United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Iowa Agriculture and
Home Economics
Experiment Station;
Cooperative Extension
Service, Iowa State
University; and Division of
Soil Conservation, Iowa
Department of Agriculture
and Land Stewardship

Soil Survey of Taylor County, Iowa

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How To Use This Soil Survey

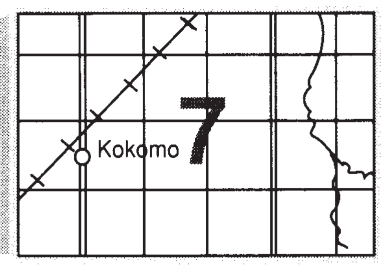
General Soil Map

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

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

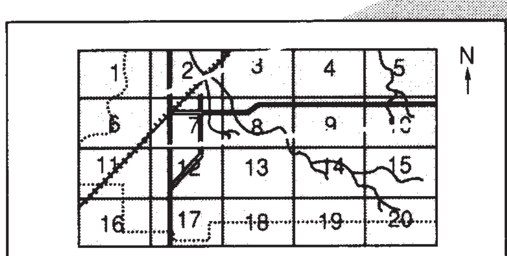
Detailed Soil Maps

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



MAP SHEET

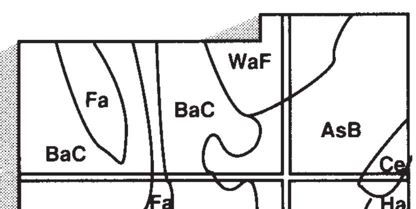
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

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

MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Natural Resources Conservation Service and the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. It is part of the technical assistance furnished to the Taylor County Soil Conservation District. Additional funding was provided by Taylor County.

Cover: A typical landscape in Taylor County. The beef cattle are grazing in an area of improved pasture. The corn and soybeans in the background are commonly grown in rotation. Areas in drainageways are typically used for hay. These soils are in an area of the Sharpsburg-Nira-Macksburg association.

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Issued July 1996

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Preface

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

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

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

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

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Soil Survey of Taylor County, Iowa

By Louis E. Boeckman, Natural Resources Conservation Service

Fieldwork by Louis E. Boeckman, Charles E. Branham, Bennie Clark, Jr., Stephen J. Ernst, James M. Gertsma, Robert D. Logar, and Mark S. Wespetal, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

TAYLOR COUNTY is in the south-central part of Iowa (fig. 1). It has an area of 337,920 acres, or 528 square miles. Bedford, the county seat, is in the center of the county, about 120 miles south and west of Des Moines.

This survey updates the soil survey of Taylor County published in 1954 (Scholtes and others, 1954). It provides additional information and has larger maps, which show the soils in greater detail.

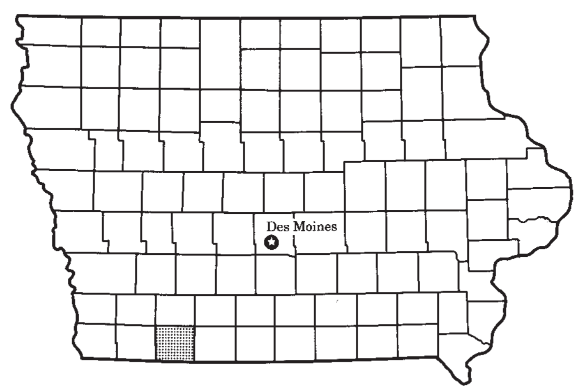

Figure 1.—Location of Taylor County in Iowa.

General Nature of the County

This section provides some general information about Taylor County. It describes transportation facilities, industry and recreation, history and development, relief and drainage, natural resources, farming, and climate.

Transportation Facilities

Three major highways serve Taylor County. State Highway 2 runs east and west, and State Highway 148 runs north and south. Both highways intersect at Bedford in the south-central part of the county. State Highway 49 runs from the northeastern part of the county and intersects State Highway 2 and State Highway 148 at Bedford. The county is bordered on the east by State Highway 25, which is oriented north and south. These routes are connected to all parts of the county by concrete or crushed rock roads.

Most farmsteads are on all-weather roads. Scheduled airline transportation is available at Des Moines and Council Bluffs, which are within 100 miles of the county. There are small municipal airports at Lenox and Bedford. Motor freight lines serve every trading center in the county.

Industry and Recreation

The county is primarily rural and has only minor industries. An egg processing plant is located in Lenox.

Several towns have grain elevators for the storage of grain. Livestock auction markets or buying stations are in several towns.

Most towns have a local park. A few county parks are throughout the county. Lake of Three Fires State Park is near Bedford.

In rural areas, hunting, fishing, and other forms of outdoor recreation are provided by rivers, creeks, and numerous small ponds. Catfish and bullheads are commonly caught in the creeks and rivers. Bass and other pondfish are generally stocked in small ponds. The abundant cover and food source provide for excellent bobwhite quail and ringneck pheasant hunting. Taylor County supports many kinds of wildlife that contribute to its recreational facilities and to its economy. White-tailed deer are plentiful and are hunted throughout the county.

History and Development

The survey area was originally occupied by the Sac, Fox, and Pottawattamie Indians. The area was ceded to the United States Government in 1842. The county was named after Zachary Taylor, who was a famous general in the war with Mexico. The early settlers came mostly from the southern states. The organization of Taylor County began in the 1840's. The area was divided into the present 16 townships in 1851. In 1853, the county seat was established in Bedford (Andreas; Taylor County Historical Society; Creston, 1910).

In 1851, the population in the county was 393. It had increased to 6,989 by 1870 and reached a high of 18,784 in 1900. The population growth was on farms, not in the towns. The railroads were responsible for the rapid growth in population. Two major lines came through Taylor County, and small towns formed and grew rapidly. Agriculture was the main industry. Most of the businesses established in the county were developed with the farming community in mind.

The county's population decreased from 12,420 in 1950 to 8,255 in 1980. Bedford is the largest city in the county. It has a population of 1,733. Lenox, the second largest city, has a population of 1,215.

As the population increased prior to 1950, settlements were made on the prairie lands and raising grain and feeding livestock became the principal farming practices. Corn, hay and forage, wheat, and oats were the main crops. Except for wheat, these crops were grown principally for subsistence and only the surplus was sold. In 1950, 80,612 acres was planted to corn. Livestock feeding was also an important industry. In 1950, 44,167 head of cattle and 90,151 hogs were sold or slaughtered on farms in Taylor County (Skow and Halley, 1984).

Relief and Drainage

The original topography of the survey area was that of a loess-covered glacial drift plain. This plain was greatly modified by the downcutting of streams resulting from geologic erosion. This shaping of the landscape was greatly influenced by the glacial till that was exposed below the original loess-covered plain. The remnants of this plain now occupy a series of stable loess-covered divides that run throughout the county. These divides are nearly level to gently sloping. They are generally 1/8 to 1/2 mile wide, but they become narrower in the southern part of the county. The divides are bordered by moderately sloping loess-covered side slopes at the upper end of drainageways. Also extending from the stable divides are slightly lowered, moderately sloping loess-covered ridges about 100 to 400 feet wide. Below these moderately sloping loess-covered areas are moderately sloping to strongly sloping areas of weathered glacial till (paleosol). Below the paleosol are strongly sloping to moderately steep areas of glacial till. The progression from the stable divide to the more dissected areas near the larger drainageways results in the moderately sloping loess-covered ridge becoming narrower and thinner, until the paleosol is exposed on the surface of the ridge where the side slopes of glacial till are longer and steeper. These steeper areas commonly include some less sloping areas that formed in valley fill, which are generally on south- and east-facing slopes along the larger drainageways and streams. The nearly level and level flood plains range from 1/8 to 3/8 mile wide (Iowa State University, 1987).

