescue, orchardgrass, red clover, sericea lespedeza, and Korean lespedeza. Alfalfa stands tend to thin out after about 2 or 3 years.

The erosion hazard is very severe in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT IVe–6

This unit consists of sloping to strongly sloping, well drained to moderately well drained, moderately eroded Caneyville and Rarden soils on uplands. The plow layer of the Caneyville soil is silty clay loam, and that of the Rarden soil is silt loam. Both soils have clayey layers in the subsoil. These soils have a moderately deep root zone, moderate to moderately low natural fertility, moderately slow permeability, and low organic-matter content. Unless limed, they are medium acid to very strongly acid in the plow layer. The available moisture capacity is moderate. Crops respond fairly well to fertilizer and lime. The Rarden soil is fairly easy to till except in spots where the clayey subsoil is exposed. Because of its silty clay loam plow layer, the Caneyville soil is more difficult to till than the Rarden soil and is subject to clodding and crusting.

The soils in this unit are not well suited to most row crops that are grown in the county. Suitable grasses and legumes are timothy, alfalfa, sweet clover, red clover, Kentucky 31 tall fescue, sericea lespedeza, and Korean lespedeza.

The erosion hazard on these soils is very severe in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT IVe–11

This unit consists of sloping, well-drained, severely eroded soils on uplands. These soils are in the Baxter, Christian, Crider, and Wellston series. These soils have a silty clay loam plow layer. The Baxter soil is cherty and slightly more droughty than the other soils in this unit. The soils in this unit have rills and shallow gullies in places. In cultivated areas, there is a very severe hazard of excessive runoff and additional damage by erosion. These soils have a deep root zone, moderate to moderately high natural fertility, and moderate to moderately slow permeability. They are very low in organic-matter content and, unless limed, are medium acid to very strongly acid in the plow layer. These soils are difficult to till and are subject to clodding and crusting. Crops respond only fairly well to fertilizer and lime.

These soils are suited to most row crops and pasture plants that are grown in the county. Suitable grasses and legumes are orchardgrass, timothy, red clover, alfalfa, Kentucky 31 tall fescue, sericea lespedeza, and Korean lespedeza (fig. 11).

The erosion hazard is very severe if these soils are cultivated. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

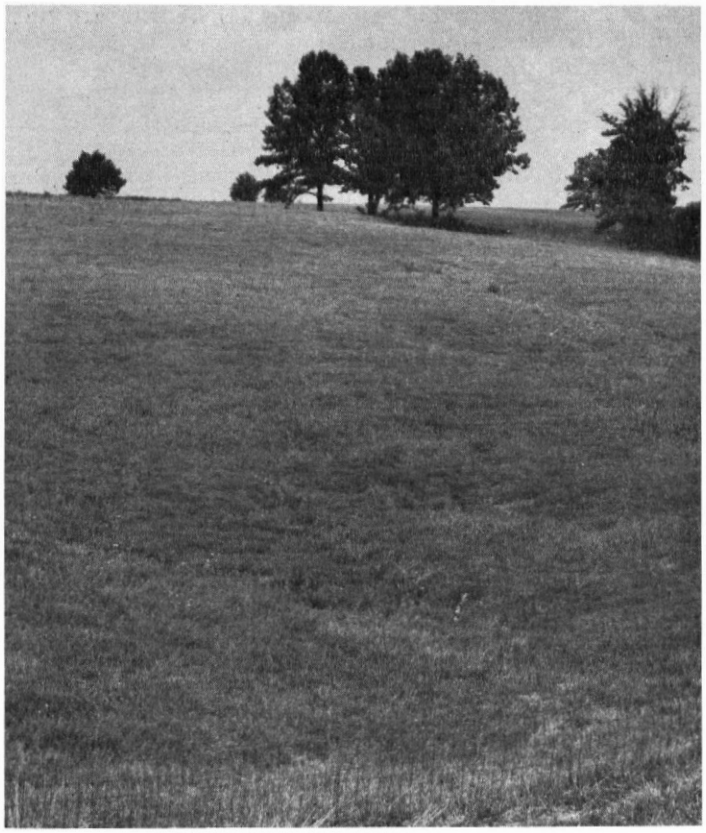

Figure 11.—Pasture of Kentucky 31 tall fescue on Wellston silty clay loam, 6 to 12 percent slopes, severely eroded, which is in capability unit IVe–11.

CAPABILITY UNIT IVe–14

This unit consists of sloping, well drained to moderately well drained, severely eroded soils on uplands. These soils are in the Gilpin, Rarden, Wellston, and Zanesville series. They have a silty clay loam plow layer. At a depth of about 24 inches, the Zanesville soil has a fragipan that slows water movement and restricts root growth. Rills and shallow gullies are in some areas. These soils have a moderately deep to deep root zone, moderate to slow permeability, and moderate to moderately low natural fertility. They are very low in organic-matter content, and are medium acid to very strongly acid in the plow layer unless limed. Crops respond fairly well to fertilizer and lime. These soils are somewhat difficult to till and are subject to clodding and crusting.

The soils in this unit are moderately well suited to most row crops and pasture plants that are grown in the county. Kentucky 31 tall fescue, orchardgrass, red clover, sericea lespedeza, and Korean lespedeza are suitable grasses and legumes (fig. 12). Alfalfa stands are generally short lived.

The erosion hazard is very severe in cultivated areas. Various combinations of cropping systems and erosion control practices can be used to slow surface runoff and reduce erosion.

CAPABILITY UNIT VIe–4

This unit consists of well drained to moderately well drained, severely eroded soils on uplands. These soils are in the Baxter, Caneyville, Gilpin, Rarden, Shelocta and

Wellston series. They are strongly sloping soils, except for the sloping and strongly sloping Caneyville soil. The plow layer of the Caneyville soil is silty clay, of the Shelocta is gravelly silt loam, and of the other soils is silty clay loam. The plow layer of the Baxter soil is also cherty. The soils in most areas have rills and shallow gullies. Unless limed, the soils of this unit are medium acid to very strongly acid in the plow layer. They have a deep to moderately deep root zone. Natural fertility is moderate to moderately low, organic-matter content is very low, and permeability is moderate to moderately slow. These soils are somewhat difficult to till because of the clay and coarse fragments in the plow layer. Crops respond fairly well to fertilizer and lime.

The soils in this unit are not suited to row crops, because of the severe hazard of additional damage by erosion. They are suited to pasture. Moderately well suited plants are orchardgrass, timothy, Korean lespedeza, and red clover, but Kentucky 31 tall fescue and sericea lespedeza are better suited.

Because of the erosion hazard, it is important that these soils are managed so that plants provide a protective cover. Pasture mixtures should be selected that provide satisfactory forage and ground cover, and that require the least frequent renovation of the pasture. The pasture should not be grazed continuously. Rest periods should be provided after each grazing period to allow regrowth of the plants.

CAPABILITY UNIT VIe-7

This unit consists of sloping to moderately steep, well-drained to somewhat excessively drained, slightly eroded to moderately eroded soils on uplands. These soils are in the Caneyville, Gilpin, and Ramsey series. The Caneyville and Gilpin soils are moderately deep, and the Ramsey soils are shallow. The plow layer is silty clay loam in the Caneyville soil, silt loam in the Gilpin soil, and loam in the Ramsey soil. These soils are low in organic-matter content, moderate to low in natural fertility, and medium to very strongly acid in the plow layer unless limed. Crops respond fairly well to fertilizer and lime.

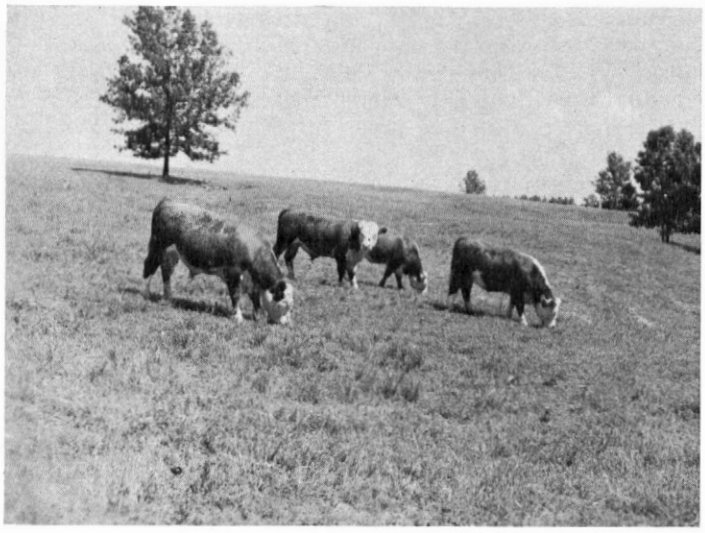

Figure 12.—**Beef cattle in a pasture on Zanesville silty clay loam, 6 to 12 percent slopes, severely eroded, which is in capability unit IVe-14. This was a critical area, but it has been shaped, treated, and stabilized with sericea lespedeza and Kentucky 31 tall fescue.**

The soils in this unit are so highly susceptible to erosion that they are not suited to cultivation. They are suited to permanent vegetation and can be used for hay or pasture (fig. 13). They are well suited to Kentucky 31 tall fescue and sericea lespedeza and are moderately well suited to orchardgrass, timothy, red clover, sweet clover, and Korean lespedeza.

Because of the hazard of erosion, it is important to maintain good vegetative cover. Plant mixtures should be selected that produce a satisfactory amount of forage, provide ground cover, and require the least frequent renovation. Grazing should be managed so that pasture plants can renew their growth after each period of grazing.

CAPABILITY UNIT VIs-1

Caneyville very rocky silty clay loam, 10 to 20 percent slopes, the only soil in this unit, occurs on uplands and is strongly sloping and well drained. Rock outcrops cover about 8 to 30 percent of the surface. The surface layer is silty clay loam, and the subsoil is silty clay. The main limiting features of this soil are rockiness, high clay content, and moderately slow permeability. This soil is medium in organic-matter content, moderate in natural fertility, and medium acid in the surface layer unless limed. It is subject to damage by erosion if not kept in protective cover. Pasture plants respond fairly well to fertilizer and lime.

This soil is too rocky and erodible for growing row crops. Loose rocks and rock outcrops interfere with tillage and make harvesting of hay crops difficult. This soil is fairly well suited to pasture. Orchardgrass, timothy, red clover, sweet clover, and Korean lespedeza can be grown, but the stands are not vigorous, are short lived, and need to be renovated frequently. Kentucky 31 tall fescue and sericea lespedeza produce more forage than the other plants and provide better cover for the soil.

Because of the rockiness and severe erosion hazard, managing this soil so that plants provide protective ground cover is most important. Pasture mixtures should be selected that provide satisfactory forage and ground cover and that require the least renovation of the pasture. The pastures should not be grazed continuously. Rest periods are needed after each grazing period to allow regrowth of the plants.

CAPABILITY UNIT VIIe-1

Weikert channery silt loam, 12 to 30 percent slopes, is the only soil in this unit. This is a strongly sloping to moderately steep, well-drained soil on the uplands. It has a channery silt loam surface layer and subsoil. Siltstone fragments, one-fourth to 8 inches in size, make up about 40 percent of the surface layer and 35 to 65 percent of the subsoil, by volume. This soil has a shallow root zone, moderately rapid permeability, and low available moisture capacity. It is low in organic-matter content and is medium acid to very strongly acid in the surface layer unless limed. Tillage is very difficult because of the high percentage of coarse fragments in the surface layer. Plants respond poorly to lime and fertilizer.

This soil is not suited to cultivation, because of steepness and the risk of damage by erosion. It is suited to only limited use as pasture and is better suited as woodland or for providing food and cover plants for wildlife.

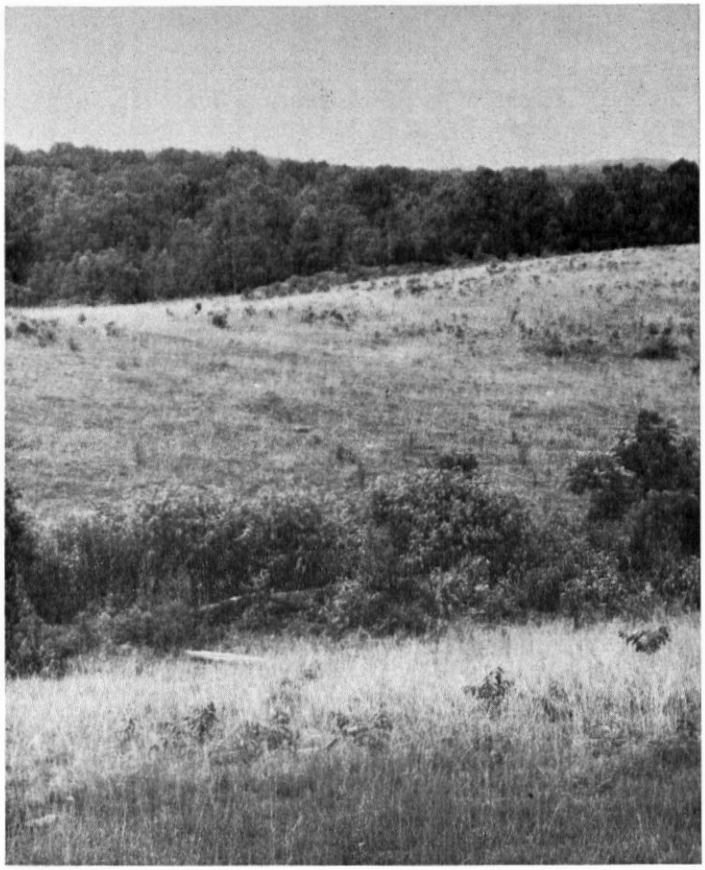

Figure 13.—Pasture on Caneyville silty clay loam, 12 to 20 percent slopes, which is in capability unit VIe–7.

Suitable pasture plants are few. Kentucky 31 tall fescue and sericea lespedeza are suited, but their stands are not vigorous and the plants are short lived. The use of a high level of management normally is not justified on this soil.

Because of the slopes and risk of erosion, managing vegetation for ground protection is very important. If the soil is used for pasture, mixtures should be selected that provide the most satisfactory forage and ground cover and that require the least frequent renovation of the pasture. Steep slopes and coarse fragments make it extremely difficult to operate farm machinery on the pastures. Consequently, mowing for weed control and the spreading of fertilizer and lime are very difficult, costly, and in places, hazardous.

The pastures should not be grazed continously. Rest periods are needed after each grazing period to allow regrowth of the plants.

CAPABILITY UNIT VIIe–3

This unit consists of well-drained to somewhat excessively drained, strongly sloping to moderately steep, severely eroded soils of the uplands. These soils are in the Gilpin, Ramsey, and Weikert series. Below the plow layer in the Weikert soil, there are siltstone fragments, ¼ inch to 3 inches in length, that make up 35 to 60 percent of the volume. The Ramsey soil has a fine sandy loam subsoil, and the Gilpin soil has a silty clay loam subsoil. The root zone of the Ramsey and Weikert soils is shallow, and that of the Gilpin soil is moderately deep. These soils are moderate to very low in available moisture capacity, moderately low to low in natural fertility, very low in organic-matter content, and medium acid to very strongly acid in the surface layer unless limed. The permeability of the Gilpin soil is moderate, and that of the other soils is rapid to moderately rapid.

The soils in this unit are not suited to cultivation, because of steepness, the effects of past erosion, and the hazard of additional erosion. They have very limited suitability for pasture and are better suited to trees or to plants that provide food and cover for wildlife. If these soils are used for pasture, the selection of pasture plants is very limited. Kentucky 31 tall fescue and sericea lespedeza are the best suited plants for these soils. Other pasture plants are less suitable, their stands are not vigorous, and the plants are short lived. The use of a high level of management normally is not justified on these soils.

Because of the slopes and risk of erosion, it is important to manage these soils so that the plants provide ground cover and protection. Pasture mixtures should be selected that give satisfactory forage and ground cover and that require the least frequent renovation of the pasture.

The steepness of the slopes makes it extremely difficult to operate farm machinery on the pastures. Consequently, mowing for weed control and spreading fertilizer and lime are difficult, costly, and in places, hazardous.

The pastures should not be grazed continuously. Rest periods are needed after each grazing period to allow regrowth of the plants.

CAPABILITY UNIT VIIe–4

Gullied land is the only mapping unit in this capability unit. It consists of areas that have an intricate pattern of moderately deep to deep gullies. A few areas are nearly free of gullies, but they show extreme sheet erosion. Some narrow strips between the gullies are only moderately eroded, but in most places the lower part of the subsoil or the parent material is exposed. Slopes generally range from about 6 to 20 percent.

Many of these areas have produced crops and pasture, but very severe gully and sheet erosion now make them unsuitable for these uses. They are presently idle or are gradually reverting to woods. In some areas redcedar or brush grow; and some areas have been planted to pine trees.

Only a few of these areas are reclaimed economically for pasture. They are better suited as woodland or for plants that provide food and cover for wildlife.

CAPABILITY UNIT VIIs–1

This unit consists of somewhat excessively drained to well-drained, moderately steep to steep, very rocky and stony soils of the uplands. These soils are in the Caneyville, Gilpin, Ramsey, and Weikert series. Stones 1 foot or more in diameter, as well as rock outcrops, cover about 1 to 30 percent of the surface. These soils are moderately deep to shallow and are low to medium in organic-matter content. The slopes, rocks, and stones hinder the use of equipment.

These soils are subject to excessive runoff and very severe erosion if protective cover is not maintained. They are suited mainly to trees or to plants that provide food and

cover for wildlife. Some areas can be used for pasture if grazing is limited. If these soils are used for pasture, Kentucky 31 tall fescue and sericea lespedeza are best suited. The amount of forage produced, however, is generally small. Other plants are extremely short lived.

The maintenance of ground cover is very important for preventing erosion on these soils. Pastures should not be grazed continuously. Rest periods should be provided after each grazing period to allow regrowth of the plants.

CAPABILITY UNIT VIIs-3

This unit consists of sloping to steep, very rocky and stony soils of the uplands. These are the Caneyville-Rock outcrop complex and severely eroded soils in the Caneyville, Gilpin, Ramsey, and Weikert series. Rock outcrops cover about 30 to 70 percent of the surface in the Caneyville-Rock outcrop complex, and rock outcrops or stones cover about 1 to 30 percent of the surface of the other soils. The soils are moderately deep to shallow and are low to very low in organic-matter content. They have excessive runoff and low intake of water. The slopes, rocks, and stones restrict the use of equipment.

The risk of additional damage by erosion is severe if these soils are not kept in protective cover. The soils are suited to trees and to plants that provide food and cover for wildlife. They generally are not suited to pasture.

Estimated yields

The estimated average yields for the most common crops grown in Grayson County under two levels of management are given in table 2. Yields for a medium level of management are shown in columns A, and those for a high level of management are shown in columns B. Yields for Gullied land (Gu) and Caneyville-Rock outcrop complex (Co) are not given, since these mapping units are not suitable for crops or pasture.

The yields given are the average that can be expected over several years. Yields for one year may be affected adversely by extremes of weather, insects, disease, or some other disaster, or they may be extremely high because of a combination of favorable factors.

The differences between yields in columns A and those in columns B represent increases in yields that may be expected by improving management. No yields under a medium level of management are given for tobacco, because a high level of management is nearly always used.

A medium level of management is management, including the application of fertilizer, generally considered as the minimum that will keep the soil from deteriorating and produce sufficient crops for some profit.

A high level of management includes: (1) using adapted recommended varieties; (2) using proper seeding rates, inoculating legumes, planting at the right time and in the right way, and using efficient harvesting methods; (3) controlling weeds, insects, and plant diseases; (4) applying fertilizer at a rate equal to or above the current recommendations of the University of Kentucky Agricultural Experiment Station or equal to or above the need shown by properly interpreted soil tests; (5) using adequate applications of lime; (6) draining naturally wet soils that are feasible to drain; (7) using cropping systems that control erosion and maintain soil structure, tilth, and organic-matter content; (8) applying erosion control measures, such as contour tillage, terracing, contour stripcropping, and sodded waterways; (9) using cover crops, crop residues, or both, to increase supplies of organic matter and control erosion; (10) using all the applicable practices of pasture management; and (11) using management practices such as minimum tillage and interseeding winter crops in row crops.

A high level of management is not considered the highest level that can be attained, but it is one that many farmers find practical to reach.

The failure to apply adequately one or more of the practices listed for a high level of management may cause the level of production to drop and may result in some permanent damage to the soil. Inadequate drainage or only partial application of practices needed for controlling runoff and erosion are examples of deficiencies if the level of management is medium.

Use of Soils as Woodland [5]

When Grayson County was first settled, approximately 80 percent of it was covered with deciduous forest. Through the years the cutting of timber to clear the land for farming has reduced the area in woodland to about 35 percent of the total acreage of the county.

The woodland in the county is privately owned. Dominant on the better sites of the uplands are mixed stands of white oak, red oak, black oak, yellow-poplar, black walnut, beech, maple, and hickory. Pin oak, cottonwood, sweetgum, sycamore, and elm are dominant on the flood plains and on low-lying stream terraces.

The best grades of bottom-land and upland hardwoods are sold for veneer, and the poorest grades are sold for lumber. Rough lumber from permanent and portable sawmills in the county is shipped to other counties in Kentucky or to Tennessee for further processing, though some of this lumber is used locally for rough construction. No lumber finishing mills operate in Grayson County. A paper pulp mill in Hancock County uses hardwoods that are not suitable for lumber or veneer.

Discussed in the following pages are the woodland suitability groups in Grayson County and the management of woodland as related to characteristics of the soils.

Woodland suitability grouping of soils

The soils of Grayson County have been placed in 10 woodland suitability groups. Each group is made up of soils that are suitable for about the the same kinds of trees, that need similar management, and that have about the same productivity.

The factors considered in placing each soil in a woodland group are: (1) potential productivity for several kinds of trees, (2) species to favor in managing existing woodland, (3) species preferred for planting, and (4) soil-related hazards and limitations to be considered in woodland management, such as erosion, equipment limitations, plant competition, and seedling mortality.

On some soils the site index, productivity, and limitations vary from one area to another because of aspect, or the compass direction in which a slope faces. Aspect is listed as north or south. Slopes that face north or east

[5] By WILLIAM M. MORRILL, woodland conservationist, and E. V. HUFFMAN, assistant State soil scientist, Soil Conservation Service.

TABLE 2.—*Estimated average acre yields of principal crops*

[Yields in columns A are those expected under a medium level of management; those in columns B under a high level of management. Absence of a yield figure indicates crop is seldom, if ever, grown on the soil at the specified level of management. Caneyville-Rock outcrop complex and Gullied land are not used for crops and are not listed]

Soil	Corn		Wheat		To-bacco	Hay						Pasture [1]	
						Alfalfa		Red clover		Lespedeza			
	A	B	A	B	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lbs.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [2]	*Cow-acre-days* [2]
Allegheny silt loam, 2 to 6 percent slopes	90	115	30	45	2,600	3.5	5.0	2.1	3.1	1.4	2.2	175	250
Allegheny silt loam, 6 to 12 percent slopes	85	105	30	40	2,400	3.3	4.5	1.9	3.0	1.2	2.0	175	250
Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded	----	60	15	25	1,600	2.0	3.0	1.1	2.0	------	1.0	120	175
Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded	----	------	----	----	-------	------	-------	------	1.7	------	------	110	155
Bonnie silt loam	----	80	----	----	-------	------	-------	------	2.5	------	1.9	160	200
Burgin silty clay loam	60	95	20	35	-------	------	-------	------	2.8	1.4	2.2	160	200
Caneyville silty clay loam, 2 to 6 percent slopes	----	65	15	25	1,600	2.0	3.5	1.6	2.6	1.0	1.7	145	185
Caneyville silty clay loam, 6 to 12 percent slopes	----	60	----	20	1,400	------	2.9	1.5	2.4	1.0	1.7	140	180
Caneyville silty clay loam, 12 to 20 percent slopes	----	------	----	----	-------	------	2.5	1.2	2.1	------	------	100	165
Caneyville very rocky silty clay loam, 10 to 20 percent slopes	----	------	----	----	-------	------	-------	------	------	------	------	85	130
Caneyville very rocky silty clay loam, 20 to 40 percent slopes	----	------	----	----	-------	------	-------	------	------	------	------	70	------
Caneyville silty clay, 6 to 20 percent slopes, severely eroded	----	------	----	----	-------	------	-------	------	------	------	------	85	130
Caneyville very rocky silty clay, 8 to 25 percent slopes, severely eroded	----	------	----	----	-------	------	-------	------	------	------	------	70	------
Captina silt loam, 2 to 6 percent slopes	70	90	25	40	2,450	2.1	3.0	1.5	2.4	1.0	1.6	140	190
Captina silt loam, 6 to 12 percent slopes	55	75	15	30	2,000	------	2.7	1.2	2.1	------	1.4	130	180
Christian silt loam, 2 to 6 percent slopes	75	100	30	40	2,500	3.1	4.3	2.1	3.2	1.1	2.0	180	235
Christian silt loam, 6 to 12 percent slopes	60	80	26	36	2,250	2.9	3.9	1.4	2.4	1.0	1.8	165	220
Christian silty clay loam, 6 to 12 percent slopes, severely eroded	----	65	----	25	1,700	------	2.5	------	2.1	------	1.0	120	175
Clifty gravelly silt loam	60	90	25	35	1,900	2.8	3.8	1.8	2.8	1.1	2.0	180	240
Crider silt loam, 2 to 6 percent slopes	85	115+	35	45	2,800	3.5	5.0	2.5	3.5	1.4	2.2	205	265
Crider silt loam, 6 to 12 percent slopes	70	95+	30	40	2,300	3.3	4.5	2.1	3.1	1.1	1.9	200	250
Crider silty clay loam, 6 to 12 percent slopes, severely eroded	----	75	20	30	1,800	2.2	3.2	1.0	2.6	------	1.3	150	200
Cuba silt loam	90	125+	35	45	2,800	3.8	5.0+	2.4	3.4	1.4	2.4	195	260
Gilpin silt loam, 6 to 12 percent slopes	----	65	15	25	1,600	------	2.4	1.1	2.1	------	1.4	130	170
Gilpin silt loam, 12 to 20 percent slopes	----	60	15	25	1,450	------	2.2	1.1	2.0	------	------	125	170
Gilpin silt loam, 20 to 30 percent slopes	----	------	----	----	-------	------	-------	------	------	------	------	115	150
Gilpin silty clay loam, 6 to 12 percent slopes, severely eroded	----	55	----	20	1,200	------	2.0	1.0	1.8	------	1.2	95	140
Gilpin silty clay loam, 12 to 20 percent slopes, severely eroded	----	------	----	----	-------	------	-------	------	------	------	------	85	130
Gilpin silty clay loam, 20 to 30 percent slopes, severely eroded	----	------	----	----	-------	------	-------	------	------	------	------	80	------
Johnsburg silt loam	----	65	----	20	1,500	------	-------	------	------	1.0	1.8	150	200
Lindside silt loam	80	120	30	40	2,500	3.0	4.2	2.2	3.2	1.3	2.2	180	245
Mercer silt loam, 2 to 6 percent slopes	60	80	25	35	2,400	2.0	2.8	1.4	2.3	1.0	1.6	135	185
Newark silt loam	60	100	25	35	2,200	------	-------	------	2.7	1.1	2.0	165	230
Nolin silt loam	90	130	35	45	2,800	4.0	5.5+	2.6	3.6	1.5	2.5	205	270
Ramsey loam, 10 to 20 percent slopes	----	------	----	----	-------	------	-------	------	------	------	------	95	130
Ramsey loam, 10 to 30 percent slopes, severly eroded	----	------	----	----	-------	------	-------	------	------	------	------	70	------
Rarden silt loam, 6 to 12 percent slopes	----	65	15	25	1,500	------	2.8	1.5	2.5	------	1.8	135	185
Rarden silt loam, 12 to 20 percent slopes	----	60	----	20	1,300	------	2.2	1.4	2.3	------	1.6	120	165
Rarden silty clay loam, 6 to 12 percent slopes, severely eroded	----	------	----	----	-------	------	2.5	1.2	2.1	------	1.4	100	150
Rarden silty clay loam, 12 to 20 percent slopes, severely eroded	----	------	----	----	-------	------	-------	------	2.0	------	------	95	140
Sadler silt loam, 0 to 2 percent slopes	60	80	25	35	2,100	------	2.5	------	2.2	1.0	1.6	170	22
Sadler silt loam, 2 to 6 percent slopes	65	85	25	35	2,450	2.1	3.0	1.4	2.3	1.0	1.6	170	220
Shelocta gravelly silt loam, 2 to 6 percent slopes	65	85	25	35	2,400	2.5	3.7	1.7	2.7	1.2	2.0	165	215

See footnotes at end of table.

TABLE 2.—*Estimated average acre yields of principal crops*—Continued

Soil	Corn		Wheat		To-bacco	Hay						Pasture [1]	
						Alfalfa		Red clover		Lespedeza			
	A	B	A	B	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lbs.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [2]	*Cow-acre-days* [2]
Shelocta gravelly silt loam, 6 to 12 percent slopes	60	80	20	30	2,000	2.3	3.3	1.5	2.5	1.0	1.8	145	200
Shelocta gravelly silt loam, 12 to 20 percent slopes	----	70	15	25	1,650	2.1	3.1	1.4	2.3	------	------	135	180
Shelocta gravelly silt loam, 12 to 20 percent slopes, severely eroded	----	----	----	----	----	------	------	------	1.9	------	------	100	140
Steff silt loam	75	110	30	40	2,500	2.8	4.0	2.0	3.0	1.2	2.1	175	240
Stendal silt loam	60	95	25	35	2,200	------	------	------	2.7	1.1	2.0	165	230
Weikert channery silt loam, 12 to 30 percent slopes	----	----	----	----	----	------	------	------	------	------	------	95	------
Weikert channery silt loam, 12 to 30 percent slopes, severely eroded	----	----	----	----	----	------	------	------	------	------	------	70	------
Weikert-Ramsey-Gilpin stony complex, 20 to 30 percent slopes	----	----	----	----	----	------	------	------	------	------	------	90	------
Weikert-Ramsey-Gilpin stony complex, 20 to 30 percent slopes, severely eroded	----	----	----	----	----	------	------	------	------	------	------	------	------
Weikert-Ramsey-Gilpin stony complex, 30 to 50 percent slopes	----	----	----	----	----	------	------	------	------	------	------	------	------
Wellston silt loam, 2 to 6 percent slopes	70	95	25	40	2,500	2.8	4.0	2.0	3.0	1.2	2.0	170	220
Wellston silt loam, 6 to 12 percent slopes	60	85	20	35	2,150	2.5	3.5	1.8	2.7	1.0	1.8	155	205
Wellston silt loam, 12 to 20 percent slopes	----	75	15	30	1,600	2.3	3.1	1.5	2.4	------	------	140	190
Wellston silty clay loam, 6 to 12 percent slopes, severely eroded	----	70	----	25	1,500	2.2	3.0	------	2.3	------	1.0	120	170
Wellston silty clay loam, 12 to 20 percent slopes, severely eroded	----	----	----	----	----	------	------	1.3	1.7	------	------	100	140
Wellston silt loam, clayey subsoil variant, 6 to 12 percent slopes	----	80	20	30	1,900	2.0	3.0	1.3	2.2	1.0	1.8	145	200
Wellston silt loam, clayey subsoil variant, 12 to 20 percent slopes	----	65	15	30	----	2.0	2.8	1.3	2.2	------	------	130	175
Wellston silty clay loam, clayey subsoil variant, 6 to 12 percent slopes, severely eroded	----	65	----	25	1,500	------	2.0	1.1	1.9	------	1.3	100	150
Wellston silty clay loam, clayey subsoil variant, 12 to 20 percent slopes, severely eroded	----	----	----	----	----	------	------	------	------	------	------	90	135
Zanesville silt loam, 2 to 6 percent slopes	70	95	25	35	2,650	2.8	3.8	2.0	3.0	1.4	2.1	170	220
Zanesville silt loam, 6 to 12 percent slopes	60	85	15	30	2,250	2.4	3.5	1.8	2.7	1.2	1.9	155	205
Zanesville silty clay loam, 6 to 12 percent slopes, severely eroded	----	60	----	20	1,500	------	2.4	1.1	2.0	------	1.3	120	170

[1] Pasture yields are generally estimated for tall fescue and a legume.

[2] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single grazing season without injury to the pasture. An animal unit is the equivalent of one cow, steer, or horse; five hogs; or seven sheep. An acre of pasture that provides 80 days of grazing for three cows has a carrying capacity of 240 cow-acre-days.

of a line drawn from true northwest to true southeast have a north aspect; those that face south or west of this line have a south aspect.

The potential productivity is expressed as site index, or the expected height in feet that a tree species or forest type will attain on a specified kind of soil or group of soils at a specified age. This age is 50 years for most species. The site index ratings shown for each woodland suitability group are expressed as a range in height, usually 10 feet or less. For example, the site index for lowland oaks on soils in woodland suitability group 1 is 100 to 110 feet.

In gathering data for determining the site indexes for tree species, many trees in this county and in adjacent areas were measured and the soils at each site were described. As nearly as possible, the studies were confined to well-stocked, naturally occurring, even-aged, essentially unmanaged stands that had not been damaged by fire, insects, disease, or grazing.

The average height and age measurements gathered for different tree species were converted to site index by using site index curves in published research (*3*, *4*, *5*, *7*, *10*, *13*). The site index curves used in determining the ratings for eastern redcedar are unpublished curves developed from observations on 271 plots in the Tennessee Valley.

Site index can be converted to a volumetric prediction of growth and yield that can be shown in wood measurements such as board feet per acre.

Predictions of average yearly growth per acre in board feet, International ¼ scale, are based on published data (*9*, *10*, *12*, *13*, *14*), and on tree growth data from soil-site evaluations by the Soil Conservation Service. Yearly growth estimates are to age 60 for yellow-poplar and oaks and to age 50 for other species.

Erosion hazard is rated according to the risk of erosion that may occur following cutting operations and where the soil is exposed along roads, skid trails, fire lanes, and landing areas. It is assumed that the woodland is well managed and is protected from fire and grazing. Soil characteristics or properties considered in rating erosion hazard include slope, rate of infiltration, permeability of the subsoil, water storage capacity, and resistance to detachment of soil particles by forces of rainfall and runoff. The following relative ratings are used to indicate the intensity of erosion control measures needed to reduce erosion. *Slight* indicates that no special measures are needed. *Moderate* indicates that some attention needs to be given to the prevention of soil erosion. *Severe* indicates that intensive erosion control measures are needed. Woodland can be protected from erosion by taking care in constructing and maintaining roads, trails, fire lanes, and landing areas.

Equipment limitations are influenced by topographic and soil characteristics, such as slope, drainage, soil texture, stoniness, and rockiness. The characteristics may restrict the use of conventional wheel or track-type equipment for harvesting and planting trees, for constructing roads, for controlling fire, and for controlling unwanted vegetation. The topography of the soils may require the use of different kinds of equipment and methods of operation, or may require a specific period when equipment is used. Generally, the limitation is *slight* if the slope is 12 percent or less and woodland machinery can be operated efficiently without construction and maintenance of permanent roads and truck trails. The rating is *moderate* if the slope is 12 to 30 percent, if the use of ordinary farm machinery is limited, if track-type equipment is necessary for efficient harvesting, or if soil wetness prevents the use of logging vehicles for 2 to 6 months in a year. The rating is *severe* if the slope is more than 30 percent and if track-type equipment is not adequate for harvesting and power winches and other special equipment are needed, or if wetness prevents use of vehicles for 6 months or more.

Unwanted trees, vines, shrubs, and other plants invade a site when openings are made in the canopy. This competition hinders the establishment and normal development of desirable seedlings, whether they occur naturally or are planted. Plant competition is *slight* if unwanted plants do not prevent adequate natural regeneration or interfere with early growth, or do not restrict the normal development of planted stock. Competition is *moderate* if unwanted plants delay establishment and hinder the growth of either planted stock or naturally regenerated seedlings, or if these unwanted plants retard the development of a fully stocked stand. Competition is *severe* if unwanted plants prevent adequate restocking, either by natural regeneration or by planting, unless site preparation is intensive or special maintenance practices are used.

Some loss of seedlings is expected if soil characteristics or topographic features are unfavorable, even though plant competition is not a factor. Seedling mortality is *slight* if the expected loss is not more than 25 percent of the number needed to provide optimum stocking. Mortality is *moderate* if the expected loss is between 25 and 50 percent. It is *severe* if the expected loss is more than 50 percent. If the rating is *moderate* or *severe*, replanting is likely to be needed to insure a fully stocked stand, and special preparation of the seedbed and special planting techniques are often necessary.

The discussion of the woodland suitability groups that follows contains a brief description of the soils in each group and evaluations for tree production based on the foregoing factors. Detailed descriptions of the soils are in the section "Descriptions of the Soils."

WOODLAND SUITABILITY GROUP 1

This group consists of deep, nearly level, well drained to moderately well drained soils on flood plains. These soils are in the Clifty, Cuba, Lindside, Nolin, and Steff series. All of them are silt loams except Clifty gravelly silt loam.

Trees that are common in the uplands and in the lowlands grow equally well on soils in this group. Upland hardwoods, such as yellow-poplar and upland oaks, grow rapidly on these soils, which are not subject to long periods of flooding.

Site indexes for the rated species are 100 to 110 for lowland oaks, 90 to 100 for sweetgum, 100 to 110 for cottonwood, 100 to 110 for yellow-poplar, and 75 to 85 for upland oaks. Potential productivity for desirable trees is high and justifies intensive management.

The potential average yearly growth per acre is approximately 450 board feet for lowland oaks, 290 board feet for upland oaks, and 600 board feet for yellow-poplar.

Species to favor in managing existing stands are lowland oaks, sweetgum, cottonwood, yellow-poplar, black walnut, white oak, and black oak. Species to favor for

planting are pin oak, sweetgum, cottonwood, and yellow-poplar.

The erosion hazard, seedling mortality, and equipment limitations are slight on these soils.

Plant competition is severe because the moisture supply in spring is abundant and favors the establishment of water-tolerant trees of low quality in the understory of saw-log stands. After logging, the shade-tolerant trees of low quality may prevent or delay the reestablishment of desirable trees unless weeding is intensive. Interplanting or conversion planting generally is not feasible, because competition from undesirable trees is severe. Trees planted in open fields often require one or more cultivations.

WOODLAND SUITABILITY GROUP 2

This group consists of nearly level, poorly drained to somewhat poorly drained soils on flood plains and uplands. These soils are in the Bonnie, Burgin, Johnsburg, Newark, and Stendal series.

The soils in this group are suited to pin oak, sweetgum, cottonwood, and other trees commonly called bottom-land hardwoods. In many places these trees grow in the same area as do yellow-poplar, upland oaks, Virginia pine, and other species common to the uplands.

Site indexes for the rated species are 95 to 105 for pin oak, 95 to 105 for cottonwood, 85 to 95 for sweetgum, 60 to 75 for upland oaks, 55 to 65 for Virginia pine, and 90 to 100 for yellow-poplar. Potential productivity for pin oak, cottonwood, sweetgum, and yellow-poplar is high and justifies intensive management. Productivity for upland oaks and pine justifies management of medium intensity.

The potential average yearly growth per acre is approximately 505 board feet for lowland oaks, 160 board feet for upland oaks, and 500 board feet for yellow-poplar.

Species to favor in managing existing stands are cottonwood, sweetgum, lowland oaks, yellow-poplar, and red, white, and black oaks. Species to favor for planting are pin oak, sweetgum, cottonwood, and yellow-poplar.