The highest elevation in the survey area is 1,305 feet above sea level near the municipal airport at Lenox along the northern county line. The elevation of the upland divides decreases in the southern part of the county. The lowest elevation is about 1,050 feet above sea level at the point where the Hundred and Two Mile River enters Missouri just south of Bedford. The larger stream valleys are commonly 80 to 150 feet in elevation below the adjacent upland divide.

All of Taylor County is in the Missouri River watershed. The northwestern part of the county is drained by the Nodaway River, and the central part is drained by the Hundred and Two Mile River and its tributaries and by Honey Creek. The southeastern part of the county is drained by the Platte River and its tributaries. Streams flow generally in a south or southwesterly direction.

Water movement in soils varies depending on natural drainage properties. The soils of the nearly level upland divides are poorly drained. Loess soils of the gently sloping upland ridges are moderately well drained to somewhat poorly drained. The moderately sloping loess soils range from poorly drained to moderately well drained. The paleosols also range from poorly drained to moderately well drained. Sidehill seeps occur between the moderately sloping loess soils and the paleosols. These seeps are caused by rainwater that percolates through the loess soils and perches at the point where the loess comes in contact with the less permeable paleosol. This perched water occurs laterally until it reaches the point where the contact between loess and till is exposed at the surface. Installing interceptor tile in the loess soils slightly upslope from these wet, seepy areas helps to intercept and drain excess moisture.

The strongly sloping to steep soils that formed in glacial till are well drained. Generally, soils on the flood plains are poorly drained or very poorly drained and are subject to flooding and ponding. Tile drainage systems generally do not perform satisfactorily in these soils because of a slowly permeable subsoil and a lack of adequate outlets. Generally, tile is supplemented by a good surface drainage system to provide adequate drainage in areas of these soils.

Natural Resources

Soil is the most important natural resource in the county. It provides a growing medium for marketable crops and for the grass grazed by livestock. Another natural resource is a limestone quarry located in the southern part of the county.

In most years and in most areas in Taylor County, the water supply is adequate for domestic use and for watering livestock. Glacial till and alluvium are the water-bearing sources for shallow wells. Glacial till aquifers are not always reliable because the soils are somewhat impermeable and rainfall tends to run off rather than be absorbed into the ground. Alluvial aquifers are shallow and are dependent on local rainfall for recharge. Climate records show patterns of spotty rainfall. The deeper glacial aquifers and bedrock aquifers at a depth of a few hundred feet are highly mineralized. Wells should be monitored periodically for ground-water pollutants. Bedford obtains its water supply from the 35-acre Ben Scane Reservoir and the Hundred and Two Mile River. The western part of the county is served by rural water supplied by the Page County Rural Water Association. The city of Lenox is supplied by the Lenox City Reservoir, which is on the Adams-Taylor county line just north of Lenox, and the Twelve-Mile reservoir in Union County supplies water to the area north and east of Lenox. Another rural water supply comes from the Clearfield Water Association in Taylor County. Water for livestock is mainly supplied from the many farm ponds in the county (Hoskins-Western-Sonderegger, 1976).

Wildlife also is an important resource in the county. The area is inhabited by ringneck pheasant, bobwhite quail, waterfowl, turkey, squirrel, rabbit, coyote, raccoon, and white-tailed deer. The many farm ponds contain bass, bluegills, crappie, catfish, and bullhead. Catfish are in the streams in the survey area. Furbearing animals are trapped along drainageways and creeks. Also, Taylor County has 850 acres of state-owned wildlife areas.

Farming

Like those across much of the Midwest, the farms in Taylor County have been increasing in size and decreasing in number (USDA/SCS, 1986; Skow and Halley, 1984). Between 1981 and 1982, the number of farms decreased from 980 to 960 but the average farm size increased from 344 to 351 acres. The state average in 1982 was 289 acres per farm.

Farm production in the county is generally mixed livestock and grain crops. Some corn is sold as a cash crop, but the amount sold varies from year to year and depends largely on the price of feeder cattle, the market for fat cattle, the market for hogs, the cash price of corn, and the quality of the corn crop. The acreage of various grain crops in Taylor County in 1985 was corn for all purposes, 78,000 acres; sorghum, 500 acres; soybeans, 68,600 acres; oats, 9,900 acres; wheat, 4,300 acres; and hay, 16,700 acres.

Beef cattle and hogs are the main livestock raised in Taylor County. The principal livestock marketed in 1984 was 121,000 hogs, 5,300 grain-fed cattle, and 4,200 grain-fed sheep and lambs. In 1984, the county marketed 600 milk cows, 21,000 beef cattle, and 3,000 lambs and farrowed 20,400 sows. Also in 1984, 30,000 laying hens were marketed in the county.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bedford in the period 1951 to 1987. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 26 degrees F and the average daily minimum temperature is 16 degrees. The lowest temperature on record, which occurred at Bedford on January 12, 1974, is -32 degrees. In summer, the average temperature is 74 degrees and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Bedford on July 13, 1954, is 107 degrees.

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

The total annual precipitation is 36.69 inches. Of this, 26 inches, or about 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 5.73 inches at Bedford on July 25, 1979. Thunderstorms occur on about 49 days each year.

The average seasonal snowfall is 24 inches. The greatest snow depth at any one time during the period of record was 25 inches. On the average, 6 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

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General Soil Map Units

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

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

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

Soil Descriptions

1. Sharpsburg-Nira-Macksburg Association

Strongly sloping to nearly level, moderately well drained and somewhat poorly drained, silty soils that formed in loess; on uplands

This association consists of soils on upland divides, convex ridges, and short convex side slopes. The landscape is nearly level to gently rolling. Slopes range from 0 to 14 percent.

This association makes up about 11 percent of the county. It is about 57 percent Sharpsburg soils, 18 percent Nira soils, 10 percent Macksburg soils, and 15 percent soils of minor extent.

Sharpsburg and Nira soils are moderately well drained and are on convex ridgetops and short convex side slopes. Macksburg soils are somewhat poorly drained and are on broad upland divides.

Typically, the surface layer of the Sharpsburg soils is black, friable silty clay loam about 8 inches thick. The subsurface layer is very dark brown, friable silty clay loam about 9 inches thick. The subsoil is firm silty clay loam about 29 inches thick. The upper part is brown; the next part is brown and is mottled in the lower portion; and the lower part is yellowish brown and mottled. The substratum to a depth of about 60 inches is mottled grayish brown, yellowish brown, strong brown, and brown silty clay loam.

Typically, the surface layer of the Nira soils is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is mottled, friable silty clay loam about 28 inches thick. The upper part is light olive brown, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam.

Typically, the surface layer of the Macksburg soils is black, friable silty clay loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable silty clay loam about 11 inches thick. The subsoil to a depth of about 60 inches is silty clay loam. The upper part is dark grayish brown and firm; the next part is grayish brown, mottled, and firm; and the lower part is light brownish gray and grayish brown, mottled, and friable.

Of minor extent in this association are the poorly drained Clearfield and Winterset soils. Clearfield soils formed in 3 to 5 feet of loess over a gray, clayey paleosol weathered from glacial till. They are in the head of drainageways downslope from the Nira and Sharpsburg soils. Winterset soils also formed in loess. They are on broad upland divides at the higher elevations and are upslope from the Macksburg and Sharpsburg soils.