The erosion hazard is slight. Equipment limitations are moderate on the Johnsburg, Newark, and Stendal soils, but they are severe on the Bonnie and Burgin soils because they are seasonally wet.

Plant competition generally is severe. Blackgum, red maple, dogwood, and other shade-tolerant trees of low quality grow in the understory of saw-log stands because moisture is abundant. These undesirable seedlings and saplings may be dominant over the more desirable species where the canopy has been removed by logging. Because of severe competition, interplanting or conversion planting generally is not feasible. Plantings in open areas may require several weedings or cultivations. Seedling mortality is slight.

WOODLAND SUITABILITY GROUP 3

This group consists of slightly eroded or moderately eroded, deep or moderately deep soils on uplands. These soils are dominantly well drained and gently sloping to moderately steep. They have a silt loam or gravelly silt loam surface layer and a moderately fine textured subsoil. They are in the Allegheny, Christian, Crider, Gilpin, Shelocta, Wellston, and Zanesville series.

The potential productivity of these soils is moderately high for upland oaks, yellow-poplar, Virginia pine, and eastern redcedar. Intensive management is justifiable. Site indexes for the rated species are 70 to 80 for upland oaks, 90 to 100 for yellow-poplar, 70 to 80 for Virginia pine, and 35 to 45 for eastern redcedar. The potential average yearly growth per acre is approximately 240 board feet for oaks and 490 board feet for yellow-poplar.

Species to favor in managing existing stands are white oak, red oak, black oak, yellow-poplar, black walnut, black locust, and sugar maple. Species to favor for planting are black locust, black walnut, yellow-poplar, white ash, northern red oak, white pine, shortleaf pine, loblolly pine, and Scotch pine.

The erosion hazard is slight on soils that have slopes of not more than 12 percent. It is moderate on soils that have slopes of 12 to 20 percent and severe where slopes are more than 20 percent. Careful attention is needed in locating, constructing, and maintaining roads and skid trails, especially where the slope exceeds 12 percent.

Equipment limitations are slight on soils that have slopes of less than 12 percent and are moderate on soils that have slopes of 12 to 30 percent. The use of track-type equipment is necessary for the efficient harvesting of timber where the slope exceeds 20 percent.

Plant competition is severe, mainly because of the favorable amount of moisture available to competing trees during the growing season. Shade-tolerant trees of low quality normally are established in the understory of saw-log stands. After the saw logs are harvested, competition from these low-quality trees interferes with natural regeneration of desirable trees. Intensive weeding normally is needed to control competition. Normally, interplanting or conversion planting is not feasible, largely because plant competition is severe. Trees planted in open fields generally require at least one cultivation. Seedling mortality is slight.

WOODLAND SUITABILITY GROUP 4

This group consists of nearly level to sloping, moderately well drained soils on uplands or stream terraces. These soils have a silt loam surface layer and are moderately deep to a fragipan. They are in the Captina, Mercer, and Sadler series.

Site indexes for the rated species are 70 to 80 for upland oaks, 85 to 95 for yellow-poplar, 70 to 80 for shortleaf pine, and 70 to 80 for Virginia pine. The potential average yearly growth per acre is approximately 240 board feet for the oaks and 440 board feet for yellow-poplar.

Species to favor in managing existing stands are yellow-poplar, white oak, northern red oak, black oak, black walnut, black cherry, white ash, and sugar maple.

The erosion hazard, equipment limitations, and seedling mortality are slight.

Plant competition is moderate. During the growing season, the supply of moisture is favorable and encourages the invasion of shade-tolerant trees of low quality in the understory of saw-log stands. After desirable trees are harvested, the shade-tolerant trees often prevent the satisfactory reestablishment of desirable trees. One or more weedings may be required to insure the growth of desirable trees. On open land that has been abandoned as cropland or pasture for 2 years or more, a weeding or cultivation may be required to release newly planted trees from the competition of low-quality trees.

WOODLAND SUITABILITY GROUP 5

This group consists mainly of well-drained, moderately deep or deep, gently sloping to steep soils on uplands. Most of these soils have a silty clay loam or silt loam surface layer and a clayey subsoil, and some of them have rock outcrops. These soils are in the Caneyville, Rarden, and Wellston series.

The potential productivity is medium for upland oaks and Virginia pine and is moderately high for eastern redcedar. A moderate intensity of management is justifiable.

Site indexes for the rated species are 55 to 65 for upland oaks, 60 to 70 for Virginia pine, and 35 to 45 for eastern redcedar. The potential average yearly growth per acre for the oaks is approximately 120 board feet.

Species to favor in managing existing stands are black oak, white oak, scarlet oak, red maple, white ash, and eastern redcedar. Species to favor for planting are shortleaf pine, loblolly pine, white pine, Virginia pine, white ash, and eastern redcedar. Scotch pine is a suitable tree to plant for Christmas trees.

The erosion hazard is slight on soils that have slopes of up to 12 percent. It is moderate where slopes are 12 to 20 percent and is severe where slopes exceed 20 percent. Careful attention is needed in locating, constructing, and maintaining roads and skid trails, especially on slopes of more than 12 percent.

Equipment limitations are slight on slopes of up to 12 percent and are moderate on slopes of more than 12 percent, except on the very rocky soils where the limitations are severe. The use of track equipment is necessary for the efficient harvesting of timber where the slope exceeds 20 percent.

Plant competition is slight to moderate because the moisture received during spring favors the establishment of water-tolerant trees of low quality in the understory of saw-log stands. These undesirable trees may prevent the establishment of desirable naturally regenerated or planted trees in the understory of saw-log stands. One or more weedings may be needed to insure the growth of desirable trees.

Seedling mortality is slight to moderate. Short periods of drought in the growing season may cause a moderate loss of newly planted trees.

WOODLAND SUITABILITY GROUP 6

This group consists of severely eroded, dominantly well drained, deep and moderately deep, sloping to moderately steep soils on uplands. These soils are in the Baxter, Christian, Crider, Gilpin, Shelocta, Wellston, and Zanesville series. They are silty clay loam in the surface layer, except that the Shelocta soil is gravelly silt loam.

Site indexes for the rated species are 55 to 65 for upland oaks and 65 to 75 for Virginia pine. A moderate intensity of management is justifiable. The potential average yearly growth per acre is approximately 120 board feet for the oaks.

Species to favor in managing existing stands are black oak, white oak, southern red oak, and Virginia pine. Species to favor for planting are loblolly pine, shortleaf pine, and Virginia pine.

The erosion hazard generally is slight on soils that have slopes of up to 12 percent, moderate where slopes are 12 to 20 percent, and severe where slopes exceed 20 percent. Careful attention is needed in locating, constructing, and maintaining roads and skid trails.

Equipment limitations are generally moderate. Track-type equipment is needed on slopes of more than 20 percent and in gullied areas.

Seedling mortality is moderate because the soils are droughty, especially during the early part of the growing season. This droughtiness may cause a substantial loss of planted or naturally regenerated seedlings. Plant competition is slight.

WOODLAND SUITABILITY GROUP 7

This group consists of severely eroded, moderately deep, dominantly well drained, sloping to steep soils on uplands. These soils have a clayey subsoil and in places rock outcrops. They are Caneyville and Rarden soils and Caneyville-Rock outcrop complex.

Site indexes for the rated species are 40 to 50 for upland oaks and 30 to 40 for eastern redcedar. A management of minimum intensity is justifiable. The potential average yearly growth per acre is approximately 50 board feet for the oaks.

Species to favor in managing existing stands are eastern redcedar, southern red oak, and post oak. Virginia pine is favored for planting.

The erosion hazard ranges from slight, on soils that have slopes of up to 12 percent, to severe on soils with slopes of more than 20 percent. Careful attention is needed in locating, constructing, and maintaining roads and skid trails.

The equipment limitations are moderate on slopes of up to 12 percent. On slopes of more than 12 percent, limitations are severe because of the clayey surface layer and, in some areas, rockiness.

Seedling mortality is moderate to severe because the soils are droughty. Dry periods of 2 to 3 weeks in the growing season may cause a moderate to severe loss of planted or naturally regenerated seedlings. Plant competition is slight.

WOODLAND SUITABILITY GROUP 8

This group consists of shallow and moderately deep, well-drained and somewhat excessively drained, mostly strongly sloping to steep, loamy soils on uplands. These soils formed mostly in residuum weathered from siltstone and sandstone. They are in the Gilpin, Ramsey, and Weikert series and are stony in places.

On slopes facing north and east, the potential productivity is medium and the site index for oaks is 60 to 70. On slopes generally facing south and west, the production potential is fair for oaks and the site index is 50 to 60. The site index for Virginia pine is 60 to 70 on slopes generally facing north or east and is 56 to 60 on slopes generally facing south and west. The potential productivity for the oaks is approximately 160 board feet per acre on the north- and east-facing slopes, and is 90 board feet per acre on the south- and west-facing slopes.

Species to favor in managing existing stands are southern red oak, scarlet oak, black oak, white oak, and Virginia pine. Species to favor for planting are shortleaf pine, loblolly pine, Virginia pine, and eastern redcedar.

The erosion hazard is moderate on soils that have slopes up to 20 percent and is severe where slopes are more than 20 percent. Special attention is needed in locating, constructing, and maintaining roads and skid trails.

Equipment limitations are moderate on slopes of 10 to 20 percent and severe on slopes of more than 20 percent. The severe limitations result from stoniness as well as steepness. Because conventional woodland equipment cannot be used on the steeper slopes, track-type equipment and power winches are needed for efficient harvest of trees.

Plant competition is slight to moderate on the north- and east-facing slopes and is slight on the south- and west-facing slopes and ridgetops.

Because the soils in this group are shallow and droughty, seedling mortality is moderate on the north- and east-facing slopes and is severe on the south- and west-facing slopes and ridgetops.

WOODLAND SUITABILITY GROUP 9

This group consists of severely eroded, shallow and moderately deep, well-drained and somewhat excessively drained, loamy, mostly strongly sloping and moderately steep soils on uplands. These soils developed mostly in residuum weathered from siltstone and sandstone and are stony in places. They are in the Gilpin, Ramsey, and Weikert series.

Site indexes for the rated species are 45 to 55 for upland oaks and 50 to 60 for Virginia pine. Management of minimum intensity is justifiable. The potential average yearly growth per acre is approximately 50 board feet for the oaks.

Species to favor in managing existing stands are black oak, scarlet oak, southern red oak, and Virginia pine. Species to favor for planting are loblolly pine, shortleaf pine, and Virginia pine.

The erosion hazard is slight on slopes of up to 12 percent and is moderate to severe on slopes of more than 12 percent. The equipment limitations are moderate because of the slope and the stones on the surface.

Plant competition is slight. Seedling mortality is moderate to severe because these soils are droughty. Dry periods of 2 to 3 weeks in the growing season may cause a moderate to severe loss of planted or naturally regenerated seedlings.

WOODLAND SUITABILITY GROUP 10

Gullied land is the only mapping unit in this group. It is so variable in origin, soil characteristics, physiography, behavior, and management requirements that onsite inspection is necessary in making interpretations regarding growth and management of trees.

Gullied land consists of areas where moderately deep or deep gullies cover more than 20 percent of the surface, or of areas where most of the soil profile has been destroyed by extreme sheet erosion. A few patches of original surface soil remain between the gullies, but in most places erosion has destroyed the original soil to the extent that it is difficult or impossible to classify.

The potential productivity is very low for most kinds of trees. Shortleaf pine, loblolly pine, and Virginia pine grow slowly in acid areas and still provide some protection and ground cover. Eastern redcedar and Virginia pine grow in areas that are alkaline but not strongly calcareous.

Gullied land can occur in any area, but it is most common on sloping to strongly sloping land that has been improperly managed.

Use of Soils for Wildlife

This section discusses the wildlife in Grayson County and the relationship of wildlife to the soils in the county. The principal kinds of wildlife in the county are the cottontail rabbit, gray squirrel, raccoon, opossum, skunk, muskrat, red fox, gray fox, bobwhite quail, and mourning dove. Many kinds of songbirds, insectivorous birds, and nongame mammals are also in the county.

The streams of the county contain the usual variety of game fish, pan fish, and rough fish commonly found throughout the State. Largemouth bass is an example of game fish, bluegill of pan fish, and bullhead of rough fish. In most of the farm ponds largemouth bass and bluegill are dominant because the ponds have been stocked with them.

Wildlife populations vary from year to year, but gray squirrels, raccoons, opossums, red foxes, and gray foxes are considered abundant. Cottontail rabbits, skunks, muskrats, bobwhite quail, mourning doves, and nongame birds and mammals are common. Ducks, geese, mink, and fox squirrels are scarce.

Both game fish and rough fish are common in the streams of the county.

Soil interpretations for wildlife habitat

Successful management of wildlife on any tract of land requires that food, cover, and water, among other things, are available in a suitable combination. Lack of any one of these necessities, an unfavorable balance between any two of them, or inadequate distribution of them may severely limit or account for the absence of desired wildlife species. Information on soils is valuable in creating, maintaining, or improving suitable food and cover plants and water for wildlife.

Most wildlife habitats are managed by planting suitable plants, by manipulating existing vegetation so as to bring about natural establishment, increase, or improvement of desired plants, or by combinations of such measures. The influence of many kinds of soil on the growth of plants is known, and it can be inferred for other soils from knowledge about the characteristics and behavior of the soil. In addition, soil information is useful in creating water areas or improving natural ones as wildlife habitat.

Soil interpretations for wildlife habitat (1) aid in selecting the more suitable sites for various kinds of habitat management; (2) serve as indicators of the level of management needed to achieve satisfactory results; and (3) serve as a means of showing why it may not generally be feasible to manage a particular area for a given kind of wildlife.

These interpretations also may serve in broad-scale planning for wildlife areas, parks and nature areas, or for acquiring wildlife lands. By means of a map overlay, suitabilities or groupings of individual habitat elements can be made.

The soil areas shown on the soil survey maps are rated without regard to positional relationships with adjoining mapped areas. The size, shape, or location of the outlined areas do not affect the rating. The influences of factors such as elevation and aspect must be appraised onsite.

In table 3, the soils of Grayson County are rated for their relative suitability for the creation, maintenance, or

improvement of eight elements of wildlife habitat. These ratings are based on limitations caused by the characteristics or behavior of the soil. The land types, Gullied land (Gu) and the Rock outcrop part of Caneyville-Rock outcrop complex (Co) are not rated, because they are so variable that the suitability of each site has to be determined by an onsite investigation. For soils in complexes it is important that the user know the soil in order to make interpretations or use the table.

Three levels of suitability are recognized. It also is recognized that certain adverse features make a site unsuited to a particular habitat element. Numerical ratings of 1 to 4 indicate the degree of soil suitability for a given habitat element. They also indicate the relative extent of soil limitations.

For specific detail on characteristics of the soils, refer to the section "Descriptions of the Soils."

Special attention is directed to the rating of the habitat element, "Coniferous woody plants". Considerable evidence indicates that under situations of *slow* growth and *delayed* canopy closure, coniferous habitats support larger numbers and varieties of wildlife than where growth and canopy closure are rapid. For this reason, soil properties that tend to promote rapid growth and canopy closure are classified as limitations to the use and management of a soil for wildlife.

In general, soils favorable to quick establishment of conifers and their rapid growth require more intensive management if results for long term use by wildlife are to be satisfactory. On soils rated poorly suited for coniferous woody plants, therefore, a temporary or short term value as wildlife habitat may be easy to establish.

Habitat suitability ratings

The following paragraph describes the ratings in table 3.

Soils rated 1 are *well suited* to the specified element of wildlife habitat. Generally, only management of low intensity is needed for the creation, maintenance, or improvement of the specified habitat element, and satisfactory results can be expected. Soils rated 2 are *suited* to the specified habitat element. Fairly frequent attention and moderate management are required for satisfactory results. Soils rated 3 are *poorly suited* and have severe limitations to use for the specified habitat element. The creation, maintenance, or improvement of the habitat element is difficult, may be expensive, and requires intensive effort for satisfactory results. Soils rated 4 are *unsuited* because limitations are so extreme that successful management for the specified element is highly impractical.

Habitat elements

In the following paragraphs the wildlife habitat elements rated in table 3 are briefly described.

Grain and seed crops are agricultural grains or seed-producing annuals planted to produce food for wildlife. Suitable plants are corn, sorghum, wheat, oats, millet, buckwheat, soybeans, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are established by planting and that furnish wildlife food and cover. Examples are fescue, bromegrass, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and panicgrass.

Wild herbaceous upland plants are native or introduced perennial grasses and forbs (weeds) that provide food and cover principally to upland forms of wildlife and that are established mainly through natural processes. Examples of these plants are bluestem, indiangrass, wheatgrass, wild ryegrass, oatgrass, pokeweed, strawberries, lespedeza, beggarweed, wild beans, nightshade, goldenrod, and dandelions.

Hardwood woody plants are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs (browse), or foliage used extensively as food by wildlife. These commonly are established through natural processes but also may be planted. Examples of these plants are oak, beech, cherry, hawthorn, dogwood, viburnum, maple, birch, poplar, grape, honeysuckle, blueberry, brier, greenbrier, autumn-olive, and multiflora rose.

Coniferous woody plants are cone-bearing trees and shrubs that are important to wildlife mainly as cover, but also may furnish food in the form of browse, seeds, or fruit-like cones. These plants commonly are established through natural processes but also may be planted. Examples of these plants are spruce, pine, white-cedar, hemlock, balsam fir, redcedar, juniper, and yew.

Wetland food and cover plants are annual and perennial, wild herbaceous plants in moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover that is extensively and dominantly used by wetland forms of wildlife. Examples of these plants are smartweed, wild millet, bulrush, spike-sedge, rushes, sedges, burreeds, wild-rice, rice cutgrass, mannagrass, and cattails.

Shallow water developments are areas of water in impoundments or excavations that generally do not exceed 6 feet in depth. Structures include low dikes, levees, shallow dugouts, level ditches, and devices for controlling the water level in marshy drainageways or channels.

Excavated ponds are dug-out areas or combinations of dug-out ponds and low dikes or dams that hold enough water of suitable quality and depth to support fish or other wildlife. Examples are ponds of one-fourth acre that are built on nearly level land and have an average depth of 6 feet for at least one-fourth of the area. A dependable high water table or other source of water is needed.

Kinds of wildlife

Table 3 also includes ratings of selected habitat elements that indicate the relative value of each soil for three main classes of wildlife. These classes are defined as follows:

Openland wildlife consists of birds and mammals that normally frequent cropland, pastures, meadows, lawns, and areas overgrown with grasses, herbs, and shrubby plants. Examples of these forms are quail, meadowlarks, field sparrows, doves, cottontail rabbits, red fox, and woodchucks.

Woodland wildlife consists of birds and mammals that normally frequent woodland made up of hardwood trees and shrubs, coniferous trees and shrubs, or mixtures of such plants. Examples of these forms are ruffed grouse, woodcock, thrushes, vireos, scarlet tanagers, gray squirrels, gray fox, whitetailed deer, racoon, and wild turkey.