Most of the gently sloping and moderately sloping upland soils in this association are used for row crops, small grain, or hay. The main enterprises are growing cash crops and feeding livestock. The soils are well suited to corn, soybeans, small grain, and hay. The available water capacity is high. The content of organic matter is moderate or high. The main management needs are measures that help to control erosion and maintain fertility.

2. Lamoni-Nira-Shelby Association

Moderately sloping to moderately steep, somewhat poorly drained to well drained, silty and loamy soils that

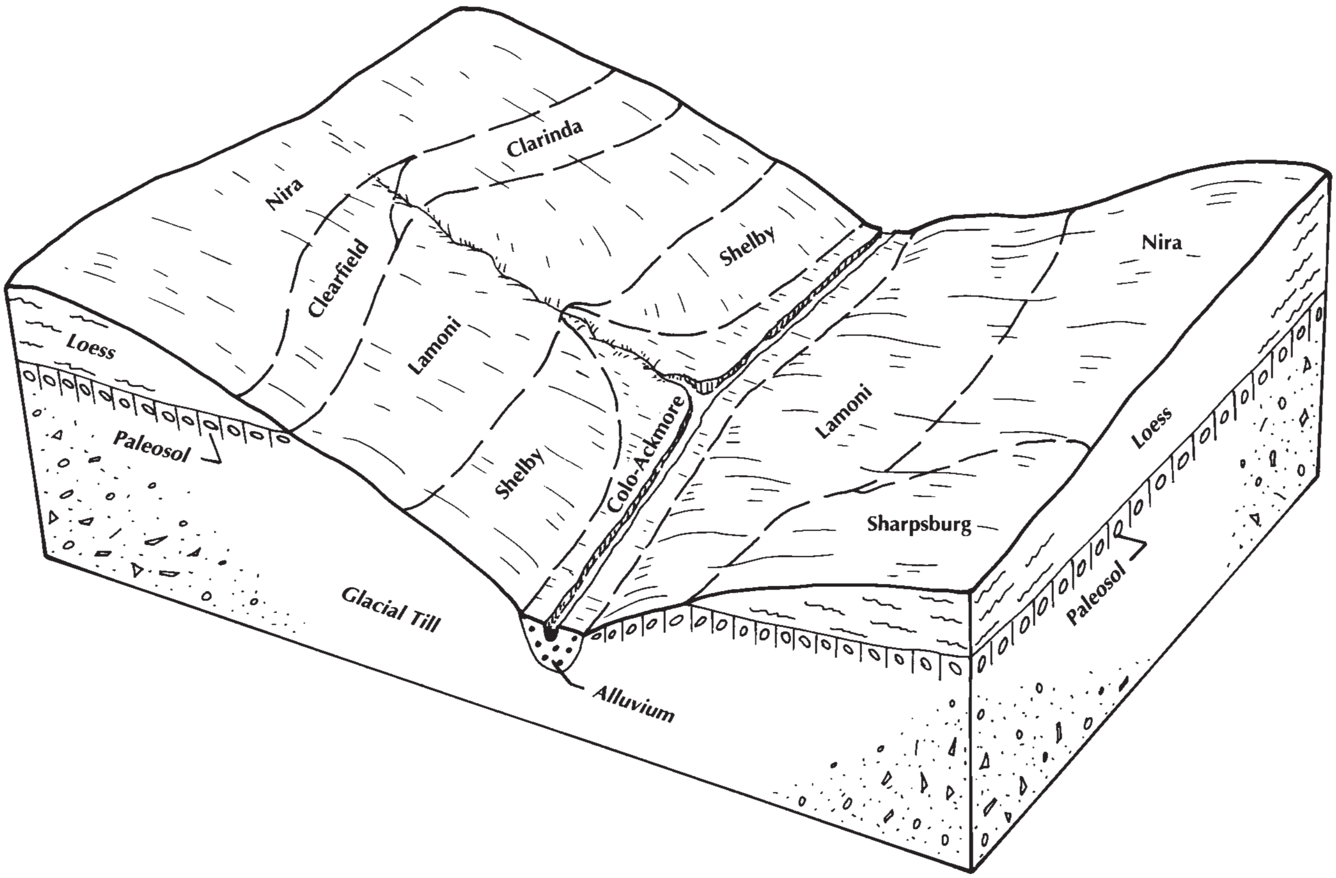

Figure 2.—Typical pattern of soils and parent material in the Lamoni-Nira-Shelby association.

formed in a paleosol derived from glacial till, in loess, and in glacial till; on uplands

This association consists of soils on moderately wide convex ridgetops and short convex side slopes. The landscape is gently undulating to hilly. Slopes range from 5 to 18 percent.

This association makes up about 62 percent of the county. It is about 34 percent Lamoni soils, 30 percent Nira soils, 11 percent Shelby soils, and 25 percent soils of minor extent (fig. 2).

Lamoni soils are somewhat poorly drained and are on short convex side slopes and the lower narrow ridges near the head of drainageways. Nira soils are moderately well drained and are on ridges and short convex side slopes. Shelby soils are well drained and are on short convex side slopes.

Typically, the surface layer of the Lamoni soils is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the dark grayish brown subsoil with the surface layer. The subsoil is 42 inches thick. The upper part is dark grayish brown, mottled, firm clay; the next part is olive gray, mottled, firm clay; and the lower part is olive gray, mottled, firm clay loam. The substratum to a depth of about 60 inches is mottled gray, olive gray, strong brown, and dark gray clay loam. Stones and pebbles are in the lower part of the subsoil.

Typically, the surface layer of the Nira soils is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer also is very dark gray, friable silty clay loam. It is about 7 inches thick. The subsoil is mottled, friable silty clay loam about 28 inches thick. The upper part is light olive brown, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam.

Typically, the surface layer of the Shelby soils is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is mottled clay loam about 29 inches thick. The upper part is dark brown and yellowish brown and is friable, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is mottled light yellowish brown, light olive brown, and light brownish gray, calcareous clay loam.

Of minor extent in this association are Ackmore, Clarinda, Clearfield, Colo, Judson, Mystic, Nira, Nodaway, Olmitz, and Sharpsburg soils. Ackmore and Nodaway soils formed in recent stratified alluvium. Ackmore soils are somewhat poorly drained, and Nodaway soils are moderately well drained. Clarinda soils are poorly drained and are upslope from the Lamoni soils. They formed in a gray, clayey paleosol weathered from glacial till. Colo and Judson soils formed in alluvium and have a thick, dark surface soil. They are in narrow drainageways and on the lower foot slopes. Colo soils are poorly drained, and Judson soils are moderately well drained. Clearfield soils are poorly drained and are on the upper parts of the head of drainageways. They formed in loess and a gray, clayey paleosol weathered from glacial till. Mystic soils are somewhat poorly drained and are on short, plane or concave side slopes and foot slopes at the lower elevations on uplands. They formed in old clayey alluvium. The moderately well drained Nira and Sharpsburg soils formed in loess. They are on ridges and side slopes in the uplands. Olmitz soils are moderately well drained and are on the foot slopes of upland side slopes. They formed in loamy alluvium and have a thick, dark surface layer.