Wetland wildlife consists of birds and mammals that normally frequent wet areas such as ponds, marshes, and swamps. Examples of these forms are ducks, geese, herons, shore birds, mink, muskrat, and beaver.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*

[A rating of 1 denotes well suited or above average; 2 denotes suitable or average; 3 denotes poorly suited or below average; and 4 denotes unsuited. Gullied land (Gu) requires onsite investigation and is not listed]

Soil series and map symbols	Habitat elements								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Allegheny: AeB, AeC	2	1	1	1	3	4	4	4	1	1	4
Baxter:											
BcC3	3	2	2	2	3	4	4	4	2	3	4
BcD3	4	2	2	2	3	4	4	4	3	3	4
Bonnie: Bo	3	2	2	1	2	3	1	3	2	1	2
Burgin: Bu	4	3	3	1	1	1	1	1	3	1	1
Caneyville:											
CcB, CcC	2	1	1	2	3	4	4	4	1	2	4
CcD	3	2	2	2	3	4	4	4	2	3	4
CeD, CeF, CID3	4	3	2	2	2	4	4	4	3	2	4
CnD3, Co	4	3	3	3	1	4	4	4	4	3	4
The Rock outcrop part of Co is not rated.											
Captina: CpB, CpC	2	1	1	1	3	4	4	4	1	1	4
Christian:											
CrB, CrC	2	1	1	1	3	4	4	4	1	1	4
CsC3	3	2	2	1	3	4	4	4	2	2	4
Clifty: Ct	2	1	1	2	3	4	4	4	1	2	4
Crider:											
CuB, CuC	2	1	1	1	3	4	4	4	1	1	4
CvC3	3	2	1	1	3	4	4	4	2	2	4
Cuba: Cw	2	1	1	1	3	4	4	4	1	1	4
Gilpin:											
GIC	2	1	1	2	3	4	4	4	1	2	4
GID, GpC3	3	2	1	2	3	4	4	4	2	2	4
GIE, GpD3	4	3	1	2	3	4	4	4	3	3	4
GpE3	4	4	1	2	3	4	4	4	3	3	4
Johnsburg: Jo	3	2	1	2	3	2	2	2	2	2	2
Lindside: Ld	2	1	1	1	3	3	3	3	1	1	3
Mercer: MtB	2	1	1	2	3	3	4	3	1	2	4
Newark: Ne	2	1	1	1	3	3	2	3	1	1	3
Nolin: No	2	1	1	1	3	4	4	4	1	1	4
Ramsey:											
RaD	3	3	2	3	2	4	4	4	3	3	4
RaE3	4	4	2	3	2	4	4	4	4	3	4
Rarden:											
RdC	2	1	2	2	3	4	4	4	1	2	4
RdD	3	2	2	2	3	4	4	4	2	3	4
ReC3	3	2	2	2	3	4	4	4	2	3	4
ReD3	4	3	2	2	3	4	4	4	3	3	4
Sadler:											
SaA	2	1	1	2	3	3	3	3	1	2	3
SaB	2	1	1	2	3	3	4	4	1	2	4

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Habitat elements								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Shelocta:											
ShB, ShC	2	1	1	1	3	4	4	4	1	1	4
ShD	3	2	1	1	3	4	4	4	2	2	4
ShD3	4	3	1	2	3	4	4	4	3	3	4
Steff: Ss	2	1	1	1	3	3	3	3	1	1	3
Stendal: St	2	1	1	1	3	3	2	3	1	1	3
Weikert:											
WcE, WcE3	4	3	2	3	2	4	4	4	3	3	4
WgE, WgE3, WgF	4	4	2	3	2	4	4	4	4	3	4
For Gilpin part of WgE, see GlE; for Gilpin part of WgE3 and WgF, see GpE3; for Ramsey part of WgE, WgE3, and WgF, see RaE3											
Wellston:											
WlB, WlC, WoC	2	1	1	1	3	4	4	4	1	1	4
WlD, WnC3, WoD, WsC3	3	2	1	1	3	4	4	4	2	2	4
WnD3, WsD3	4	3	1	1	3	4	4	4	3	2	4
Zanesville:											
ZaB, ZaC	2	1	1	2	3	4	4	4	1	2	4
ZcC3	3	2	1	2	3	4	4	4	2	2	4

Engineering Uses of Soils [6]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material. In this section are those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, strength, density, shrink-swell potential, available moisture capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties are furnished in tables 4 and 5. The estimates and interpretations of soil properties in these tables can be used in:

1. Planning and designing of agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

[6] ROBERT H. SPENCER, Jr., civil engineer, Soil Conservation Service, assisted in preparing this section.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers reported here. Small areas of other soils are included in the mapping units as shown on the detailed soil maps because of the scale of mapping and the natural variation of soils. The soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than they have in engineering. Among the terms that have special meaning in soil science are gravel, sand, silt, clay, surface soil, subsoil, and horizon. These and other terms are defined in the Glossary at the back of this soil survey.

Engineering classification of the soils

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHO system (*1*, *11*) adopted by the American Association of State Highway Officials, and the Unified system (*20*, *11*) used by the SCS engineers, Department of Defense, and others.

The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system, a soil is placed in one of seven basic

groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation), and in group 7 are clay soils that have low strength when wet. The best soils for subgrade are therefore classified as A–1, the next best A–2, and so on to class A–7, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7; and A–7–5, A–7–6. If soil material is near a classification boundary it is given a symbol showing both classes; for example, A–2 or A–4. Within each group, the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest.

In the Unified system, soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are 8 classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; 6 classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and 1 class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO classification with index numbers in parentheses and the Unified system classification for tested soils are shown in table 6; the estimated classification for both systems for all soils mapped in the survey area is given in table 4.

Estimated physical and chemical properties of the soils

Table 4 provides estimated engineering properties of the soils. The properties are shown for a typical profile of each soil series. A complete description of each soil is given in the section "Descriptions of the Soils." The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and on field experience.

Some of the properties shown in the table need no explanation. Others are defined in the Glossary or explained as follows:

Seasonal high water table refers to free water that collects in the soil profile during the seasons of highest rainfall, either as perched water that is separated from the ground water by a nearly impervious soil layer or as a part of the ground water.

USDA texture (*17*) is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary of this soil survey.

Permeability, as used in table 4, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available moisture capacity (also termed available water capacity) is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is expressed in table 4 as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential indicates the volume change to be expected when the moisture content of soil material changes. The shrinking and swelling of soils greatly damages building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with soil materials.

Engineering interpretations of soils

Table 5 rates the soils of Grayson County according to their suitability and limiting features for several uses related to engineering. Detrimental or undesirable features are emphasized. The ratings and other interpretations in this table are based on estimated engineering properties of the soils given in table 4, on available test data, and on field experience. The information specifically applies to soil depths indicated in table 4, but it is reasonably reliable to a depth of about 6 feet for most soils, and several more feet for some other soils. For soils in complexes, the user should know the soil in order to make interpretations or to use this table.

Topsoil is a term used to designate soil material used on lawns, roadbanks, and other areas where vegetation is to be established and maintained. The ratings indicate suitability for such use.

Road fill is material used to build embankments. The ratings indicate performance of soil material moved from borrow areas for this purpose.

Highway location is influenced by features of the undisturbed soil that affect highway construction and maintenance. These soil features are the principal ones that affect geographic location of the highways.

Farm pond reservoir areas are affected by features of the soil that mainly contribute to the loss of water by seepage.

Farm pond embankments serve as dams. The features of disturbed soil from both the subsoil and substratum greatly influenced the construction of embankments.

Agricultural drainage is influenced by features of the undisturbed soil that affect the installation and performance of surface and subsurface drainage installations.

Irrigation is affected by features of undisturbed soil that influence soil moisture relations and the potential of a soil to produce specific crops. Before planning an irrigation project, a feasibility study made by a qualified consultant is desirable.

Terraces and diversions are affected by soil features that influence their stability or hinder layout and construction. Also, diversions are affected by hazards or sedimentation in channels and the difficulty of establishing and maintaining cover.

Grassed waterways are affected by soil features that influence the establishment and maintenance of plant growth or affect layout and construction.

Foundations for low buildings are affected chiefly by features of the undisturbed soil that influence the capacity to support low buildings having normal foundation loads. Specific values of bearing strength are not assigned.

TABLE 4.—*Estimated engineering*

[The properties of Gullied land

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Classification
	Bedrock	Seasonal high water table		USDA texture
	Feet	*Feet*	*Inches*	
Allegheny: AeB, AeC	5–15	6+	0–11	Silt loam
			11–29	Clay loam
			29–50	Sandy clay loam
Baxter: BcC3, BcD3	5–12	6+	0–10	Cherty silty clay loam
			10–39	Cherty clay
			39–60	Clay
Bonnie: Bo	5–20	[2] 0	0–50	Silt loam
Burgin: Bu	3–8	0	0–10	Silty clay loam
			10–16	Silty clay
			16–28	Clay
			28–39	Silty clay
			39	Limestone.
Caneyville: CcB, CcC, CcD, CeD, CeF, ClD3, CnD3, Co—Rock outcrop in mapping unit Co is too variable for properties to be estimated.	1½–3½	6+	0–5	Silty clay loam
			5–18	Silty clay
			18–24	Clay
			24	Limestone.
Captina: CpB, CpC	5–15	1½–2	0–24	Silt loam
			24–36	Silty clay loam (fragipan)
			36–49	Silt loam (fragipan)
Christian: CrB, CrC, CsC3	3½–5	6+	0–6	Silt loam
			6–12	Silty clay loam
			12–28	Silty clay
			28–49	Clay
Clifty: Ct	5–20	[2] 4+	0–30	Gravelly silt loam
			30–60	Gravelly loam
Crider: CuB, CuC, CvC3	5–8	6+	0–6	Silt loam
			6–45	Silty clay loam
			45–60	Silty clay
Cuba: Cw	5–20	[2] 4+	0–50	Silt loam
Gilpin: GlC, GlD, GlE, GpC3, GpD3, GpE3	1½–3	6+	0–6	Silt loam
			6–19	Silty clay loam
			19–27	Channery loam
			27	Sandstone.
Johnsburg: Jo	4–12	½–1	0–12	Silt loam
			12–36	Silt loam (fragipan)
			36–50	Silty clay loam
Lindside: Ld	5–20	[2] 1½–2	0–50	Silt loam
Mercer: MtB	4–7	1½–2	0–6	Silt loam
			6–23	Silty clay loam
			23–34	Silty clay loam (fragipan)
			34–52	Silty clay
Newark: Ne	5–20	[2] ½–1½	0–50	Silt loam
Nolin: No	5–20	[2] 4+	0–52	Silt loam
Ramsey: RaD, RaE3	1–2	6+	0–6	Loam
			6–11	Fine sandy loam
			11–18	Fine sand
			18	Sandstone.

properties of soils

(Gu) are too variable to estimate]

Classification—Continued		Percentage passing sieve—				Permeability	Available moisture capacity	Reaction	Shrink-swell potential
Unified [1]	AASHO [1]	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
						Inches per hour	*Inches per inch of soil*	*pH value*	
ML or CL	A-4 or A-6	95–100	95–100	90–100	70–85	0. 63–2. 0	0. 19–0. 23	4. 5–5. 5	Low.
ML or CL	A-4 or A-6	95–100	95–100	90–100	65–80	0. 63–2. 0	0. 15–0. 18	4. 5–5. 0	Low.
SC or CL	A-2 or A-6	95–100	95–100	80–95	30–55	0. 63–6. 3	0. 15–0. 18	4. 5–5. 0	Low.
CL or CH	A-6 or A-7	65–85	65–80	50–75	50–70	0. 63–2. 0	0. 12–0. 15	4. 5–6. 0	Low to moderate.
CH	A-7	65–85	65–80	60–80	55–80	0. 63–2. 0	0. 09–0. 12	4. 5–5. 0	Moderate.
CH	A-7	95–100	95–100	90–100	90–95	0. 63–2. 0	0. 14–0. 17	4. 5–5. 0	Moderate.
ML or CL	A-4 or A-6	100	100	90–100	85–100	0. 63–2. 0	0. 19–0. 23	4. 5–7. 3	Low.
CL	A-7	95–100	95–100	85–100	70–95	0. 63–2. 0	0. 15–0. 19	6. 6–7. 3	Low to moderate.
CL or CH	A-7	95–100	95–100	85–100	70–95	0. 2–0. 63	0. 15–0. 18	6. 6–7. 3	Moderate.
CL or CH	A-7	95–100	95–100	85–100	75–85	0. 06–0. 2	0. 14–0. 17	6. 6–7. 3	High.
ML–CL	A-7	95–100	95–100	85–100	75–85	0. 06–0. 63	0. 15–0. 18	7. 4–7. 8	Moderate to high.
ML or CL	A-7	95–100	95–100	85–100	80–95	0. 63–2. 0	0. 16–0. 19	5. 6–7. 3	Low to moderate.
MH–CH or CL	A-7	95–100	95–100	90–100	90–100	0. 2–0. 63	0. 15–0. 18	5. 6–6. 0	Moderate.
MH or CH	A-7	95–100	95–100	90–100	85–100	0. 2–0. 63	0. 14–0. 17	5. 6–6. 0	High.
ML–CL	A-4	100	100	90–100	80–90	0. 63–2. 0	0. 19–0. 23	4. 5–6. 0	Low.
ML–CL	A-6 or A-7	100	100	95–100	85–95	0. 06–0. 2	0. 16–0. 19	4. 5–5. 0	Low.
ML–CL	A-4	100	100	90–100	70–90	0. 06–0. 2	0. 16–0. 19	4. 5–5. 0	Low.
ML or CL	A-4 or A-6	95–100	90–100	90–100	80–90	0. 63–2. 0	0. 19–0. 23	4. 5–6. 5	Low.
ML or CL	A-4 or A-7	100	100	95–100	85–95	0. 63–2. 0	0. 16–0. 19	4. 5–5. 0	Moderate to low.
MH or CH	A-7	95–100	90–100	85–100	80–95	0. 2–2. 0	0. 15–0. 18	4. 5–5. 0	Moderate.
MH or CH	A-7	95–100	90–100	85–100	80–100	0. 2–0. 63	0. 14–0. 17	4. 5–5. 0	Moderate.
GM or ML	A-4	70–80	60–70	50–60	35–55	2. 0–6. 3	0. 11–0. 14	4. 5–5. 5	Low.
GM or GC	A-2 or A-4	60–80	60–70	50–60	30–45	2. 0–20. 0	0. 10–0. 13	4. 5–5. 5	Low.
ML or CL	A-4	100	100	100	95–100	0. 63–2. 0	0. 19–0. 23	5. 1–7. 8	Low.
ML or CL	A-4 or A-6	100	100	95–100	85–95	0. 63–2. 0	0. 16–0. 19	5. 1–5. 5	Low.
MH or CH	A-7	100	100	95–100	90–95	0. 2–2. 0	0. 15–0. 18	5. 1–5. 5	Moderate.
ML or CL	A-4 or A-6	95–100	90–100	90–100	80–90	0. 63–2. 0	0. 19–0. 23	4. 5–6. 0	Low.
ML	A-4	95–100	95–100	90–100	70–90	0. 63–2. 0	0. 19–0. 23	4. 5–7. 3	Low.
CL	A-6 or A-7	90–100	85–100	80–100	75–95	0. 63–2. 0	0. 16–0. 19	4. 5–5. 0	Low.
GM or ML	A-4	65–75	65–75	60–75	45–70	2. 0–6. 3	0. 08–0. 11	4. 5–5. 0	Low.
ML or CL	A-4	95–100	95–100	90–100	85–95	0. 63–2. 0	0. 19–0. 23	4. 0–5. 0	Low.
ML or CL	A-4 or A-6	95–100	95–100	90–100	90–100	0. 06–0. 2	0. 16–0. 19	4. 0–5. 0	Low.
ML–CL or CL	A-6	95–100	95–100	90–100	90–100	0. 06–0. 2	0. 16–0. 19	4. 0–5. 0	Low.
ML or CL	A-4 or A-6	95–100	95–100	90–100	75–95	0. 63–2. 0	0. 19–0. 23	5. 6–7. 3	Low.
ML or ML–CL	A-4 or A-6	100	100	90–100	80–95	0. 63–2. 0	0. 19–0. 23	4. 5–5. 5	Low.
ML–CL or CL	A-6 or A-7	100	100	90–100	85–95	0. 63–2. 0	0. 16–0. 19	4. 5–5. 0	Low to moderate.
CL	A-7	100	95–100	90–100	80–90	0. 06–0. 2	0. 15–0. 18	4. 5–5. 0	Low to moderate.
CH	A-7	100	100	95–100	90–100	0. 2–0. 63	0. 15–0. 18	5. 1–6. 0	Moderate to high.
ML or CL	A-4 or A-6	100	100	90–100	85–95	0. 63–2. 0	0. 19–0. 23	5. 6–7. 3	Low.
ML or CL	A-4 or A-6	95–100	90–100	90–100	85–100	0. 63–2. 0	0. 19–0. 23	5. 6–7. 3	Low.
ML	A-4	100	100	85–95	60–75	2. 0–6. 3	0. 15–0. 18	4. 5–5. 0	Low.
SM or ML	A-4	80–100	75–100	70–85	40–55	2. 0–10. 0	0. 13–0. 16	4. 5–5. 5	Very low.
SM	A-2	70–100	65–100	50–65	20–35	>6. 3	0. 02–0. 05	4. 5–5. 0	Very low.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Classification
	Bedrock	Seasonal high water table		USDA texture
	Feet	*Feet*	*Inches*	
Rarden: RdC, RdD, ReC3, ReD3	2–3½	6+	0–5	Silt loam
			5–17	Silty clay loam
			17–29	Silty clay
			29–37	Sandy clay
			37	Shale.
Sadler; SaA, SaB	4–10	1½–2	0–24	Silt loam
			24–48	Silt loam (fragipan)
			48–62	Clay loam
			62–76	Loam
Shelocta: ShB, ShC, ShD, ShD3	3½–5+	6+	0–13	Gravelly silt loam
			13–52	Gravelly silty clay loam
Steff: Ss	5–20	[2] 1½–2	0–52	Silt loam
Stendal: St	5–20	[2] ½–1½	0–50	Silt loam
Weikert: WcE, WcE3, WgE, WgE3, WgF. For properties of Gilpin and Ramsey soils in mapping units WgE, WgE3, and WgF, refer to their respective series.	⅔–1½	6+	0–6	Channery silt loam
			6–12	Channery silt loam
			12–17	Very channery silt loam
			17	Siltstone and sandstone.
Wellston: WlB, WlC, WlD, WnC3, WnD3	3½–6	6+	0–6	Silt loam
			6–31	Silty clay loam
			31–39	Gravelly clay loam
			39–47	Sandy clay loam
			47	Sandstone.
Wellston, clayey subsoil variant: WoC, WoD, WsC3, WsD3.	3½–6	6+	0–8	Silt loam
			8–22	Silty clay loam
			22–51	Silty clay
			51–70	Silty clay loam
Zanesville: ZaB, ZaC, ZcC3	3½–8	2½–4+	0–11	Silt loam
			11–28	Silty clay loam
			28–37	Silt loam (fragipan)
			37–45	Silty clay loam (fragipan)
			45–60	Sandy clay loam
			60	Sandstone.

[1] Data is based on material 3 inches or smaller in size.

properties of soils—Continued

Classification—Continued		Percentage passing sieve—				Permeability	Available moisture capacity	Reaction	Shrink-swell potential
Unified [1]	AASHO [1]	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
						Inches per hour	*Inches per inch of soil*	*pH value*	
ML–CL	A–4	95–100	95–100	90–95	80–90	0. 63–2. 0	0. 19–0. 23	4. 5–5. 0	Low.
ML–CL	A–6 or A–7	95–100	95–100	90–100	90–95	0. 63–2. 0	0. 16–0. 19	4. 5–5. 0	Moderate.
CL or MH–CH	A–7	100	100	95–100	90–100	0. 2–0. 63	0. 15–0. 18	4. 5–5. 0	High.
SC or CL	A–7	100	100	85–95	45–60	0. 2–0. 63	0. 15–0. 18	4. 5–5. 0	High to moderate.
ML–CL or ML	A–4 or A–6	95–100	95–100	90–100	85–95	0. 63–2. 0	0. 19–0. 23	4. 5–6. 5	Low.
ML–CL	A–4 to A–6	100	100	100	85–95	0. 06–0. 2	0. 16–0. 19	4. 5–5. 0	Low.
ML–CL or CL	A–6	90–100	85–100	85–100	75–95	0. 63–2. 0	0. 15–0. 18	4. 5–5. 0	Low.
ML–CL or CL	A–4 or A–6	100	100	95–100	85–95	0. 63–6. 3	0. 15–0. 18	4. 5–5. 0	Low.
GM or ML	A–4	65–90	65–90	55–85	35–55	0. 63–6. 3	0. 13–0. 16	4. 5–6. 0	Low.
ML or CL or GC	A–4 or A–6	60–80	60–80	50–65	45–65	0. 63–6. 3	0. 11–0. 14	4. 5–5. 0	Low.
ML–CL or ML	A–4	95–100	90–100	85–100	75–95	0. 63–2. 0	0. 19–0. 23	4. 5–6. 0	Low.
ML–CL or ML	A–4	95–100	95–100	90–100	75–95	0. 63–2. 0	0. 19–0. 23	4. 5–7. 3	Low.
GM or ML	A–4	70–80	65–80	60–75	45–70	2. 0–20. 0	0. 09–0. 12	5. 1–6. 0	Very low.
SM or GM	A–4	70–80	50–60	45–55	40–50	2. 0–6. 3	0. 09–0. 12	4. 5–5. 0	Very low.
GM or SM–SC	A–2 or A–4	45–60	40–55	35–50	25–40	6. 3–20. 0	0. 06–0. 19	4. 5–5. 0	Very low.
ML	A–4	90–100	90–100	85–95	65–85	0. 63–2. 0	0. 19–0. 23	4. 5–6. 0	Low.
CL	A–6 or A–7	95–100	95–100	95–100	85–95	0. 63–2. 0	0. 16–0. 19	4. 5–5. 5	Low.
CL or GC	A–6	60–80	60–80	55–75	45–70	0. 63–6. 3	0. 12–0. 15	4. 5–5. 5	Low.
SC or CL	A–6	75–95	75–95	70–90	40–60	0. 63–6. 3	0. 15–0. 18	4. 5–5. 5	Low.
ML	A–4	90–100	90–100	85–100	80–90	0. 63–2. 0	0. 19–0. 23	4. 5–5. 0	Low.
CL	A–6	100	100	95–100	90–100	0. 63–2. 0	0. 16–0. 19	4. 0–5. 5	Low.
MH–CH	A–7	95–100	90–100	90–100	85–95	0. 20–0. 63	0. 15–0. 18	4. 0–5. 5	High.
MH–CH	A–7	90–100	90–100	85–95	80–90	0. 20–0. 63	0. 15–0. 18	4. 0–5. 5	Moderate.
ML	A–4	100	100	100	95–100	0. 63–2. 0	0. 19–0. 23	4. 5–7. 3	Low.
CL or ML–CL	A–6	100	100	95–100	90–100	0. 63–2. 0	0. 16–0. 19	4. 5–5. 0	Low.
CL	A–6	80–100	80–100	80–95	75–90	0. 06–0. 63	0. 16–0. 19	4. 5–5. 0	Low.
CL	A–6	95–100	95–100	90–100	85–95	0. 06–0. 2	0. 15–0. 18	4. 5–5. 0	Low.
SC or CL	A–2 or A–6	95–100	95–100	80–95	30–55	0. 63–2. 0	0. 15–0. 18	4. 5–5. 0	Low.

[2] Subject to flooding.

TABLE 5.—*Engineering*

[The properties of Gullied land (Gu) are so

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Highway location	Farm ponds: Reservoir area
Allegheny: AeB, AeC	Good	Fair to poor: A–2, A–4, or A–6.	Slope	Variable texture in substratum; subject to seepage.
Baxter: BcC3, BcD3	Poor: cherty; high clay content.	Poor: cherty; moderate shrink-swell potential; A–6 or A–7.	Karst topography; slope.	Karst topography; subject to seepage; slope.
Bonnie: Bo	Fair to good: seasonal water table at the surface.	Fair to poor: seasonal water table at the surface; A–4 or A–6.	Seasonal water table at the surface; occasional flooding.	Seasonal water table at the surface; subject to seepage.
Burgin: Bu	Fair: clayey below depth of 10 inches; seasonal water table at the surface.	Poor: plastic; high compressibility; A–7; seasonal water table at the surface; moderate to high shrink-swell potential.	Seasonal water table at the surface; bedrock at depth of 36 to 60 inches or more.	Seasonal water table at the surface; bedrock at depth of 36 to 60 inches or more.
Caneyville: CcB, CcC, CcD, CeD, CeF, ClD3, CnD3, Co. Rock outcrop in mapping unit Co is too variable for interpretations to be made.	Poor: bedrock at depth of 20 to 40 inches; high clay content.	Poor: bedrock at depth of 20 to 40 inches; high clay content; A–7; high compressibility; high shrink-swell potential.	Bedrock at depth of 20 to 40 inches; slope.	Bedrock at depth of 20 to 40 inches; sinkholes and seepage in some places.
Captina: CpB, CpC	Good	Fair to poor: seasonal water table at depth of 18 to 24 inches; A–4, A–6, or A–7.	Seasonal water table at depth of 18 to 24 inches.	Seasonal water table at depth of 18 to 24 inches.
Christian: CrB, CrC, CsC3	Good to depth of 12 inches where not severely eroded; poor below 12 inches; clayey.	Poor: moderate shrink-swell potential; A–4, A–6, or A–7.	Bedrock at depth of 40 to 60 inches.	Bedrock at depth of 40 to 60 inches; seepage in some parts of limestone areas.
Clifty: Ct	Poor: high gravel content.	Good to fair: A–2 or A–4.	Occasional flooding; high gravel content.	Seepage
Crider: CuB, CuC, CvC3	Good	Fair to poor: A–4, A–6, or A–7.	Karst topography in some areas; slope.	Seepage in some areas of karst topography.
Cuba: Cw	Good	Fair: A–4 or A–6	Occasional flooding	Seepage in subsoil in some areas.

interpretations

variable that interpretations were not made]

Soil features affecting—Continued					
Farm ponds—Cont'd Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings
Fair stability and compaction.	Well drained	Slope	Slope	Slope	Medium compressibility.
Cherty; moderate shrink-swell potential.	Well drained	Severely eroded; cherty; slope.	Karst topography in some areas; slope; severely eroded.	Slope; severely eroded.	Moderate shrink-swell potential below depth of 10 inches; cherty.
Piping hazard	Seasonal water table at the surface; occasional flooding; outlets may be a problem.	Seasonal water table at the surface; occasional flooding.	Seasonal water table at the surface; occasional flooding; nearly level.	Possible siltation; occasional flooding.	Seasonal water table at the surface; occasional flooding.
High compressibility; moderate to high shrink-swell potential.	Seasonal water table at the surface; slow permeability; outlets may be a problem.	Seasonal water table at the surface.	Dense clayey subsoil; nearly level; seasonal water table at the surface.	Possible siltation	Bedrock at depth of 36 to 60 inches or more; moderate to high shrink-swell potential; seasonal water table at the surface.
Limited volume due to depth to bedrock; high clay content; high compressibility; high shrink-swell potential.	Well drained	Moderately to severely eroded; slope.	Dense clayey subsoil; slope; rocky in some places; bedrock at depth of 20 to 40 inches.	Dense clayey subsoil; some areas severely eroded; rocky in places; slope.	Bedrock at depth of 20 to 40 inches; high shrink-swell potential.
Fair stability and compaction.	Fragipan at depth of 24 inches; seasonal water table at depth of 18 to 24 inches.	Fragipan at depth of 24 inches; moderately eroded; slope.	Siltation in some areas; slope.	Siltation in some areas; fragipan at depth of 24 inches; slope.	Seasonal water table at depth of 18 to 24 inches.
Moderate shrink-swell potential.	Well drained	Clayey subsoil; slope.	Clayey subsoil and substratum; slope.	Clayey subsoil; siltation in some areas; slope.	Moderate shrink-swell potential in subsoil; bedrock at depth of 40 to 60 inches.
Pervious	Well drained	Occasional flooding	Occasional flooding; high gravel content; siltation in some areas; nearly level.	Possible siltation; occasional flooding.	Occassional flooding.
Fair stability and compaction.	Well drained	Slope	Karst topography in some areas; slope.	Karst topography; slope.	Medium compressibility.
Piping hazard; poor to fair stability and compaction.	Well drained	Occasional flooding	Occasional flooding; possible siltation; nearly level.	Possible siltation; occasional flooding.	Occasional flooding; subject to liquidity.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Highway location	Farm ponds: Reservoir area
Gilpin: GIC, GID, GIE, GpC3, GpD3, GpE3	Fair: channery material at depth of 19 inches.	Fair: limited volume; channery material; A–4, A–6, or A–7; bedrock at depth of 20 to 40 inches.	Bedrock at depth of 20 to 40 inches; slope.	Bedrock at depth of 20 to 40 inches.
Johnsburg: Jo	Good	Fair: seasonal water table at depth of 6 to 12 inches; A–4 or A–6.	Seasonal water table at depth of 6 to 12 inches.	Seasonal water table at depth of 6 to 12 inches.
Lindside: Ld	Good	Fair: seasonal water table at depth of 18 to 24 inches; A–4 or A–6.	Seasonal water table at depth of 18 to 24 inches; occasional flooding.	Seasonal water table at depth of 18 to 24 inches; subject to seepage.
Mercer: MtB	Good	Poor: seasonal water table at depth of 18 to 24 inches; A–4, A–6, or A–7.	Seasonal water table at depth of 18 to 24 inches; bedrock at depth of 48 to 84 inches; moderate shrink-swell potential below 24 inches.	Seepage in some areas; seasonal water table at depth of 18 to 24 inches.
Newark: Ne	Good	Fair to poor: seasonal water table at depth of 6 to 18 inches; A–4 or A–6.	Occasional flooding; seasonal water table at depth of 6 to 18 inches.	Seasonal water table at depth of 6 to 18 inches; seepage in some areas.
Nolin: No	Good	Fair: A–4 or A–6	Occasional flooding	Seepage in subsoil in some areas.
Ramsey: RaD, RaE3	Poor: low fertility; unstable; bedrock at depth of 10 to 20 inches.	Poor: bedrock at depth of 10 to 20 inches.	Bedrock at depth of 10 to 20 inches; slope.	Bedrock at depth of 10 to 20 inches; seepage in some areas.
Rarden: RdC, RdD, ReC3, ReD3	Fair to depth of 17 inches; poor below 17 inches; clayey.	Fair: high shrink-swell potential; A–4, A–6, or A–7; bedrock at depth of 24 to 40 inches.	Bedrock at depth of 24 to 40 inches; slope.	Bedrock at depth of 24 to 40 inches.
Sadler: SaA, SaB	Good	Fair to good: seasonal water table at depth of 18 to 24 inches; A–4 or A–6.	Seasonal water table at depth of 18 to 24 inches.	Seasonal water table at depth of 18 to 24 inches; seepage in some areas.
Shelocta: ShB, ShC, ShD, ShD3	Fair: contains gravel.	Fair: A–4 or A–6	Slope	Seepage in some areas.
Steff: Ss	Good	Fair to good: seasonal water table at depth of 18 to 24 inches; A–4.	Seasonal water table at depth of 18 to 24 inches; occasional flooding.	Seasonal water table at depth of 18 to 24 inches.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds—Cont'd Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings
Channery material below 19 inches; fair stability.	Well drained	Slope	Bedrock at depth of 20 to 40 inches; slope.	Siltation in some areas; slope; some severely eroded areas.	Bedrock at depth of 20 to 40 inches; medium compressibility.
Medium compressibility; fair stability.	Fragipan at depth of 12 inches; few available outlets; seasonal water table at depth of 6 to 12 inches.	Fragipan at depth of 12 inches.	Fragipan at depth of 12 inches; seasonal water table at depth of 6 to 12 inches.	Fragipan at depth of 12 inches; seepage from side slopes.	Seasonal water table at depth of 6 to 12 inches; medium compressibility.
Piping hazard; fair stability and compaction.	Seasonal water table at depth of 18 to 24 inches; occasional flooding.	Seasonal water table at depth of 18 to 24 inches; occasional flooding.	Siltation in some areas; occasional flooding.	Possible siltation; occasional flooding.	Seasonal water table at depth of 18 to 24 inches; occasional flooding.
Clayey below depth of 30 inches; moderate shrink-swell potential.	Fragipan at depth of 23 inches; seasonal water table at depth of 18 to 24 inches.	Fragipan at depth of 23 inches; seasonal water table at depth of 18 to 24 inches.	Dense clayey subsoil below depth of 30 inches; seasonal water table at depth of 18 to 24 inches.	Fragipan at depth of 23 inches; subject to seepage from side slopes.	Moderate shrink-swell potential in subsoil; seasonal water table at depth of 18 to 24 inches.
Piping hazard; fair stability.	Seasonal water table at depth of 6 to 18 inches; occasional flooding.	Seasonal water table at depth of 6 to 18 inches; occasional flooding.	Occasional flooding; seasonal water table at depth of 6 to 18 inches; siltation in some areas; nearly level.	Possible siltation; occasional flooding.	Seasonal water table at depth of 6 to 18 inches; occasional flooding.
Piping hazard; fair stability.	Well drained	Occasional flooding; siltation in some areas.	Siltation in some areas; occasional flooding; nearly level.	Possible siltation; occasional flooding.	Occasional flooding.
Piping hazard	Somewhat excessively drained.	Sandy; slope; droughty.	Stony; slope; bedrock at depth of 10 to 20 inches.	Bedrock at depth of 10 to 20 inches; slope; stony; droughty.	Bedrock at depth of 10 to 20 inches.
High shrink-swell potential; fair compaction.	Well drained to moderately well drained.	Slope; some severely eroded areas.	Dense clayey subsoil.	Slope; some severely eroded areas; dense clayey subsoil.	Bedrock at depth of 24 to 40 inches; high shrink-swell potential; high compressibility.
Possible piping; fair stability.	Seasonal water table at depth of 18 to 24 inches; fragipan at depth of 24 inches.	Fragipan at depth of 24 inches; seasonal water table at depth of 18 to 24 inches.	Fragipan at depth of 24 inches.	Possible siltation; fragipan at depth of 24 inches.	Seasonal water table at depth of 18 to 24 inches; medium compressibility.
Possible piping; contains gravel.	Well drained	Slope: gravelly material.	Gravelly material	Slope; gravelly material.	Subject to liquidity.
Piping hazard; fair stability and compaction.	Seasonal water table at depth of 18 to 24 inches; occasional flooding.	Seasonal water table at depth of 18 to 24 inches; occasional flooding.	Seasonal water table at depth of 18 to 24 inches; occasional flooding; nearly level.	Possible siltation; occasional flooding.	Seasonal water table at depth of 18 to 24 inches; occasional flooding; subject to liquidity.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Highway location	Farm ponds: Reservoir area
Stendal: St	Good	Fair to good: seasonal water table at depth of 6 to 18 inches; A–4.	Seasonal water table at depth of 6 to 18 inches; occasional flooding.	Seasonal water table at depth of 6 to 18 inches; seepage in some areas.
Weikert: WcE, WcE3, WgE, WgE3, WgF. For interpretations of Gilpin and Ramsey soils in mapping units WgE, WgE3, and WgF, refer to their respective series.	Poor: channery material; bedrock at depth of 8 to 20 inches.	Poor: bedrock at depth of 8 to 20 inches.	Bedrock at depth of 8 to 20 inches; slope.	Bedrock at depth of 8 to 20 inches; slope.
Wellston: WlB, WlC, WlD, WnC3, WnD3.	Good to fair to depth of 31 inches.	Fair to poor: A–4, A–6, or A–7.	Bedrock at depth of 40 to 60 inches; slope.	Bedrock at depth of 40 to 60 inches; slope; seepage in some areas.
Wellston, clayey subsoil variant: WoC, WoD, WsC3, WsD3.	Good to depth of 22 inches; poor below 22 inches; high clay content.	Poor: moderate to high shrink-swell potential; A–4, A–6, or A–7.	Bedrock at depth of 40 to 60 inches; slope.	Bedrock at depth of 40 to 60 inches; slope.
Zanesville: ZaB, ZaC, ZcC3	Good	Fair to poor: A–6	Slope	Slope

Engineering test data

Table 6 contains the results of engineering tests performed by the Kentucky Department of Highways on several important soils in Grayson County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering. The soil series selected for the engineering tests are among the most extensive in the survey area and represent about 48 percent of Grayson County.

Columns in table 6 that are not self-explanatory are explained as follows:

Maximum dry density is the maximum unit dry weight of the soil when it has been compacted with optimum moisture by the prescribed method of compaction. The moisture content that gives the highest dry unit weight is called the *optimum moisture* content for the specific method of compaction.

Mechanical analyses show the percentages, by weight, of soil particles that would pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve. Silt and clay pass through the No. 200 sieve. Silt is that material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is that fraction smaller than 0.002 millimeter in diameter passing through the No. 200 sieve. The clay fraction was determined by the hydrometer method, rather than the pipette method that most soil scientists use in determining the clay in soil samples.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic. The liquid limit is the moisture content at which the material changes from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds—Cont'd Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings
Piping hazard; fair stability and compaction.	Seasonal water table at depth of 6 to 18 inches; occasional flooding.	Seasonal water table at depth of 6 to 18 inches; occasional flooding.	Possible siltation; nearly level; occasional flooding.	Possible siltation; occasional flooding.	Seasonal water table at depth of 6 to 18 inches; occasional flooding; subject to liquidity.
Channery material; piping of material from some areas.	Well drained	Channery material; slope.	Channery material; slope; bedrock at depth of 8 to 20 inches.	Bedrock at depth of 8 to 20 inches; slope; channery material.	Bedrock at depth of 8 to 20 inches.
Fair stability and compaction.	Well drained	Slope; some severely eroded areas.	Slope	Slope; some severely eroded areas.	Bedrock at depth of 40 to 60 inches; medium compressibility.
Moderate to high shrink-swell potential; fair to poor compaction.	Well drained	Slope; some severely eroded areas.	Slope	Slope; some severely eroded areas.	Bedrock at depth of 40 to 60 inches; moderate to high shrink-swell potential below 22 inches.
Fair to good stability and compaction.	Well drained to moderately well drained.	Slope; fragipan at depth of 28 inches.	Slope	Slope; some severely eroded areas.	Seasonal water table at depth of 30 to 48 inches; medium compressibility.

Use of Soils for Town and Country Planning

Soils are an important consideration in planning nonfarm and recreational uses of land. The interpretations in this section point out soil-related limitations and problems expected to be encountered in such uses. The most severe limitations listed may be overcome if the cost involved can be justified. The information is not intended to eliminate the need of onsite investigations for specific uses, but serves as a guide for screening sites and for planning more detailed investigations.

Table 7 shows the estimated degree of limitation and kinds of limitations for selected town and country uses of the soils. Interpretations for Gullied land (Gu) and Rock outcrop (in Co) are not given. For soils in complexes, the user should know the soil in order to make interpretations or use the table.

The rating is *slight* if the soils have few known limitations that affect the use indicated. It is *moderate* if the soils have one or more properties that limit use. Correcting these limitations increases installation and maintenance costs. The rating is *severe* if the soils have one or more properties that seriously limit use. Using soils that have severe limitations increases the probability of failure and adds to the cost of installation and maintenance.

The kinds of limitations, expressed in terms of soil characteristics or properties, are shown only for the moderate and severe ratings. Some of the kinds of terms that may not be found in a standard dictionary or that have a special meaning are defined in the Glossary in the back of this publication.