Most of the moderately sloping upland soils in this association are used for cultivated crops. The moderately steep and strongly sloping soils are used for permanent pasture and hay. Some areas are cultivated in a rotation system. The moderately steep areas are used for permanent pasture, wildlife habitat, or woodland. Many ponds in the strongly sloping and moderately steep areas help to control erosion and provide water for livestock. The main enterprises are cash grain crops, hay production, and livestock.

Corn, soybeans, small grain, and hay grow well on the moderately sloping soils in this association. The strongly sloping soils are suited or poorly suited to corn and small grain and are moderately well suited to hay and pasture. These soils are poorly suited to legumes, however, because of the seasonal high water table and poor drainage. The available water capacity is high. The content of organic matter is moderate. The main management concerns are controlling water erosion, preventing the formation of gullies, and maintaining fertility.

3. Gara-Armstrong-Ladoga Association

Steep to moderately sloping, well drained and moderately well drained, loamy and silty soils that formed in glacial till, in a paleosol derived from glacial till, and in loess; on uplands

This association consists of soils on ridges and side slopes. The landscape is gently rolling to steep. Slopes range from 5 to 25 percent.

This association makes up about 16 percent of the county. It is about 33 percent Gara soils, 23 percent Armstrong soils, 12 percent Ladoga soils, and 32 percent soils of minor extent (fig. 3).

Gara soils are well drained and are on ridges and side slopes. Armstrong soils are moderately well drained and are on narrow convex ridges and side slopes. Ladoga soils are moderately well drained and are on ridges and convex side slopes.

Typically, the surface layer of the Gara soils is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the dark yellowish brown subsoil with the surface layer. The subsoil is about 34 inches thick. The upper part is yellowish brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam.

Typically, the surface layer of the Armstrong soils is dark grayish brown, friable loam about 6 inches thick. Plowing has mixed some of the strong brown subsoil with the surface layer. The subsoil is about 38 inches thick. The upper part is strong brown, mottled, friable clay loam; the next part is strong brown, mottled, firm clay; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is light brownish gray clay loam.

Typically, the surface layer of the Ladoga soils is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is about 45 inches thick. The upper part is brown and yellowish brown, firm silty clay loam; the next part is yellowish brown, mottled, firm silty clay; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silty clay loam.

Of minor extent in this association are Colo, Judson, Lineville, Mystic, Nodaway, Olmitz, and Vesser soils. Colo, Judson, Nodaway, and Vesser soils formed in alluvium. They are in narrow drainageways and on the lower foot slopes. Colo soils are poorly drained, Vesser soils are somewhat poorly drained, and Judson and Nodaway soils are moderately well drained. Lineville soils are moderately well drained and are on ridges slightly below the Ladoga soils and upslope from the Armstrong soils. They formed in loess and

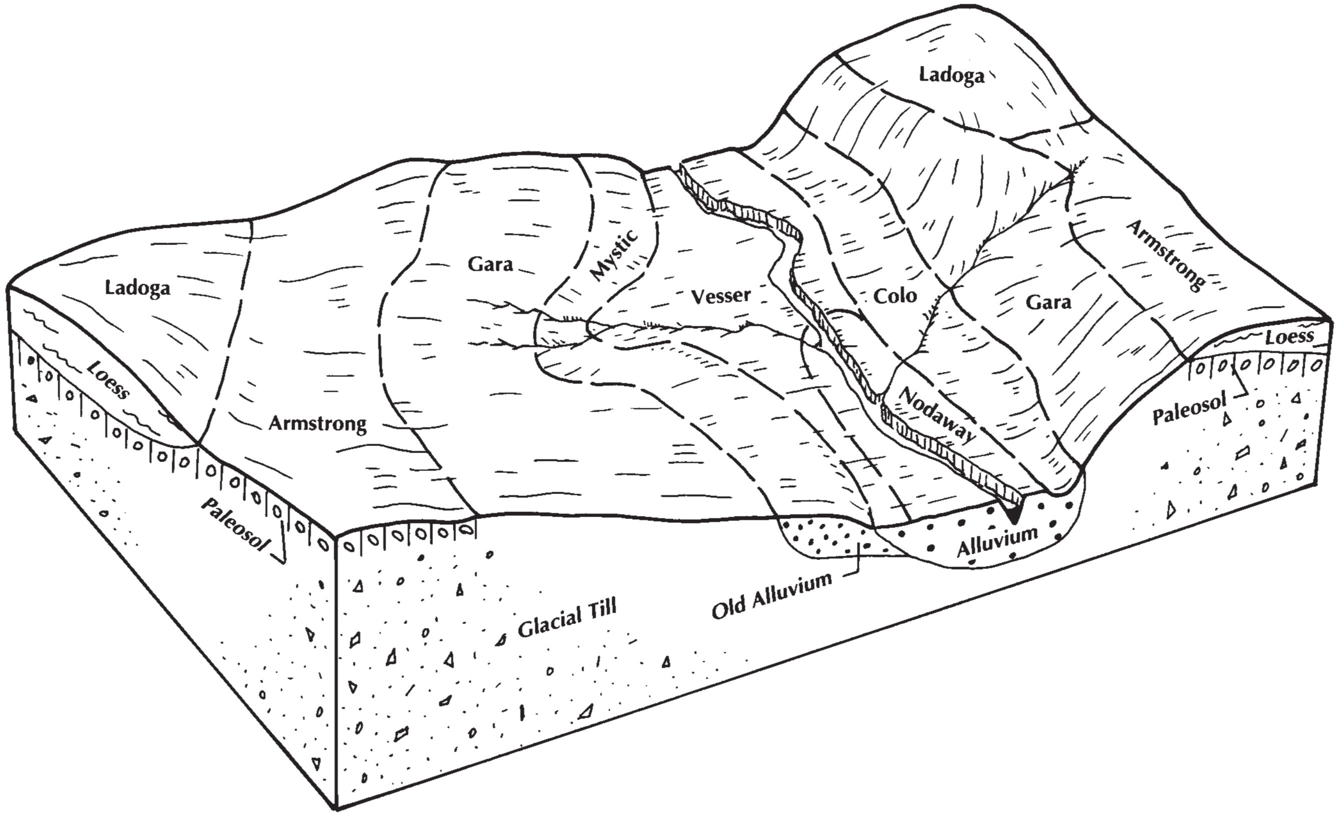

Figure 3.—Typical pattern of soils and parent material in the Gara-Armstrong-Ladoga association.

pedisediments over a red, clayey paleosol weathered from glacial till. Mystic soils are somewhat poorly drained and are at the lower elevations on short, convex to slightly concave side slopes in the uplands, downslope from the Gara soils. They formed in ancient clayey alluvium derived from glacial till. Olmitz soils are moderately well drained and are on foot slopes in the uplands. They formed in alluvium and have a thick, dark surface soil.

Most of the moderately sloping and strongly sloping upland soils in this association are used for cultivated crops or for hay. The moderately steep and steep soils are used for pasture, woodland, or wildlife habitat. Many ponds in the strongly sloping and moderately steep areas help to control erosion and provide a source of water for livestock. The main enterprises are row crops, hay, and livestock.

The moderately sloping soils are suited to corn, soybeans, small grain, and hay. The strongly sloping soils are poorly suited to corn but are suited to small grain in a rotation with hay. The moderately steep and steep soils are well suited to pasture, woodland, and wildlife habitat. The available water capacity is high. The content of organic matter is moderate. The main management concerns are controlling water erosion, preventing the formation of gullies, and maintaining fertility.