TABLE 6.—*Engineering*

[Tests made by Division of Research, Kentucky

Soil name and location	Parent material	Depth	Moisture-density [1]	
			Maximum dry density	Optimum moisture
		Inches	*Lb. per cu. ft.*	*Percent*
Caneyville silty clay loam:				
3.5 miles northwest of Leitchfield, 0.5 mile north of State Route 737, on gravel road, west roadbank. (Modal profile)	Mixed limestone, sandstone, and shale.	9–18	81	26
		18–24	84	25
Sadler silt loam:				
0.9 mile southeast of Caneyville, 660 feet west of farmhouse. (Nonmodal profile; deeper to a fragipan than modal)	Loess over sandstone, siltstone, and shale.	13–23	106	18
		33–42	110	18
2 miles south of Caneyville, 430 ft. northwest of a farmhouse. (Modal profile)	Loess over sandstone, siltstone, and shale.	13–20	106	18
		24–38	109	18
		62–76	106	18
Wellston silt loam:				
0.5 mile north of Caneyville, 0.3 mile east of State Route 79. (Modal profile)	Loess over sandstone and siltstone.	1–8	100	22
		18–28	105	20
		42–73	102	22
Wellston silt loam, clayey subsoil variant:				
2 miles south of Caneyville, 0.5 mile west of State Route 185. (Modal profile)	Loess over acid shale.	3–14	101	22
		30–38	94	25
		48–58	98	23
Zanesville silt loam:				
0.8 mile southeast of Caneyville, 500 feet south of gravel road. (Nonmodal profile; more shallow to the fragipan and more clayey in lower subsoil than modal)	Loess over acid shale.	12–23	100	22
		32–38	105	20
		58–71	106	20
2 miles south of Caneyville, 590 feet north of a farmhouse. (Nonmodal profile; more shallow to bedrock than modal)	Loess over sandstone and shale.	11–18	104	20
		36–48	114	15

[1] Based on American Association of State Highway Officials (AASHO) Designation: T 99–57 (*1*).

[2] Mechanical analysis according to American Association of State Highway Officials Designation: T 88–57 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size

test data

Department of Highways, Lexington, Kentucky]

Mechanical analysis [2]—									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [3]—					Percentage smaller than—							
¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified [4]
---	100	99	98	97	96	90	74	67	70	35	A–7–5(20)	MH–CH
---	---	100	99	97	96	91	74	63	72	32	A–7–5(20)	MH
---	100	99	97	95	95	76	39	31	33	11	A–6(8)	ML–CL
96	90	86	82	76	95	62	35	26	33	15	A–6(8)	CL
---	---	100	99	93	88	68	33	23	29	6	A–4(8)	ML–CL
---	---	100	99	91	84	61	31	23	27	7	A–4(8)	ML–CL
---	---	---	---	90	77	58	38	32	35	19	A–6(11)	CL
99	96	93	88	75	66	45	16	8	[5] NP	[5] NP	A–4(8)	ML
100	99	98	98	88	83	72	41	30	35	18	A–6(11)	CL
---	---	100	99	96	94	77	36	28	34	12	A–6(9)	ML–CL
---	---	100	99	97	97	81	43	37	37	14	A–6(10)	ML–CL
100	98	96	95	91	91	86	69	57	56	27	A–7–6(18)	MH–CH
98	92	91	87	84	84	82	63	46	57	28	A–7–6(18)	MH–CH
---	100	98	97	94	94	78	42	33	37	12	A–6(9)	ML–CL
100	97	92	88	81	76	63	37	27	36	15	A–6(10)	CL
---	100	99	98	96	93	84	63	49	48	22	A–7–6(14)	ML–CL
---	---	100	98	96	96	78	35	29	32	11	A–6(8)	ML–CL
97	91	85	83	76	71	54	31	21	28	12	A–6(9)	CL

fractions. The mechanical analysis used in this table are not suitable for naming textural classes for soils.

[3] Material larger than 3 inches discarded from sample.

[4] Based on Unified Soil Classification System (*20*). SCS and BPR have agreed that all soils having plasticity indexes within two points of the A-line are to be given a borderline classification. An example of a borderline classification obtained by this use is ML-CL.

[5] NP=Nonplastic.

TABLE 7.—*Limitations of soils for*

[Gullied land (Gu) is so variable

Soil series and map symbols	Septic tank filter fields	Locations for buildings (three stories or less with basements)	Campsites	
			Trailers	Tents
Allegheny:				
AeB	Slight	Slight	Moderate: slope	Slight
AeC	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope
Baxter:				
BcC3	Moderate: slope	Moderate: slope; moderate shrink-swell potential.	Severe: slope	Moderate: coarse fragments; slope; cherty silty clay loam surface layer.
BcD3	Severe: slope	Moderate: slope; moderate shrink-swell potential.	Severe: slope	Severe: slope
Bonnie: Bo	Severe: high water table; flooding hazard.	Severe: high water table; flooding hazard.	Severe: high water table.	Severe: high water table.
Burgin: Bu	Severe: slow permeability; high water table.	Severe: high water table.	Severe: high water table; slow permeability.	Severe: high water table; slow permeability.
Caneyville:				
CcB	Severe: bedrock at depth of 20 to 40 inches; moderately slow permeability.	Severe: bedrock at depth of 20 to 40 inches.	Moderate: moderately slow permeability; slope; silty clay loam surface layer.	Moderate: moderately slow permeability; silty clay loam surface layer.
CcC	Severe: bedrock at depth of 20 to 40 inches; moderately slow permeability.	Severe: bedrock at depth of 20 to 40 inches.	Severe: slope	Moderate: moderately slow permeability; slope; silty clay loam surface layer.
CcD	Severe: bedrock at depth of 20 to 40 inches; moderately slow permeability; slope.	Severe: bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope
CeD, CeF, Co Interpretations for the Rock outcrop part of Co are not given.	Severe: moderately slow permeability; slope; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: rock outcrops; slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope
ClD3	Severe: bedrock at depth of 20 to 40 inches; moderately slow permeability; slope.	Severe: bedrock at depth of 20 to 40 inches.	Severe: slope; silty clay surface layer.	Severe: slope; silty clay surface layer.
CnD3	Severe: moderately slow permeability; slope; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: slope; very rocky silty clay surface layer.	Severe: slope; very rocky silty clay surface layer.

town and country planning

that limitations are not rated]

County and access roads	Streets and parking lots	Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Cemeteries
Slight	Moderate: slope	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Moderate: slope	Severe: slope	Severe: slope; coarse fragments.	Moderate: slope; cherty silty clay loam surface layer; coarse fragments.	Severe: past erosion.	Severe: slope; cherty silty clay loam surface layer; past erosion.
Severe: slope	Severe: slope	Severe: slope; coarse fragments.	Severe: slope	Severe: slope; past erosion.	Severe: slope; cherty silty clay loam surface layer.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table.	Severe: high water table.	Severe: high water table; slow permeability.	Severe: high water table.	Severe: high water table.	Severe: high water table; slow permeability.
Severe: bedrock at depth of 20 to 40 inches.	Severe: bedrock at depth of 20 to 40 inches.	Moderate: bedrock at depth of 20 to 40 inches; moderately slow permeability; silty clay loam surface layer.	Slight	Moderate: bedrock at depth of 20 to 40 inches.	Severe: bedrock at depth of 20 to 40 inches.
Severe: bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Moderate: slope; silty clay loam surface layer.	Moderate: slope; bedrock at depth of 20 to 40 inches.	Severe: bedrock at depth of 20 to 40 inches.
Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope	Severe: slope; bedrock at depth of 20 to 40 inches.
Severe: slope; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: slope; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: slope; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope; rock outcrops.	Severe: slope; rock outcrops; bedrock at depth of 20 to 40 inches.
Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope; silty clay surface layer; bedrock at depth of 20 to 40 inches.	Severe: slope; silty clay surface layer.	Severe: slope; silty clay surface layer; past erosion.	Severe: silty clay surface layer; slope; bedrock at depth of 20 to 40 inches.
Severe: slope; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: slope; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: slope; very rocky silty clay surface layer; rock outcrops; bedrock at depth of 20 to 40 inches.	Severe: slope; very rocky silty clay surface layer.	Severe: slope; very rocky silty clay surface layer; past erosion; rock outcrops.	Severe: very rocky silty clay surface layer; slope; rock outcrops; bedrock at depth of 20 to 40 inches.

TABLE 7.—*Limitations of soils for*

Soil series and map symbols	Septic tank filter fields	Locations for buildings (three stories or less with basements)	Campsites	
			Trailers	Tents
Captina:				
CpB	Severe: slow permeability in fragipan.	Moderate: high water table.	Severe: slow permeability in fragipan.	Severe: slow permeability in fragipan.
CpC	Severe: slow permeability in fragipan.	Moderate: high water table; slope.	Severe: slope; slow permeability in fragipan.	Severe: slow permeability in fragipan.
Christian:				
CrB	Severe: moderately slow permeability.	Moderate: moderate shrink-swell potential; bedrock at depth of 40 to 60 inches.	Moderate: moderately slow permeability; slope.	Moderate: moderately slow permeability.
CrC	Severe: moderately slow permeability.	Moderate: moderate shrink-swell potential; bedrock at depth of 40 to 60 inches.	Severe: slope	Moderate: slope; moderately slow permeability.
CsC3	Severe: moderately slow permeability.	Moderate: moderate shrink-swell potential; slope; bedrock at depth of 40 to 60 inches.	Severe: slope	Moderate: silty clay loam surface layer; slope.
Clifty: Ct	Severe: flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard; coarse fragments.	Moderate: flooding hazard; coarse fragments.
Crider:				
CuB	Slight	Slight	Moderate: slope	Slight
CuC	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope
CvC3	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.
Cuba: Cw	Severe: flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.
Gilpin:				
GlC	Severe: bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Moderate: slope
GlD	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope
GlE, GpE3	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope	Severe: slope
GpC3	Severe: bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Moderate: slope; silty clay loam surface layer.
GpD3	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope

town and country planning—Continued

County and access roads	Streets and parking lots	Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Cemeteries
Moderate: high water table.	Moderate: high water table; slope.	Severe: slow permeability in fragipan.	Slight	Slight	Severe: slow permeability in fragipan.
Moderate: high water table; slope.	Severe: slope	Severe: slow permeability in fragipan; slope.	Moderate: slope	Moderate: slope	Severe: slow permeability in fragipan.
Moderate: bedrock at depth of 40 to 60 inches.	Moderate: slope; bedrock at depth of 40 to 60 inches.	Moderate: slope	Slight	Slight	Moderate: moderately slow permeability; bedrock at depth of 40 to 60 inches.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: moderately slow permeability; bedrock at depth of 40 to 60 inches; slope.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.	Severe: silty clay loam surface layer; past erosion.	Severe: past erosion.
Severe: flooding hazard.	Severe: flooding hazard.	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: flooding hazard.
Slight	Moderate: slope	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.	Severe: past erosion.	Severe: silty clay loam surface layer; slope; past erosion.
Severe: flooding hazard.	Severe: flooding hazard.	Slight	Slight	Slight	Moderate: flooding hazard.
Moderate: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope	Moderate: slope	Moderate: bedrock at depth of 20 to 40 inches; slope.	Severe: bedrock at depth of 20 to 40 inches; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock at depth of 20 to 40 inches.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: slope; bedrock at depth of 20 to 40 inches.	Severe: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.	Severe: past erosion.	Severe: slope; bedrock at depth of 20 to 40 inches.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: past erosion; slope.	Severe: slope; bedrock at depth of 20 to 40 inches.

TABLE 7.—*Limitations of soils for*

Soil series and map symbols	Septic tank filter fields	Locations for buildings (three stories or less with basements)	Campsites	
			Trailers	Tents
Johnsburg: Jo	Severe: high water table; slow permeability in fragipan.	Severe: high water table; frost action.	Severe: high water table; slow permeability in fragipan.	Severe: high water table; slow permeability in fragipan.
Lindside: Ld	Severe: flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard; high water table.	Moderate: flooding hazard; high water table.
Mercer: MtB	Severe: slow permeability in fragipan.	Moderate: high water table; moderate shrink-swell potential.	Severe: slow permeability in fragipan.	Severe: slow permeability in fragipan.
Newark: Ne	Severe: high water table; flooding hazard.	Severe: high water table; flooding hazard.	Severe: high water table.	Severe: high water table.
Nolin: No	Severe: flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.
Ramsey:				
RaD	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.
RaE3	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.
Rarden:				
RdC	Severe: moderately slow permeability; bedrock at depth of 24 to 40 inches.	Moderate: high shrink-swell potential; slope; bedrock at depth of 24 to 40 inches.	Severe: slope	Moderate: moderately slow permeability; slope.
RdD	Severe: moderately slow permeability; slope; bedrock at depth of 24 to 40 inches.	Moderate: high shrink-swell potential; bedrock at depth of 24 to 40 inches.	Severe: slope	Severe: slope
ReC3	Severe: moderately slow permeability; bedrock at depth of 24 to 40 inches.	Moderate: high shrink-swell potential; slope; bedrock at depth of 24 to 40 inches.	Severe: slope	Moderate: moderately slow permeability; slope; silty clay loam surface layer.
ReD3	Severe: moderately slow permeability; slope; bedrock at depth of 24 to 40 inches.	Moderate: high shrink-swell potential; bedrock at depth of 24 to 40 inches.	Severe: slope	Severe: slope
Sadler:				
SaA	Severe: slow permeability in fragipan.	Moderate: high water table.	Severe: slow permeability in fragipan.	Severe: slow permeability in fragipan.
SaB	Severe: slow permeability in fragipan.	Moderate: high water table.	Severe: slow permeability in fragipan.	Severe: slow permeability in fragipan.

town and country planning—Continued

County and access roads	Streets and parking lots	Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Cemeteries
Moderate: high water table.	Moderate: high water table.	Severe: high water table; slow permeability in fragipan.	Moderate: high water table.	Moderate: high water table; depth to fragipan.	Severe: high water table; slow permeability in fragipan.
Severe: flooding hazard.	Severe: flooding hazard.	Moderate: high water table.	Slight	Slight	Moderate: flooding hazard; high water table.
Moderate: high water table.	Moderate: high water table; slope.	Severe: slow permeability in fragipan.	Slight	Slight	Severe: slow permeability in fragipan.
Severe: flooding hazard.	Severe: flooding hazard.	Severe: high water table.	Moderate: high water table; flooding hazard.	Moderate: high water table; flooding hazard.	Severe: high water table.
Severe: flooding hazard.	Severe: flooding hazard.	Slight	Slight	Slight	Moderate: flooding hazard.
Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: low available moisture capacity; slope; bedrock at depth of 10 to 20 inches.	Severe: low available moisture capacity; slope; bedrock at depth of 10 to 20 inches.
Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: very low available moisture capacity; past erosion; slope; bedrock at depth of 10 to 20 inches.	Severe: very low available moisture capacity; slope; past erosion; bedrock at depth of 10 to 20 inches.
Moderate: slope; bedrock at depth of 24 to 40 inches.	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope; bedrock at depth of 24 to 40 inches.	Moderate: slope; bedrock at depth of 24 to 40 inches.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: slope; bedrock at depth of 24 to 40 inches.	Severe: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.	Severe: past erosion.	Severe: past erosion.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; past erosion.	Severe: slope; past erosion.
Moderate: high water table.	Moderate: high water table.	Severe: slow permeability in fragipan.	Slight	Slight	Severe: slow permeability in fragipan.
Moderate: high water table.	Moderate: high water table; slope.	Severe: slow permeability ih fragipan.	Slight	Slight	Severe: slow permeability in fragipan.

TABLE 7.—*Limitations of soils for*

Soil series and map symbols	Septic tank filter fields	Locations for buildings (three stories or less with basements)	Campsites	
			Trailers	Tents
Shelocta:				
ShB	Slight	Slight	Moderate: slope; coarse fragments.	Moderate: coarse fragments.
ShC	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope; coarse fragments.
ShD, ShD3	Severe: slope	Moderate: slope	Severe: slope	Severe: slope
Steff: Ss	Severe: flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard; high water table.	Moderate: flooding hazard; high water table.
Stendal: St	Severe: high water table; flooding hazard.	Severe: high water table; flooding hazard.	Severe: high water table.	Severe: high water table.
Weikert: WcE, WcE3, WgE, WgE3, WgF. For Gilpin part of WgE, WgE3 and WgF, see GlE. For Ramsey part of WgE and WgF, see RaD. For Ramsey part of WgE3, see RaE3.	Severe: slope; bedrock at depth of 8 to 20 inches.	Severe: slope; bedrock at depth of 8 to 20 inches.	Severe: slope; bedrock at depth of 8 to 20 inches.	Severe: slope; bedrock at depth of 8 to 20 inches.
Wellston:				
WlB	Slight	Slight	Moderate: slope	Slight
WlC	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope
WlD, WoD	Severe: slope	Moderate: slope	Severe: slope	Severe: slope
WnC3	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.
WnD3, WsD3	Severe: slope	Moderate: slope	Severe: slope	Severe: slope
WoC	Severe: moderately slow permeability.	Moderate: slope	Severe: slope	Moderate: slope
WsC3	Severe: moderately slow permeability.	Moderate: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.
Zanesville:				
ZaB	Severe: slow permeability in fragipan.	Moderate: high water table.	Moderate: high water table; slow permeability in fragipan; slope.	Moderate: high water table; slow permeability in fragipan.
ZaC	Severe: slow permeability in fragipan; slope.	Moderate: high water table; slope.	Severe: slope	Moderate: high water table; slow permeability in fragipan; slope.
ZcC3	Severe: slow permeability in fragipan; slope.	Moderate: high water table; slope.	Severe: slope	Moderate: high water table; slow permeability in fragipan; slope.

town and country planning—Continued

County and access roads	Streets and parking lots	Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Cemeteries
Slight	Moderate: slope	Severe: coarse fragments.	Moderate: coarse fragments.	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.	Moderate: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope; coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
Severe: flooding hazard.	Severe: flooding hazard.	Moderate: high water table.	Slight	Slight	Moderate: flooding hazard; high water table.
Severe: flooding hazard.	Severe: flooding hazard.	Severe: high water table.	Moderate: high water table; flooding hazard.	Moderate: high water table; flooding hazard.	Severe: high water table.
Severe: slope; bedrock at depth of 8 to 20 inches.	Severe: slope; bedrock at depth of 8 to 20 inches.	Severe: slope; coarse fragments; bedrock at depth of 8 to 20 inches.	Severe: slope; bedrock at depth of 8 to 20 inches.	Severe: slope; bedrock at depth of 8 to 20 inches.	Severe: slope; bedrock at depth of 8 to 20 inches.
Slight	Moderate: slope	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.	Severe: past erosion.	Severe: past erosion.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; past erosion.	Severe: slope; past erosion.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Moderate: slope	Severe: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.	Severe: past erosion.	Severe: past erosion.
Moderate: high water table.	Moderate: high water table; slope.	Moderate: high water table; slow permeability in fragipan; slope.	Slight	Slight	Moderate: high water table; slow permeability in fragipan.
Moderate: high water table; slope.	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: high water table; slow permeability in fragipan; slope.
Moderate: high water table; slope.	Severe: slope	Severe: slope	Moderate: slope	Severe: past erosion.	Severe: slope; past erosion.

The criteria used to rate the soils vary somewhat among the different uses related to town and country planning. The uses rated in table 7 are based on the following factors:

Septic tank filter field.—The ratings for this use are based on soil permeability, depth to seasonal water table, depth to bedrock, surface rockiness and stoniness, slope, and hazard of flooding. Possible pollution hazards to a water supply source are not a consideration here.

Building locations.—This use includes dwellings and service buildings limited to three stories or less that have basements and are located in areas less congested than in subdivisions. The ratings are based on depth to seasonal water table, depth to bedrock, slope, surface rockiness and stoniness, hazard of flooding, frost action, and shrink-swell potential. Slope is more restrictive for subdivision locations than for other areas.

Campsites (trailer and tent).—The ratings for this intensive use are based on depth to bedrock, permeability, depth to seasonal water table, surface rockiness and stoniness, texture of surface layer, and hazard of flooding. Slope is more restrictive for trailer parks than for tent areas.

County and access roads.—The ratings for county and access roads are for hard surface roads normally used for county and small town traffic. The ratings are based on depth to seasonal water table, slope, depth to rock, surface rockiness and stoniness, and hazard of flooding.

Streets and parking lots.—The ratings for streets and parking lots in subdivisions, where the slope is more restrictive than in open areas, are based on depth to seasonal water table, slope, depth to rock, surface rockiness and stoniness, and hazard of flooding.

Athletic fields.—The ratings for this intensive use are for sports such as baseball, football, and volleyball that normally require a nearly level area and are subject to heavy foot traffic. The ratings are based on depth to seasonal water table, soil permeability, slope, depth to bedrock, surface rockiness and stoniness, texture of the surface layer, and hazard of flooding.

Play and picnic areas.—These areas are subject to less intensive use than athletic fields. With the exception of soil permeability, which is not a consideration for this use, the same factors as for athletic fields apply but, for the most part, are less restrictive.

Lawns, landscaping, and golf fairways.—The soils are rated for these uses under the assumption that soil material at the site will be used; no importation of fill or topsoil is considered in the ratings. The soil factors to be considered are the same as those factors for athletic fields with the addition of the effects of past erosion on severely eroded soils.

Cemeteries.—These are community-type cemeteries. The soils are rated for this use under the assumption that soil material at the site will be used. No consideration is given to importation of fill or topsoil in the ratings. The soil factors to be considered are the same as those for athletic fields with the addition of the effects of past erosion.

Formation and Classification of the Soils

In this section the factors of soil formation and their relation to the soils in Grayson County are discussed. Then, the soil series are placed in higher categories of the current system of soil classification and in the great soil groups of the old system.

Formation of Soils

The characteristics of the soil at any given point depend on climate; on the physical and chemical composition of parent material; on relief; on plant and animal life; and on time. Soil is formed by the interaction of these five factors. The relative importance of each factor differs from one area to another. In some areas one factor may dominate in the formation of soil characteristics, and in other areas another factor may dominate. Climate and plant and animal life are not likely to vary much in an area the size of a county, but there may be many local differences in relief and parent material.

Since the interrelationships among the five factors are complex, the effects of any one factor are hard to determine. Following is a brief discussion of some ways that each of these factors have influenced the formation of soils in Grayson County.

Climate

Climate affects the physical, chemical, and biological relationships in the soil. It influences the kind and number of plants and animals, the weathering of rocks and minerals, erosion, and the rate of soil formation.

The soils of Grayson County formed in a temperate, moist climate. Since the soils were moist and subject to leaching during formation, many of the soluble bases have been largely leached out of the solum, and clay minerals have moved from the surface layer into the subsoil. As a result, many of the soils are acid and have a relatively high content of clay in the subsoil. Wellston and Crider soils are examples. Climate has been a relatively uniform factor within the county and accounts for only slight differences among the soils.

Parent material

Parent material is the unconsolidated mass in which a soil formed. The soils in Grayson County formed mostly in thin loess, in material weathered from rocks in place, and in alluvium washed from these kinds of soil and deposited along the streams. Most of the surface rock formations consist of siltstone, sandstone, shale, and limestone. Most gently sloping and sloping soils in Grayson County have 2 to 4 feet of loess (windblown silty material) over the residual parent material. Wellston and Crider soils are examples.

The chemical composition, the mineral content, and the texture of the soils in the county have been influenced greatly by the kind of parent material in which the soils formed. For example, Ramsey soils formed in material weathered mostly from sandstone and are coarser textured than Rarden soils, which formed in material weathered mostly from shale. Cuba and other alluvial soils have the same general composition as the surrounding soils on uplands, from which their parent material was derived.

Relief

The relief in Grayson County is varied. The maximum difference in elevation between the valleys and the adjacent hill crests generally is about 300 feet, but this dif-

ference is about 500 feet in a few places. Slopes range from nearly level to steep.

Most of the county consists of narrow to moderately broad, gently sloping to sloping ridgetops and strongly sloping to steep side slopes. From the ridgetops, little soil material is lost through erosion because much of the rain enters the soils and percolates downward through the solum. As a result, most soils on ridgetops are deep to bedrock and have well-defined horizons. Examples are the Zanesville and Sadler soils, which have a fragipan, and the Wellston soils, which do not.

Steep soils on side slopes are more likely to be shallow because much of the rainfall runs off instead of percolating through the soils. As a result, erosion has been rapid and leaching has been at a minimum. These soils, therefore, have weakly defined horizons and are shallow. Examples are the Weikert and Ramsey soils.

Relief modifies the effects of climate even though temperature and rainfall are about the same throughout the county.

Plant and animal life

The vegetation that grows during the period of soil formation influences the kind of soil that is formed. The native vegetation of Grayson County was mostly hardwood forest.

Soils that formed under forest vegetation, and were undisturbed during formation, have a thin, dark-colored surface layer and a leached, lighter colored subsurface layer. Examples of soils formed under forest vegetation are Wellston, Zanesville, and Crider. Soils that formed under grass normally have a thicker surface layer and contain more organic matter than soils that formed under forest. Burgin soils, which are inextensive in Grayson County, probably formed under grass or cane, or both.

The organisms that live in the soil serve an important function in soil formation by breaking down plant and animal residues. When these residues are broken down, minerals are released, and humus, which aids in the formation of soil structure, is formed.

Man has had some influence in the formation of soils. He will influence future soil development by such practices as cultivation, irrigation, drainage, introduction of new plants, and removal of part of the original surface layer.

Time

The effect of the active factors of soil formation—climate and living organisms—depends largely on the length of time the processes of soil formation have been in progress. Because of the influence of parent material and relief, this may be difficult to determine. If the influence of the active factors has been fairly uniform, the relative age of a soil can be determined by the degree of development of its genetic horizons. Soils that have little or no evidence of horizon development are considered to be young soils; those that have well-differentiated horizons are considered to be mature.

Nolin soils, which formed in alluvium recently deposited on flood plains, are examples of young soils. Allegheny soils, which formed in alluvium on stream terraces, are older soils and show some evidence of profile development. Zanesville and Sadler soils formed in 2 to 4 feet of loess and residuum on nearly level to sloping uplands. They have well-differentiated horizons and are considered to be more mature than the Allegheny soils.

Classification of Soils

Soils are classified so that we can more readily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation (*6*). First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific locations.

In classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*16*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*15*, *18*). Therefore, readers interested in developments of the current system should search the latest literature available. In this subsection some of the classes in the current system and the great soil groups in the older system are given for each soil series in table 8. The classes in the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates.

Table 8 shows the five soil orders in Grayson County—Ultisols, Inceptisols, Mollisols, Entisols, and Alfisols. Ultisols are soils that are highly developed but still contain some weatherable minerals. Inceptisols are soils that have weakly expressed horizons or the beginning of such horizons. Mollisols have a thick, soft, friable surface layer that has been darkened by organic matter. Alfisols have a clay-enriched B horizon that is high in base saturation. Entisols are recent mineral soils that do not have genetic horizons or have only the beginnings of such horizons.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Soil suborders are separated into great groups on basis of uniformity in the kinds and sequence of major horizons. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans interferring with growth of roots or movements of water. The features used are the self-

mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 8, because it is the last word in the name of the subgroup.

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Hapludults.

FAMILY: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils where used for engineering. Among the properties considered are tetxure, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. An example is fine-loamy, mixed, mesic family of Typic Hapludults.

SERIES: The series consists of a group of soil that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at State, regional and National levels of responsibility for soil classification results in a judgment that the new series should be established. Most of the soil series described in this publication have been established earlier. Two of the soil series used in this survey had tentative status when the survey was sent to the printer. They are the Sadler and Steff series.

Laboratory Analyses

Soil classification, to a great extent, is based on the relationship between the horizons and the specific soil characteristics that can be observed, inferred, or determined by close field examination. Also essential to the soil scientist in classifying soils are physical, chemical, and mineralogical data obtained from laboratory analyses. These data are given in tables 9 and 10. They support many field decisions that must be made for placement of soils at all categories of classification.

Laboratory data are used to estimate available moisture capacity, acidity, base-exchange capacity, mineralogical composition, organic-matter content, and other soil characteristics that affect management. These data are also used to develop concepts of soil formation.

In Grayson County, chemical and physical properties of the Sadler, Wellston, and Zanesville soils were determined by laboratory analyses.

The Sadler soil and the clayey subsoil variant of the Wellston soil sampled are representative examples of these soils as they were mapped in Grayson County. Their profile descriptions are given in the section "Descriptions of the Soils" in this soil survey. The Zanesville soil that was sampled differs from a typical profile of the series in not having a C horizon or sandy clay loam layer between the fragipan and bedrock. Following is a profile description of the Zanesville soil that was sampled.

TABLE 8.—*Soil series classified according to the current system of classification and the revised 1938 system*

Series	Current classification			Great soil group of the 1938 classification
	Family	Subgroup	Order	
Allegheny	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Baxter	Clayey, mixed, mesic	Typic Paleudults	Ultisols	Red-Yellow Podzolic soils.
Bonnie	Fine-silty, mixed, acid, mesic	Typic Fluvaquents	Entisols	Low-Humic Gley soils.
Burgin	Fine, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols	Humic Gley soils.
Caneyville	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic soils. intergrading to Lithosols.
Captina	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils that have a fragipan.
Christian	Clayey, kaolinitic, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Clifty	Fine-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Crider	Fine-silty, mixed, mesic	Typic Paleudalfs	Alfisols	Red-Yellow Podzolic soils intergrading to Reddish-Brown Lateritic soils.
Cuba	Fine-silty, mixed, mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown soils intergrading to Red-Yellow Podzolic soils.
Johnsburg	Fine-silty, mixed, mesic	Aquic Fragiudults	Ultisols	Planosols that have a fragipan.
Lindside	Fine-silty, mixed, mesic	Aquic Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Mercer	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols	Red-Yellow Podzolic soils.
Newark	Fine-silty, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols	Alluvial soils integrating to Low-Humic Gley soils.
Nolin	Fine-silty, mixed, mesic	Dystric Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.

TABLE 8.—*Soil series classified according to the current system of classification and the revised 1938 system*—Continued

Series	Current classification			Great soil group of the 1938 classification
	Family	Subgroup	Order	
Ramsey	Loamy, siliceous, mesic	Lithic Dystrochrepts	Inceptisols	Lithosols intergrading to Sols Bruns Acides.
Rarden [1]	Clayey, mixed, mesic	Aquic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Sadler [2]	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols	Red-Yellow Podzolic soils that have a fragipan.
Shelocta	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Steff [2]	Fine-silty, mixed, mesic	Aquic Fluventic Dystrochrepts.	Inceptisols	Alluvial soils.
Stendal	Fine-silty, mixed, acid, mesic	Aeric Fluvaquents	Entisols	Alluvial soils intergrading to Low-Humic Gley soils.
Weikert	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols	Lithosols intergrading to Sols Bruns Acides.
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils.
Zanesville	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils that have a fragipan.

[1] The Rarden soils in this survey area are taxadjuncts to the series. They are outside of the defined range for the series in that the upper 24 inches of the clay-enriched horizon contains no mottles that have chromas of 2 or less.

[2] At the time this survey was sent to the printer, the Sadler and Steff series were tentative.

Zanesville silt loam

Classification: Typic Fragiudult, fine-silty, mixed, mesic.
Soil sample No.: S63Ky43–9.
Location: 2 miles south of Caneyville.
Slope: 2 percent.

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many fine roots; few, very small, dark-brown concretions; slightly acid; abrupt, smooth boundary.

B1t—7 to 11 inches, brown (7.5YR 4/4) silt loam that has few, fine, faint variegations of dark yellowish brown (10YR 4/4); weak, medium, subangular blocky structure; friable, slightly sticky; common roots; few faint clay films; few, small, black concretions; very strongly acid; clear, wavy boundary.

B21t—11 to 18 inches, brown (7.5YR 4/4) heavy silt loam; moderate, medium, subangular blocky structure; slightly firm; common roots; common fine and medium pores; few reddish-brown clay films; very strongly acid; clear, wavy boundary.

B22—18 to 24 inches, strong-brown (7.5YR 5/6) to yellowish-brown (10YR 5/6) silt loam that has few, fine, faint mottles of light yellowish brown (2.5Y 6/4) and brown (7.5YR 4/4); weak, coarse, prismatic structure that breaks to weak, thick, platy and medium, angular blocky structure; firm; common, small, very dark brown concretions; few, pale-brown silt coatings on vertical surfaces of peds; very strongly acid; clear, wavy boundary.

IIBx1—24 to 36 inches, yellowish-brown (10YR 5/4) silt loam that has common, medium, distinct mottles of light brownish gray (10YR 6/2) and brown (7.5YR 4/4); weak, medium, angular blocky structure; compact and brittle; common pores; several tongues of gray silty clay loam flows (2 inches in diameter and smaller) extend through the horizon; about 5 percent, by volume, small sandstone fragments (5 to 20 millimeters in size); many, small, black concretions; very strongly acid; gradual, smooth boundary.

IIBx2—36 to 48 inches, mottled yellowish-brown (10YR 5/6), light brownish-gray (2.5Y 6/2), gray (10YR 5/1), and strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium, angular blocky structure; compact and brittle; noticeable clay films along ped surfaces; several gray silty clay loam tongues (1 inch or less in diameter) extend through horizon; about 5 percent, by volume, small rounded sandstone fragments (¼ to 1 inch in size); very strongly acid.

R—48 inches +, sandstone bedrock.

Laboratory Methods

Particle-size distribution was determined by the pipette method (*19*). The reaction was determined by using the glass electrode and a soil-water ratio and a soil-one normal KCl ratio of 1:1. Organic carbon was determined by wet combustion, using a modification of the Walkley-Black method. A 77 percent recover factor was used (*19*). Bulk density measurements were made on natural soil clods (*19*). Water retention measurements at 1/3 atmosphere of tension were made on natural clods with pressure plate equipment (*19*). Water retention at 15 atmospheres was determined on sieved samples with pressure-membrane apparatus (*19*).

The cation exchange capacity was calculated by summation of extractable cations. The extractable calcium was determined by a calcium oxalate precipitation and a cerate titration procedure. Magnesium was determined by precipitation as magnesium ammonium phosphate (*19*). Extractable sodium and potassium were determined with a Beckman DU flame spectophotometer. The barium chloride-triethanolamine method was used to determine extractable hydrogen (*19*). Extractable aluminum was determined by leaching the soil with one normal KCl and aluminum determined by KF titration (*19*).

The percent of base saturation was determined by dividing the sum of the extractable calcium (Ca), magnesium (Mg), sodium (Na), and potassium (K), by the cation exchange capacity, and multiplying by 100.

TABLE 9.—*Chemical and physical*

[Analysis by the Soil Survey Laboratory, Soil Conservation Service, Beltsville, Md. Dashes in columns

Soil	Horizon	Depth	Coarse fragments (>2 mm.)	Particle-size distribution							USDA textural class
				Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
Sadler silt loam.	Ap	0–7	(1)	0.5	1.0	0.7	2.2	10.4	72.9	12.3	Silt loam
Location: 2 miles south of Caneyville.	B1	7–13	(1)	.3	1.0	.6	1.1	6.9	68.2	21.9	Silt loam
	B2t	13–20	(1)	.1	.6	.5	.6	7.6	68.6	22.0	Silt loam
Laboratory No.: S63Ky43–13.	A'2	20–24	(1)	.2	.9	.6	1.1	8.5	68.5	20.2	Silt loam
	IIBx1	24–38	(1)	.1	.2	.2	1.8	18.4	58.3	21.0	Silt loam
	IIBx2	38–48	(1)	.4	.2	.2	1.9	20.9	57.0	19.4	Silt loam
	IIB3t	48–62	(1)	.1	.1	.2	1.4	21.0	49.8	27.4	Clay loam
	IIC1	62–76	(1)	.1	.1	.2	1.3	34.0	37.9	26.4	Loam
Wellston silt loam, clayey subsoil variant.	Ap2	1–8	5	1.3	.9	.4	1.2	5.7	70.7	19.8	Silt loam
	B1	8–12	(1)	.8	.6	.3	.9	3.2	65.9	28.3	Silty clay loam.
Location: 2 miles south of Caneyville.	B21t	12–22	4	.8	.6	.3	.6	2.0	65.2	30.5	Silty clay loam.
	IIB22tb	22–33	8	2.1	1.5	.6	1.0	1.9	43.5	49.4	Silty clay
Laboratory No.: S63Ky43–12.	IIB23tb	33–44	2	1.5	1.2	.5	.8	1.6	40.6	53.8	Silty clay
	IIB3b	44–51	2	1.7	1.8	.8	1.2	2.3	50.0	42.2	Silty clay
	IIC	51–70	(1)	2.1	2.2	.8	1.5	2.0	52.2	39.2	Silty clay loam.
Zanesville silt loam.	Ap	0–7	(1)	.4	.8	.6	.8	4.0	78.6	14.8	Silt loam
Location: 2 miles south of Caneyville.	B1t	7–11	1	.3	.6	.4	.4	2.4	70.4	25.5	Silt loam
	B21t	11–18	(1)	.3	.6	.4	.5	2.0	70.0	26.2	Silt loam
Laboratory No.: S63Ky43–9.	B22	18–24	(1)	.3	.4	.3	.7	3.0	71.8	23.5	Silt loam
	IIBx1	24–36	4	1.3	.7	.3	1.6	9.7	65.4	21.0	Silt loam
	IIBx2	36–48	16	1.6	1.1	.4	2.4	12.4	57.0	25.1	Silt loam

[1] Trace.

Linear extensibility is a measure of the change in dimension of a natural soil clod on going from a dry to a moist state. It is estimated from the laboratory bulk density data and the coarse fragment conversion factor *Cm* (*19*).

In table 10, clay mineralogy was determined by differential thermal analysis (*8*), and by X-ray diffraction using a Norelco diffractometer, FeK_a radiation, scanning speed of 1 degree per minute, with samples oriented on glass slides. Slides of magnesium saturated, ethylene glycol solvated clays, and potassium-saturated clays were scanned without heating. The latter were subsequently scanned after heating to 100° C., 250° C., and 500° C.

Relative amounts of montmorillonite, vermiculite, and mica were estimated from areas enclosed by first-order X-ray diffraction peaks of basal spacings. Amounts of kaolinite were estimated by differential thermal analysis from the size of the respective endothermic peaks, as compared to known standards.

Interpretations of Laboratory Data [7]

The Wellston, Zanesville, and Sadler soils developed in thin loess and residuum from sandstone, siltstone, and shale. The laboratory data indicates a lithologic discontinuity in each profile. This break is at a depth of 22 inches in the Wellston soils and 24 inches in the Zanesville and the Sadler soils. The horizons above these depths contain more silt than horizons below them.

Further evidence of the lithologic discontinuity in the Wellston soil is indicated by the higher clay content. The lithologic discontinuity is evident in the Zanesville soil by the increase in coarse fragments and sand. The abrupt change of clay mineralogy at a depth of 24 inches in the Sadler soil also indicates a discontinuity.

These soils have well-developed soil horizons, which indicate a long period of soil formation. The loess may have been calcareous or at least high in bases at the time it was deposited. Most of the bases have been leached from the upper part of the solum and have been replaced by hydrogen. This results in low base saturation and very strongly acid reaction. Some of the leached bases may have been absorbed on the clay in the lower horizons. The greater amount of exchangeable calcium in the surface horizons of the Zanesville and Sadler soils probably is the result of liming.

The B horizons contain more clay than the A horizons, partly because of translocation of clay. This fact supports observations made in the field that some of the B horizons have clay films on the ped surfaces and in soil pores.