4. Nodaway-Humeston-Wabash Association

Nearly level and gently sloping, moderately well drained to very poorly drained, loamy and clayey soils that formed in alluvium; on flood plains

This association consists of soils on flood plains and foot slopes along major streams and tributaries. These soils are subject to flooding. The landscape is level to undulating. Slopes range from 0 to 5 percent.

This association makes up about 11 percent of the county. It is about 36 percent Nodaway soils, 25 percent Humeston soils, 14 percent Wabash soils, and 25 percent soils of minor extent (fig. 4).

The moderately well drained Nodaway soils are nearly level. They are on flood plains adjacent to the stream channels. The poorly drained Humeston soils are nearly level and gently sloping. They are on flood plains and foot slopes along the major streams and

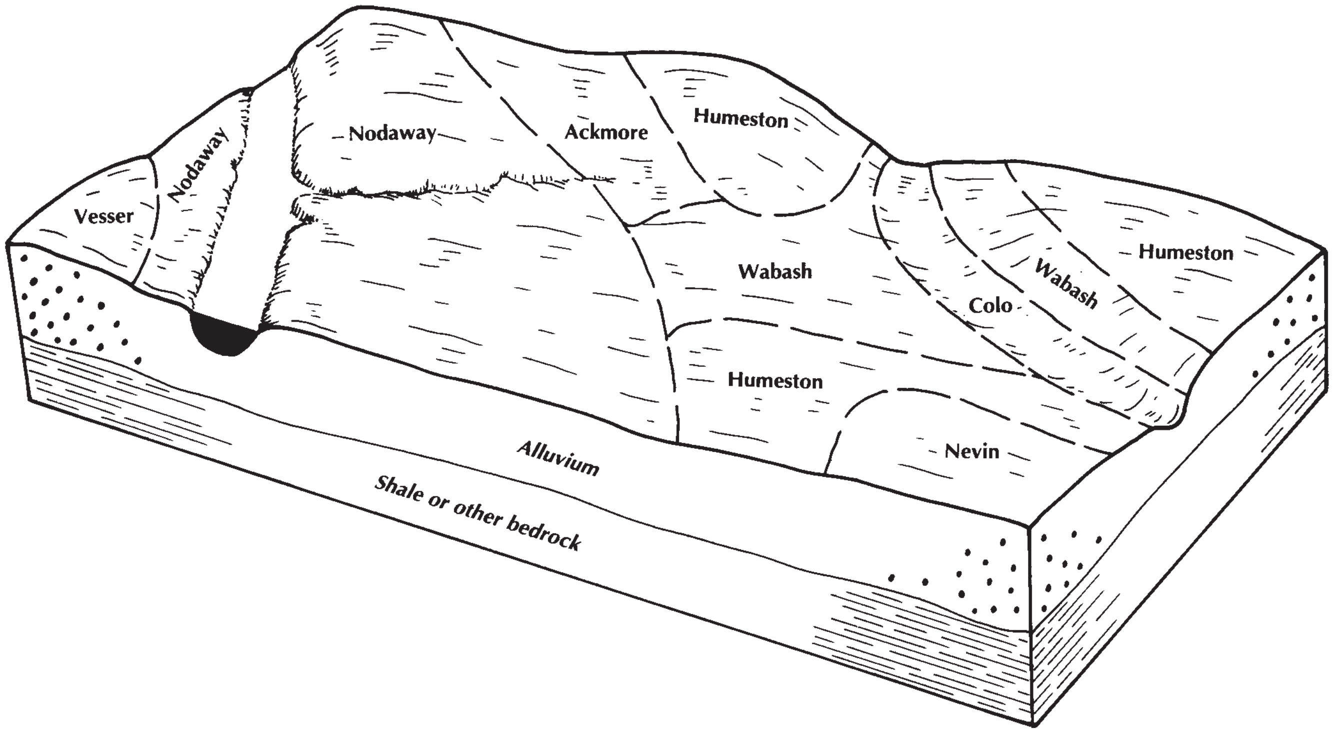

Figure 4.—Typical pattern of soils and parent material in the Nodaway-Humeston-Wabash association.

tributaries. The very poorly drained Wabash soils are nearly level. They are in low areas on flood plains along the major streams and along small tributaries.

Typically, the surface layer of the Nodaway soils is very dark grayish brown, friable silt loam that has strata of dark grayish brown. It is about 7 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, very dark grayish brown, dark grayish brown, and grayish brown silt loam.

Typically, the surface layer of the Humeston soils is very dark gray, friable silty clay loam about 10 inches thick. The subsurface layer is very dark gray and dark gray, mottled, friable silt loam about 14 inches thick. The subsoil extends to a depth of about 60 inches. It is mottled. The upper part is dark gray, firm silty clay loam, and the lower part is very dark gray, firm silty clay.

Typically, the surface layer of the Wabash soils is black, friable silty clay loam about 8 inches thick. The subsurface layer is about 12 inches thick. The upper part is black, friable silty clay loam, and the lower part is black, friable silty clay. The subsoil extends to a depth of about 60 inches. The upper part is black and very dark gray, firm silty clay; the next part is dark gray and very dark gray, mottled, firm silty clay; and the lower part is dark gray and gray, mottled, very firm silty clay.

Of minor extent in this association are Ackmore, Colo, Judson, Kennebec, Olmitz, Sharpsburg, and Vesser soils. Ackmore soils are somewhat poorly drained and are on flood plains and foot slopes adjacent to the upland tributaries. They have a black surface soil buried at a depth of about 30 inches by recent alluvium. Colo soils are poorly drained and are on flood plains. Kennebec soils are moderately well drained and are on flood plains. Colo and Kennebec soils have less clay than the Wabash soils. Olmitz and Judson soils are moderately well drained and are on foot slopes adjacent to upland side slopes. Judson soils have silty textures, and Olmitz soils have loamy textures. Sharpsburg soils are moderately well drained. They formed in loess on high stream benches. They are at the higher elevations. Vesser soils are somewhat poorly drained and are on flood plains. They have less clay than the Humeston soils.

Most of the soils in this association are used for cultivated crops, small grain, or hay. The areas that are characterized by meandering stream channels are used for pasture, woodland, or wildlife habitat. The main enterprise is growing cash grain crops.

Nodaway soils are well suited to corn, soybeans, small grain, hay, and pasture if protected from flooding. Wabash and Humeston soils are suited to corn, soybeans, small grain, and hay if adequately drained and protected from flooding. In undrained areas these soils are suited to pasture. This association is subject to occasional or frequent flooding. The available water capacity is moderate to very high. The organic matter content is high or very high. The main management concerns are protecting the soils from flooding and maintaining fertility. Diversions and dikes help to control flooding and divert the runoff water from adjacent areas. A surface drainage system is needed in areas of the Humeston and Wabash soils if adequate outlets are available.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Shelby clay loam, 9 to 14 percent slopes, moderately eroded, is a phase of the Shelby series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Colo-Judson-Nodaway complex, 0 to 5 percent slopes, is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, limestone quarry, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

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

Soil Descriptions

5B—Colo-Ackmore complex, 0 to 5 percent slopes. These nearly level and gently sloping soils are in narrow drainageways that extend from the uplands to small streams. The poorly drained Colo soil is on the upper parts of the landscape. The somewhat poorly drained Ackmore soil is on the lower parts of the landscape, near stream channels. It is occasionally flooded for brief periods. Areas of this map unit are long and narrow and range from 5 to more than 20 acres in size. They are about 55 percent Colo soil and 35 percent Ackmore soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Colo soil is black and very dark grayish brown, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, mottled, friable silty clay loam about 23 inches thick. The upper part of the subsoil is very dark gray, mottled, firm silty clay loam. The lower part to a depth of about 60 inches is dark gray, mottled, firm silty clay loam.