[7] FRANK R. COX, Jr., soil scientist, Soil Conservation Service, helped in writing these interpretations.

characteristics of three representative soils

indicate that the characteristic was not determined. The symbol < means less than; > means more than]

Reaction		Organic carbon	Extractable iron as Fe	Water content		Extractable cations (milliequivalents per 100 grams of soil)					Cation exchange capacity (sum)	Base saturation	Extractable aluminum (Al)	Bulk density		Linear extensibility	Water retention difference
KCl	Water			Tension at ⅓ atmosphere	Tension at 15 atmospheres	Ca	Mg	Na	K	H				Tension of ⅓ atmosphere	Oven-dry		
pH	*pH*	*Percent*	*Percent*	*Percent*	*Percent*						*Meq./100 gm.*	*Percent*	*Meq./100 gm.*	*Gm./cc.*	*Gm./cc.*	*Percent*	*Inches per inch of soil*
5.7	6.5	0.78	1.3	19.5	4.9	6.4	0.4	(1)	0.1	2.7	9.6	72	0	1.57	1.60	0.6	0.23
3.6	4.8	.25	1.9	23.0	9.0	1.7	1.3	0.1	.1	9.0	12.2	26	3.3	1.48	1.54	1.3	.21
3.4	4.7	.14	2.0	24.2	9.6	8	1.6	.1	.2	10.9	13.6	20	4.9	1.35	1.46	2.6	.20
3.4	4.6	.11	1.8	--------	8.3	.4	1.7	.1	.1	9.9	12.2	19	5.2	--------	------	1.6	.14
3.0	4.7	.08	1.3	18.1	9.4	.3	2.5	.2	.1	9.9	13.0	24	6.9	1.60	1.68	1.0	.14
3.1	4.6	.06	1.3	16.6	8.3	.5	2.7	.2	.1	7.8	11.3	31	5.2	1.71	1.76	1.6	.11
3.1	4.7	.06	1.9	18.6	11.7	1.2	5.5	.4	.1	8.0	15.2	47	4.9	1.64	1.72	------	--------
3.0	4.8	.06	1.7	--------	11.5	1.7	6.4	.4	.1	5.9	14.5	59	2.2	--------	------	------	--------
3.8	4.6	1.08	1.7	23.8	7.3	.5	.7	.1	.1	9.9	11.3	12	2.0	1.38	1.43	1.2	.22
3.5	4.6	.38	2.1	22.7	10.7	.5	1.3	(1)	.1	10.5	12.4	15	4.0	1.50	1.58	1.7	.18
3.4	4.6	.27	2.8	22.8	13.5	1.0	2.1	(1)	.2	12.0	15.3	22	5.6	1.56	1.68	2.4	.14
3.2	4.6	.19	4.2	25.2	17.2	.9	3.6	.1	.2	16.7	21.5	22	10.1	1.54	1.66	2.4	.12
3.3	4.7	.15	4.0	27.5	20.2	1.0	4.6	.1	.2	19.5	25.4	23	12.7	1.50	1.69	4.0	.11
3.2	4.5	.12	3.1	24.3	17.3	1.4	5.8	.2	.2	16.5	24.1	32	8.4	1.56	1.80	4.8	.11
3.0	4.5	.08	3.1	22.6	15.6	2.3	7.5	.2	.2	13.8	24.0	42	5.7	1.62	1.88	5.1	.11
5.1	5.9	1.18	1.1	21.8	5.5	5.4	.5	.1	.1	3.5	9.6	64	0	1.40	1.44	.9	.23
3.7	4.9	.42	2.0	22.2	9.5	2.9	1.4	(1)	.2	7.6	12.1	37	1.4	1.45	1.52	1.5	.18
3.5	4.4	.23	2.3	25.6	10.7	1.3	1.8	.1	.2	11.2	14.6	23	4.6	1.42	1.51	2.1	.21
3.4	4.7	.04	2.5	26.6	10.5	.6	2.2	.2	.2	11.8	15.0	21	6.0	1.44	1.50	1.4	.23
3.3	4.7	.09	2.0	18.8	9.0	.6	2.6	.3	.2	10.4	14.1	26	5.6	1.74	1.80	1.1	.16
3.1	4.7	.07	2.7	17.3	9.4	.6	3.2	.3	.1	10.4	14.6	29	6.2	1.72	1.76	.7	.12

Most of the clay, however, especially that in the lower part of the B horizon and in the C horizon, is from the parent material.

The fragipan in the Zanesville and Sadler soils has higher bulk density and lower moisture-holding capacity than the horizons above the fragipan. This is caused by the closer packing of the soil particles and less pore space in the fragipan. The fragipan, therefore, is less favorable for root growth and moisture movement.

The laboratory data confirm the field classification of these soils.

The mineral composition of selected horizons of these three soils is given in table 10.

The presence of weatherable minerals and minerals that are resistant to weathering in the coarse silt indicates that these soils are in an intermediate stage of weathering.

These soils have some properties that make them satisfactory for farming. They contain enough clay to have a good capacity for holding plant nutrients, but the soils are very strongly acid and liming is necessary for good crop growth. Because of the high content of silt in the surface horizons, the plow layer is friable and can be easily tilled.

General Nature of the County

This section provides general information about Grayson County. It briefly describes the climate; history and development; physiography, geology, relief, and drainage; natural resources; and farming of the county.

Climate [8]

The climate of Grayson County is temperate and is favorable for many kinds of plants and animals. Summers are warm and humid, and winters are moderately cold. Distinct wet and dry seasons do not occur, for precipitation is fairly well distributed throughout the year.

All seasons are marked by weather changes that come from passing weather fronts and associated centers of high and low pressure. This activity is least late in spring and in summer, is somewhat greater in fall, and is greatest in winter and early in spring. Day-to-day temperatures de-

[8] By ALLEN B. ELAM, Jr., climatologist for Kentucky, National Weather Service, U.S. Department of Commerce.

part least from the average during the period of minimum activity, and they vary most during the period of greatest activity.

Data on temperature and precipitation are given in table 11. The probabilities of freezing temperatures after specified dates in spring and before specified dates in fall are given in table 12. In 2 years out of 10, temperature of 98°F. or higher occurs on at least 4 days in July, but not necessarily on consecutive days. The average length of the growing season is about 195 days. At the other extreme, a temperature of 9° or lower will occur on at least 4 days in January in 2 years out of 10.

In winter, a daily freeze-thaw cycle is normal. A temperature of 32° or lower occurs on an average of about 85 nights during the winter, but on all but about 11 of the 85 days, the temperature rises to above freezing during the day. The temperature drops to zero or below on an average of once each winter.

Ordinarily, the supply of moisture is ample throughout the year, but in some years there are periods of inadequate or excessive precipitation. Thunderstorms occur on an average of about 50 days a year and are most frequent from March through August.

At some time during almost every year, at least 1.2 inches of rain will fall in a 1-hour period. The chance is 30 percent that this will happen in July, and it is less than 1 percent that it will happen in December, January, or February. Once in 10 years, most commonly in July, at least 4.6 inches of rain can be expected in a 24-hour period.

The average yearly snowfall at Leitchfield is about 10 inches. During the period 1931–60 the greatest annual snowfall occurred in 1960 and was about 44 inches. The least snowfall recorded occurred in 1959 and was 0.6 inch.

The county has a favorable and moderate climate. Fall has many mild, sunny days and is considered a good season for outdoor activities.

History and Development

Grayson County was established in 1810 from lands taken from the western part of Hardin County and the eastern part of Ohio County. It was named in honor of Colonel William Grayson, a revolutionary soldier and statesman from Virginia.[9] Leitchfield, the county seat, was incorporated by the State legislature in 1866.

Through the years farming has been the main source of income for Grayson County, but in recent years light industries have located in the county. These industries include a cheese plant, concrete products plant, clothing factory, electronics plant, fertilizer blending plant, and a beehive plant. Local employment is approximately 800

[9] Taken from unpublished 453-page "History of Grayson County," prepared by DUVALL MORRISON, Caneyville, Kentucky.

TABLE 10.—*Mineral composition of selected horizons of some representative soils*

[The analyses were made by the Soil Survey Laboratory, Soil Conservation Service, Beltsville, Maryland. In some places the amount of minerals is given in percent; in other places the amount is indicated as X, small; XX, moderate; XXX, large; XXXX, dominant; and Tr, trace. Dashed lines indicate that the mineral was not detected or that tests were not made]

Soil	Horizon	Depth	Clay fraction analysis						Coarse silt (20–50 microns)	
			Montmorillonite	Vermiculite	Mica	Interstratified vermiculite and mica	Quartz	Kaolinite	Resistant minerals	Weatherable minerals
		Inches						*Percent*	*Percent*	*Percent*
Sadler silt loam.	Ap	0–7	----	XX	Tr	----	Tr	5	48	52
Location: 2 miles south of Caneyville.	B2t	13–20	----	XXX	Tr	----	Tr	8	----	----
Laboratory No.: S63Ky43–13.	A'2	20–24	X	X	Tr	----	Tr	5	----	----
	IIBx1	24–38	XXX	Tr	----	----	Tr	15	49	51
	IIB3	48–62	XXX	----	----	----	Tr	15	48	52
	IIC1	62–76	XXX	----	----	----	Tr	20	----	----
Wellston silt loam, clayey subsoil variant.	Ap2	1–8	----	XX	X	X	Tr	10	----	----
Location: 2 miles south of Caneyville.	B21t	12–22	----	XX	X	X	Tr	15	57	43
Laboratory No.: S63Ky43–12.	IIB22tb	22–33	----	XX	X	X	Tr	15	55	45
	IIC1	51–70	----	XX	X	X	Tr	20	----	----
Zanesville silt loam.	Ap	0–7	----	XX	Tr	----	X	5	----	----
Location: 2 miles south of Caneyville.	B21t	11–18	----	XXX	X	----	X	5	64	36
Laboratory No.: S63Ky43–9.	IIBx1	24–36	----	XXXX	Tr	----	Tr	10	55	45

TABLE 11.—*Temperature and preciptation*[1]

[Data from records of National Weather Service at Leitchfield, Kentucky]

Month	Temperature				Precipitation			
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Days with 1.0 inch or more of snow
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Number*
January	46	28	64	9	5.3	1.3	9.9	4
February	49	29	65	12	4.0	1.1	7.7	3
March	57	36	75	20	5.1	2.3	8.5	1
April	69	46	83	32	4.2	2.1	6.6	0
May	78	54	89	41	4.1	1.4	7.8	0
June	86	63	95	53	4.5	1.7	8.0	0
July	89	66	98	57	4.1	1.2	7.1	0
August	88	65	97	55	3.4	1.2	6.1	0
September	83	58	95	45	3.0	.9	5.4	0
October	72	47	85	34	2.7	1.3	4.3	0
November	57	36	73	22	3.9	1.4	6.9	1
December	47	30	64	13	4.0	1.8	6.2	3

[1] Record for period 1931–60.

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data from records of National Weather Service, at Leitchfield, Kentucky]

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 19	March 24	April 6	April 16	April 29
2 years in 10 later than	March 11	March 17	March 31	April 10	April 24
5 years in 10 later than	February 25	March 5	March 19	March 30	April 14
Fall:					
1 year in 10 earlier than	November 25	November 15	November 3	October 23	October 10
2 years in 10 earlier than	November 30	November 21	November 9	October 28	October 15
5 years in 10 earlier than	December 10	December 1	November 19	November 6	October 25

persons. Many residents commute daily to work in Louisville, Fort Knox, and Brandenburg.

Grayson County is served by the Illinois Central Railroad, the Western Kentucky Parkway (toll), U.S. Highway No. 62, several State highways, and many county roads. Five trucking firms serve the county, and two buslines provide transportation for the residents.

The county has two large flood-control reservoirs. These are Rough River Reservoir in the northern part of the county and Nolin River Reservoir in the southeastern part. These two lakes provide excellent recreational facilities for the area and are increasing the business of merchants.

The population of Grayson County was 2,301 in 1810. By 1900, population had increased to 19,878, but it had decreased by 1930 to 17,055 and to 15,834 by 1960. This decrease is attributed to the lack of enough industry in the county to provide adequate jobs for the residents, and the trend toward larger more mechanized farms.

Physiography, Geology, Relief, and Drainage

Grayson County is in the Western Coal Field and the Pennyroyal physiographic areas. The Western Coal Field is generally in the southwestern one-third of the county, and the Pennyroyal physiographic area is in the northeastern two-thirds. The exposed rocks in the Western Coal Field are of Pennsylvanian age and dominantly are siltstone, sandstone, and shale. Exposed rocks in the Pennyroyal area are of Mississippian age and are interbedded

siltstone, sandstone, shale, and limestone. Both areas generally have about 2 to 4 feet of loess on the ridgetops.

Weikert, Gilpin, Wellston, Zanesville, and Sadler soils are common to both the Western Coal Field and the Pennyroyal areas (fig. 14). In the Western Coal Field, these soils are underlain by the Tradewater and Caseyville For mations. Many formations are at or near the surface in the Pennyroyal area, but dominant under these soils are the Hardinsburg Sandstone and the Big Clifty Sandstone, which are members of the Golconda formation.

Several faults are in the county. Rough Creek fault is the most prominent one. It extends from the Ohio County line in the northwest through an area called the sinks, a karst area near Short Creek, Kentucky, to Grayson Springs in the east-central part of the county. Most of the faulted area is in the Caneyville-Weikert-Zanesville soil association. Common rock formations at or near the surface in the faulted areas are the Glen Dean Limestone, Reelsville Limestone, and Haney Limestone, which are members of the Golconda Formation. Caneyville, Christian, and Mercer soils overlie these formations.

Grayson County ranges from nearly level to steep in relief, but about 48 percent of the county is gently sloping to sloping. Soils of the flood plains make up about 6 percent of the county. The highest elevation in the county is approximately 963 feet above sea level, at Buzzard Ridge, about 3½ miles southwest of Millerstown and 1½ miles west of State Route 479. The lowest elevation in the county is approximately 410 feet above sea level at the site where Rough River enters Ohio County.

Grayson County is drained by the Rough River and its tributaries on the northern boundary, by the Nolin River and its tributaries on the southeastern boundary, and by Bear Creek and its tributaries in the south-central part of the county. The water from these three major watersheds flows into Green River.

Figure 14.—A road cut along Western Kentucky Parkway that shows distinct layers of sandstone and shale capped with loess. These kinds of parent material and rock strata normally underlie the Zanesville, Wellston, Gilpin, and Weikert soils in the Western Coal Field.

Natural Resources

One of the greatest natural resources in Grayson County is timber, because approximately 35 percent of the total land area is wooded.

Two limestone quarries operate near Leitchfield and supply limestone for farming, industry, and roadbuilding. In some areas of the county, there are deposits of rock asphalt that have been used in surfacing roads. Also in the county are clay deposits suitable for making common brick and sewer pipe. If sufficient quantities are located, these deposits may have considerable commercial value. Quantitative data on these deposits are not available.

Thin seams of coal are in some areas of the county. A few small mines have operated since 1948, but there has been no large commercial production. A few small oil wells have been drilled since 1956. A low-pressure natural gasfield near Shrewsbury has been providing the gas supply for Leitchfield for a number of years.

Both surface and ground water are used for public and industrial supplies. A new water system is under construction to provide water for Leitchfield and Clarkson from Rough River Reservoir. A water system has recently been completed at Caneyville to provide water from a multiple-purpose floodwater retarding structure. Drilled wells provide water for most rural homes. In most areas wells have to be drilled more than 100 feet deep to reach a water supply adequate for home use.

Farming

For many years much of the income in Grayson County has come from the sale of farm products. According to the U.S. Census of Agriculture, of all farm products sold in 1964, 56 percent was from livestock and livestock products and the remaining 44 percent was from crops.

In the early days corn was the most important crop. In 1919, 57,445 acres of corn were grown. This decreased to 13,079 acres by 1964. Total acres of cropland has steadily decreased since 1950. Much of this acreage has been converted to pasture and hayland. Burley tobacco is the most important cash crop grown (fig. 15). In 1964, 1,604 acres were harvested and the average yield was 2,031 pounds per acre.

The number of beef cattle has gradually increased in recent years. Hog production has remained steady. Several moderate-sized dairy farms are in the county. The poultry produced has declined sharply in recent years.

In 1964, there were 1,549 farms in Grayson County; the average-sized farm was 126 acres. The size of farms has gradually increased since 1937. Many small farms in the rough, hilly section of the county have been abandoned. Broomsedge, blackberry briers, persimmon, and weeds soon start to grow in these areas, but many of these areas eventually revert to woodland through natural revegetation.

Figure 15.—**Harvesting burley tobacco grown on the contour on Zanesville silt loam, 2 to 6 percent slopes. This is the most important cash crop grown in the county.**

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Glossary

Acidity. See Reaction, soil.

Alluvium. Fine material, such as sand, silt, or clay, that has been deposited on land by streams.

Available moisture capacity. The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

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

Bottom land. Nearly level land on the bottom of a valley that has a stream flowing through it. Subject to flooding and often referred to as a flood plain.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Also called clay coat, clay skin.

Concretion. Hard grains, pellets, or nodules, of various sizes, shapes, and colors, consisting of concentrations of compounds that cement the soil grains together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.
Friable.—When moist, crushes easily under gentle to moderate 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, is 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; tends to stretch somewhat and pull apart, rather than to pull free from other material.
Hard.—When dry, is 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.—Is hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Diversion. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage, surface. Runoff, or surface flow, of water from an area.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Fertility, soil. The quality that enables a soil to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as moisture, light, temperature, and the physical condition (or tilth) of the soils, are favorable.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A dense brittle subsurface horizon very low in organic matter and clay but rich in silt or very fine sand. The layer seems to be cemented when it is dry, is hard or very hard, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick, and they generally occur in the lower part of the B horizon, 15 to 40 inches below the surface.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and it is therefore characterized by the accumulation of humus. The horizon may have lost one or more soluble salts, clay, and sesquioxides (iron and aluminum oxides).
B horizon.—The mineral horizon below an A horizon. The B horizon is characterized by (1) the accumulation of clay, sesquioxides, humus, or some combination of these; (2) a prismatic or blocky structure; (3) redder or stronger colors than the A horizon; or (4) some combination of these. The combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.
C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numberal precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath the A and B horizons.

Karst topography. Topography peculiar to an area underlain by limestone where underground solution and underground streams have caused many depressions, or sinkholes, and caves.

Leaching. The removal of soluble materials from soils or other materials by percolating water.

Loess. A fine-grained eolian deposit consisting dominantly of silt-sized particles.

Minimum tillage. Limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage.

Morphology, soil. The makeup of the soil, including the texture, structure, consistence, color, and other physical, mineralogical, and biological properties of the various horizons of the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Mulch planting. Planting row crops in grass, stubble, or crop residue without prior seedbed preparation, and performing subsequent operations in a manner that will keep protective amounts of residue on or near the surface of the soil during the growing season.

Natural drainage. The moisture conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channel or the blocking of drainage outlets. Seven different classes of natural drainage are recognized:

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.
Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.
Well-drained soils are nearly free from mottling and are commonly of intermediate texture.
Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and C horizons.
Somewhat poorly drained soils are wet for significant periods, but not all the time and, in Podzolic soils commonly have mottlings below a depth of 6 to 16 inches, in the lower A horizon and in the B and C horizons.
Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.
Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray; with or without mottling, in deeper parts of the profile.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Parent material. The disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Permissible soil loss. The maximum average annual soil loss in tons per acre from soil that will not cause deterioration of the soil or lower its ability to grow plants.

Plow layer. The soil ordinarily moved in tillage; equivalent to surface soil.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. In words, the degrees of acidity or alkalinity are expressed thus:

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

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residuum is not soil but is frequently the material in which a soil has formed.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Root zone. The part of the soil that is penetrated, or can be penetrated by plant roots. Terms used to indicate the depth of the root zone in this soil survey are: *Very shallow*, less than 10 inches; *shallow*, 10 to 20 inches; *moderately deep*, 20 to 30 inches; and *deep*, 30 inches or more.

Runoff. See Drainage, surface.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and no more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by hardening of clay deposits.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope, gradient. Terms used in this survey to describe the range of slopes are: *nearly level*, 0 to 2 percent; *gently sloping*, 2 to 6 percent; *sloping*, 6 to 12 percent; *strongly sloping*, 12 to 20 percent; *moderately steep*, 20 to 30 percent; *steep*, 30 to 50 percent; and *very steep*, more than 50 percent.

Soil. The natural medium for the growth of land plants on the surface of the earth; it is composed of organic and mineral materials.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The material of the solum in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, to serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. Structureless soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer lying below the solum or true soil, the C or R horizon.

Surface soil. The soil ordinarily moved in tillage or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (constructed). An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). A flat or gently undulating old alluvial plain bordering a stream valley, river, lake, or the sea. Elevation is intermediate between the flood plain and the upland.

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 as follows: Sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland. Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Variegation. Contrasting color patches that vary in number and size; assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

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