Typically, the surface layer of the Ackmore soil is dark gray and grayish brown, friable silt loam about 8 inches thick. The substratum is stratified very dark gray and grayish brown, mottled silt loam about 22 inches thick. Below this to a depth of about 60 inches is a buried surface layer of black, friable or firm silty clay loam.

Included with these soils in mapping are small areas of the moderately well drained, stratified Nodaway soils near the stream channels. Nodaway soils have a lower content of organic matter than the Colo and Ackmore soils. They make up about 10 percent of the unit.

Permeability is moderate in the Colo and Ackmore soils. Surface runoff is medium on the Colo soil and slow on the Ackmore soil. The soils have a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is high in the Colo soil and very high in the Ackmore soil. The shrink-swell potential is high in the Ackmore soil at a depth of 2 to 3 feet. The content of organic matter is about 5 to 7 percent in the surface layer of the Colo soil and 1 to 3 percent in the surface layer of the Ackmore soil. The subsoil of the Colo soil generally has a medium supply of available phosphorus and potassium. The subsoil of the Ackmore soil generally has a low supply of available phosphorus and a very low supply of available potassium. Tilth is fair in areas of both soils, but the soils tend to puddle if worked when wet.

Most areas are managed along with the adjacent soils as cropland, pasture, or hayland. If these soils are drained and protected from runoff water, they are moderately well suited to corn, soybeans, and small grain. Many areas are dissected by waterways that cannot be crossed by machinery. Areas near small streams are subject to brief periods of flooding. Terraces, contour stripcropping, a system of conservation tillage that leaves crop residue on the surface, grassed waterways, and contour farming are needed in upslope areas. These practices help to prevent gully erosion and minimize flooding. Tile drainage may also be needed to remove excess water. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies according to previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

The Ackmore soil is well suited to grasses for hay, and the Colo soil is suited to this use. The Colo soil is poorly suited to pasture, but the Ackmore soil is well suited. Both soils are poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

8B—Judson silty clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on foot slopes and alluvial fans. Most areas are irregularly shaped and range from 5 to 75 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is black, very dark brown, and very dark grayish brown silty clay loam about 25 inches thick. The subsoil to a depth of about 60 inches is dark brown and brown, mottled, friable silty clay loam.

Included with this soil in mapping are small areas of the nearly level and poorly drained Colo soils. These soils dry out more slowly after rains than the Judson soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Judson soil. Surface runoff is medium. The available water capacity is very high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. In some areas, runoff from soils upslope results in siltation on this soil. Measures that control runoff are needed on the soils upslope. Grassed waterways remove excess water and help to prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies according to previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIe.

8C—Judson silty clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the lower foot slopes. Most areas are irregularly shaped and range from 5 to 15 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is friable silty clay loam about 23 inches thick. The upper part is black, and the lower part is very dark brown. The subsoil is dark brown, mottled, friable silty clay loam about 17 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

Permeability is moderate, and surface runoff is medium. The available water capacity is very high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain. Water erosion is a hazard. It can be controlled, however, by contour stripcropping, terraces, a system of conservation tillage that leaves crop residue on the surface, and a crop rotation that includes meadow crops. In some areas runoff from soils upslope results in siltation and gullying. Measures that control runoff on the soils upslope are needed. Grassed waterways remove excess water and help to prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, minimizes surface crusting, improves fertility, and increases the rate of water infiltration.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

24D—Shelby clay loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on convex side slopes and nose slopes in the uplands that are dissected by small drainageways. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. The subsurface layer is dark brown, friable clay loam about 4 inches thick. The subsoil is about 31 inches thick. The upper part is brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is mottled light olive brown, light yellowish brown, and light brownish gray, calcareous clay loam. In places the surface layer and subsoil are thinner because of erosion.

Included with this soil in mapping are some small areas of Adair and Lamoni soils. These soils have a clayey subsoil and are more difficult to till than the Shelby soil. They are on the upper parts of side slopes and on the shoulders of side slopes. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are used for pasture and hay. Some areas are cultivated. In most areas this soil is managed along with adjacent soils. It is suited to corn and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled in row-cropped areas by a system of conservation tillage that leaves crop residue on the surface and by crop rotations that include meadow crops. Some areas have slopes long and smooth enough to be farmed on the contour and terraced, but keeping cuts to a minimum can prevent unnecessary exposure of the less productive underlying firm glacial till, which is low in fertility. Medium and large stones from the subsoil may also interfere with some tillage operations. A combination of conservation measures is commonly needed to control erosion. Using conservation practices that increase the rate of water infiltration in upslope areas also helps to control erosion on this soil. Good tilth generally can be easily maintained. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture.

Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

24D2—Shelby clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes in the uplands that are dissected by small drainageways. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is clay loam about 29 inches thick. It is mottled. The upper part is brown and yellowish brown and friable, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is mottled light yellowish brown, light olive brown, and light brownish gray, calcareous clay loam. It has white nodules of lime. Stones and pebbles are on the surface and throughout the soil. In some places the surface layer is thicker and darker. In other places the surface layer and subsoil are thinner because of erosion.

Included with this soil in mapping are some small areas of Adair and Lamoni soils. These soils have a clayey subsoil and are more difficult to till than the Shelby soil. They are on the upper parts of side slopes and on the shoulders of side slopes. Also included are areas of the severely eroded Shelby soils. These areas are about ½ acre in size and are scattered throughout the unit. They are low in organic matter and are more difficult to manage than the major Shelby soil. Also, they require more fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet.

Some areas are cultivated, and some areas are used for pasture. In most areas this soil is managed along with adjacent soils. It is suited to corn and small grain. If cultivated crops are grown, further erosion is a hazard. It can be controlled in row-cropped areas by a system of conservation tillage that leaves crop residue on the surface and by crop rotations that include meadow crops. Some areas have slopes long and smooth enough to be farmed on the contour and terraced. If terraces are installed, however, the productivity of this soil after construction is limited. Cuts needed for terraces will expose the subsoil, which is low in fertility. Topsoil material is needed to cover this construction. In places, medium and large stones from the subsoil may also interfere with some tillage operations. A combination of conservation measures is commonly needed to control erosion. Conservation practices that increase the rate of water infiltration in upslope areas also help to control erosion on this soil. More fertilizer management practices are needed on this soil than on the less eroded Shelby soils. Good tilth generally can be easily maintained. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

24E—Shelby clay loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on convex side slopes in the uplands that are dissected by small drainageways. Most areas are long and narrow and are generally parallel to intermittent streams. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is very dark gray, friable clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable clay loam about 3 inches thick. The subsoil is clay loam about 30 inches thick. The upper part is brown and friable, and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is mottled light olive brown, light yellowish brown, and light brownish gray, calcareous clay loam. It has white nodules of lime. Stones and pebbles are throughout the soil. In some places the surface layer and subsoil are thinner because of erosion.

Included with this soil in mapping are small areas of Adair and Lamoni soils. These soils have a clayey subsoil and are more difficult to till than the Shelby soil. They are on the upper side slopes and on the shoulders of side slopes. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are used for hay and pasture. Some areas were cultivated in the past. This soil is poorly suited to cultivated crops. It is better suited to hay and pasture. If cultivated crops are grown, erosion is a severe hazard. Row crops should be grown only in a rotation that includes several years of meadow crops. In years when row crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping help to control erosion. Conservation tillage and contour farming increase the rate of water infiltration and help to control runoff. Grassed waterways help to prevent the formation of gullies. The soil is poorly suited to terraces because slopes are too steep. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IVe.

24E2—Shelby clay loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes in the uplands that are dissected by small drainageways. Most areas are long and narrow and are generally parallel to intermittent streams. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is firm clay loam about 25 inches thick. The upper part is brown, and the lower part is yellowish brown and mottled. The substratum to a depth of about 60 inches is mottled light olive brown, light yellowish brown, and light brownish gray, calcareous clay loam. It has nodules of lime. Stones and pebbles are on the surface and throughout the soil. In some places the surface layer and subsoil are thicker and darker.

Included with this soil in mapping are small areas of Adair and Lamoni soils. These soils have a clayey subsoil and are more difficult to manage than the Shelby soil. They are on the upper side slopes and on the shoulders of side slopes. Also included are areas of the severely eroded Shelby soils. These areas are about ½ acre in size and are scattered throughout the unit. The included Shelby soils are low in organic matter and are more difficult to manage than the major Shelby soil. Also, they require more fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are used for pasture. This soil is poorly suited to cultivated crops. It is better suited to small grain, hay, and pasture. If cultivated crops are grown, further erosion is a severe hazard. Row crops should be grown only in a crop rotation that includes many years of meadow crops. In years when row crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping help to control erosion. Conservation tillage and contour farming increase the rate of water infiltration and help to control runoff. Grassed waterways help to prevent the formation of gullies. The soil is poorly suited to terraces because it is too shallow over the unfertile glacial till. More fertilizer management practices are needed on this soil than on the less eroded Shelby soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IVe.

51—Vesser silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains. It is occasionally flooded for brief periods. Most areas are irregularly shaped and range from 5 to more than 30 acres in size.

Typically, the surface layer is black, friable silt loam about 12 inches thick. The subsurface layer is very dark gray, friable silt loam about 18 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is friable silty clay loam. It is dark gray in the upper part and gray and dark gray in the lower part.

Included with this soil in mapping are small areas of the poorly drained Humeston soils at the lower elevations. These soils contain more clay than the Vesser soil and cannot be drained as easily. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Vesser soil. A seasonal high water table is at a depth of 1 to 3 feet. Surface runoff is slow. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain (fig. 5). The seasonal high water table is the major limitation affecting crop production. Row crops can be grown in many years if the soil is adequately drained and protected from floodwater. A subsurface drainage system is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and raises the low soil temperature.

This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table and the flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and deferred grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

51+—Vesser silt loam, overwash, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains. It is occasionally flooded for brief periods. Most areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is recently deposited alluvium about 15 inches thick. It is dark brown and dark grayish brown, friable silt loam. The next layer is black, friable silt loam about 12 inches thick. The subsurface layer is very dark gray, friable silt loam about 18 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is friable silty clay loam. The upper part is dark gray, and the lower part is gray and dark gray and is mottled.

Included with this soil in mapping are small areas of the poorly drained Humeston soils at the lower elevations. These soils contain more clay than the Vesser soil and are more difficult to drain. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Vesser soil. A seasonal high water table is at a depth of 1 to 3 feet. Surface runoff is slow. The available water capacity is high. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. The seasonal high water table and flooding are the major limitations affecting crop production. Row crops can be grown in

Figure 5.—Soybeans in an area of Vesser silt loam, 0 to 2 percent slopes. Soybeans are generally grown in rotation with corn.

many years if the soil is adequately drained and protected from floodwater. A subsurface drainage system is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and raises the low soil temperature. Herbicide application rates should be adjusted because of the lower organic matter content in the surface layer.

This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table and the flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and deferred grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

51B—Vesser silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on the lower foot slopes and alluvial fans. It is subject to rare flooding. Most areas are irregularly shaped and range from 5 to 10 acres in size.

Typically, the surface layer is black, friable silt loam about 10 inches thick. The subsurface layer is very dark gray, friable silt loam about 12 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is friable silty clay loam. It is mottled. The upper part is dark gray, and the lower part is gray and dark gray.

Included with this soil in mapping are small areas of the poorly drained Humeston soils on foot slopes near drainageways. These soils contain more clay than the Vesser soil and are more difficult to drain. Also included are the poorly drained Colo soils on low foot slopes. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Vesser soil. A seasonal high water table is at a depth of 1 to 3 feet. Surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. The seasonal high water table is the major limitation affecting crop production. Row crops can be grown in many years if the soil is adequately drained and protected from floodwater. A subsurface drainage system is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and raises the soil temperature.

This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and deferred grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

51B+—Vesser silt loam, overwash, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on the lower foot slopes and alluvial fans. It is occasionally flooded for brief periods. Most areas are irregularly shaped and range from 5 to 10 acres in size.

Typically, the surface layer is recently deposited alluvium about 12 inches thick. It is dark brown and dark grayish brown, friable silt loam. The next layer is black, friable silt loam about 10 inches thick. The subsurface layer is very dark gray, friable silt loam about 12 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is friable silty clay loam. It is mottled. The upper part is dark gray, and the lower part is gray and dark gray.

Included with this soil in mapping are small areas of the poorly drained Humeston soils on foot slopes near drainageways. These soils contain more clay than the Vesser soil and are more difficult to drain. Also included are the poorly drained Colo soils on low foot slopes. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Vesser soil. A seasonal high water table is at a depth of 1 to 3 feet. Surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. The seasonal high water table and the flooding are the major limitations affecting crop production. Row crops can be grown in many years if the soil is adequately drained and protected from floodwater. A subsurface drainage system is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and raises the soil temperature. Herbicide application rates should be adjusted because of the lower organic matter content in the surface layer.

This soil is moderately well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table and the flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and deferred grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

69C—Clearfield silty clay loam, 5 to 9 percent slopes. This moderately sloping, poorly drained soil is on short convex side slopes and in coves at the head of drainageways at the lower elevations in the uplands. Most areas are long and narrow or irregularly shaped and range from 5 to 15 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 5 inches thick. The subsoil is silty clay loam about 28 inches thick. The upper part is dark gray, mottled, and firm; the next part is olive gray, mottled, and friable; and the lower part is light brownish gray, light gray, and reddish yellow and is firm. A paleosol of dark gray and gray, firm silty clay is at a depth of about 41 inches. In some places the depth to the gray, clayey paleosol is more than 5 feet. In other places the slopes are steeper. In some areas the topsoil is thinner because of erosion.

Included with this soil in mapping are small areas of Clarinda soils on the lower side slopes near the head of drainageways in the uplands. These soils formed in a gray, clayey paleosol that weathered from glacial till. Seedbed preparation is more difficult on these soils than on the Clearfield soil. Also included are the moderately well drained Nira soils upslope from the Clearfield soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the upper part of the Clearfield soil and very slow in the underlying paleosol. Surface runoff is medium. The available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet. The shrink-swell potential is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet.

Many areas are cultivated. Some areas are used for pasture or hayland. This soil is suited to corn, soybeans, and small grain. Because the soil is poorly drained and remains wet and seepy for long periods, a combination of tile drainage and terraces is needed to allow for timely management activities and to control erosion. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. If cultivated crops are grown continuously, erosion is a severe hazard. It can be controlled in intensively row-cropped areas by a combination of soil conservation practices, such as a system of conservation tillage that leaves crop residue on the surface, winter cover crops, contour stripcropping, grassed headlands and waterways, terraces, and a crop rotation that includes grasses and legumes. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table and poor drainage. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. Any seedbed preparation or interseeding should be on the contour.

The land capability classification is IIIw.

69C2—Clearfield silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, poorly drained soil is on short convex side slopes and in coves at the head of drainageways at the lower elevations in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 15 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 7 inches thick. Plowing has mixed some of the grayish brown subsoil with the surface layer. The subsoil is firm silty clay loam about 35 inches thick. The upper part is dark grayish brown, the next part is olive gray and mottled, and the lower part is mottled light brownish gray, light gray, and reddish yellow. A paleosol of gray, firm silty clay is at a depth of 42 inches. In some places the depth to the gray, clayey paleosol is more than 5 feet. In other places the slopes are steeper.

Included with this soil in mapping are small areas of Clarinda soils on the lower side slopes near the head of drainageways in the uplands. These soils formed in a gray, clayey paleosol that weathered from glacial till. Seedbed preparation is more difficult on these soils than on the Clearfield soil. Also included are the moderately well drained Nira soils upslope from the Clearfield soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the upper part of the Clearfield soil and very slow in the underlying paleosol. Surface runoff is medium. The available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet. The shrink-swell potential is high. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil generally has a low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain. Because the soil is poorly drained and remains wet and seepy for long periods, a combination of tile drainage and terraces is needed to allow for timely field operations and to control erosion. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. If cultivated crops are grown continuously, further erosion is a severe hazard. It can be controlled in intensively row-cropped areas by a combination of soil conservation practices, such as a system of conservation tillage that leaves crop residue on the surface, winter cover crops, contour stripcropping, grassed headlands and waterways, terraces, and a crop rotation that includes grasses and legumes. More fertilizer management practices are needed on this soil than on the less eroded Clearfield soils. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table and poor drainage. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. Any seedbed preparation or interseeding should be on the contour.

The land capability classification is IIIw.

76C—Ladoga silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on narrow, convex ridges and side slopes that are slightly lower than the gently sloping upland ridgetops. Most areas are long and narrow or irregularly shaped. Individual areas range from 4 to 15 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown and brown, friable silt loam about 5 inches thick. The subsoil to a depth of about 60 inches is brown and yellowish brown, firm silty clay and silty clay loam. In some places the soil has a grayish brown substratum at a depth of 24 inches or more. In other places the surface soil is thinner because of erosion.

Permeability is moderately slow, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated or used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, contour stripcropping, terraces, and crop rotations that include meadow crops help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is moderately well suited to trees, and some small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

76C2—Ladoga silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on narrow, convex ridges and side slopes that are slightly lower than the nearly level upland ridgetops. Most areas are long and narrow or irregularly shaped. Individual areas range from 4 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is about 45 inches thick. The upper part is brown and yellowish brown, firm silty clay loam; the next part is yellowish brown, mottled, firm silty clay; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silty clay loam. In some places the soil has a grayish brown substratum at a depth of 24 inches or more.

Included with this soil in mapping are small areas of Armstrong and Lineville soils. Armstrong soils are downslope from the Ladoga soil on the lower convex narrow ridges and side slopes. They contain more clay than the Ladoga soil and formed in a paleosol that weathered from glacial till. Lineville soils are downslope from the Ladoga soil on the slightly lower narrow convex ridges. They formed in loess over loamy sediments and in the underlying weathered glacial till. Seedbed preparation is more difficult in areas of these soils than on the Ladoga soil. Also, these soils are more droughty during the later part of the growing season. Also included are areas of the severely eroded Ladoga soils. These areas are ¼ to ½ acre in size and are scattered throughout the unit. The severely eroded Ladoga soils are low in organic matter, cannot be easily managed, and require more fertility management practices than the major Ladoga soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Ladoga soil, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. Some areas are used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, contour stripcropping, terraces, and crop rotations that include meadow crops help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. More fertilizer management practices are needed on this soil than on the less eroded Ladoga soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is moderately well suited to trees. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

76D—Ladoga silt loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on convex to slightly concave side slopes in the uplands in areas that commonly border the broad and flat flood plains. Most areas are long and narrow or irregularly shaped. Individual areas range from 4 to 10 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 3 inches thick. The subsoil is about 46 inches thick. The upper part is brown and yellowish brown, mottled, firm silty clay loam; the next part is yellowish brown, mottled, firm silty clay; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silty clay loam. In places the soil has a grayish brown subsoil at a depth of 24 inches or more. In some areas the substratum is loam over a red, clayey soil. In other areas the surface layer is thinner because of erosion.

Included with this soil in mapping are small areas of the somewhat poorly drained Mystic soils on concave side slopes that border valleys of major streams and tributaries. These soils formed in clayey ancient alluvium. Seedbed preparation is more difficult on these soils than on the Ladoga soil. Also included are areas of sandy textured soils on convex side slopes. These sandy soils are better drained than the Ladoga soil and contain more sand. All of the included soils may become droughty during the later part of the growing season. They make up as much as 5 percent of the unit.

Permeability is moderately slow in the Ladoga soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil typically has a high supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If the soil is used for cultivated crops, the hazard of erosion is severe. If an intensive row-cropping system is used, a combination of conservation practices may be needed, such as a system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, grassed waterways, contour stripcropping, and rotations that include grasses and legumes. Because this soil occurs in relatively small areas, it is generally managed with soils that are more poorly suited to row crops. Applying a combination of conservation practices on this soil as well as in upslope areas can minimize soil losses. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves soil fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is moderately well suited to trees, and most areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

76D2—Ladoga silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex to slightly concave side slopes in the uplands. It is commonly in areas that border the broad and flat flood plains. Most areas of this unit are long and narrow or irregularly shaped. Individual areas range from 4 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 5 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is about 40 inches thick. The upper part is brown and yellowish brown, firm silty clay loam; the next part is yellowish brown, mottled, firm silty clay; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silty clay loam. In some places a grayish brown subsoil is at a depth as shallow as 24 inches. In other places the substratum is loam overlying a red, clayey soil.

Included with this soil in mapping are small areas of the somewhat poorly drained Mystic soils on concave side slopes that border valleys of major streams and tributaries. These soils formed in clayey ancient alluvium. Preparing a seedbed is more difficult in areas of these soils than in areas of the Ladoga soil. Also included are areas of sandy soils on convex side slopes. These soils are better drained than the Ladoga soil and contain more sand. The Mystic soils and the sandy included soils are droughty during the later part of the growing season. Areas of severely eroded Ladoga soils are also included in mapping. These areas are ¼ to ½ acre in size and are scattered throughout the unit. The soils in these areas have a low content of organic matter and require more fertility management practices than the major Ladoga soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Ladoga soil. Surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. Some areas are used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, contour stripcropping, terraces, and crop rotations that include grasses and legumes help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Because the areas of this soil are relatively small, the soil is generally farmed along with soils that are more poorly suited to row crops. Applying a combination of conservation practices on this soil and in upslope areas can minimize soil losses. More fertilizer management practices are needed on this soil than on the less eroded Ladoga soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is moderately well suited to trees, and a few small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

88—Nevin silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low stream terraces. Most areas are irregularly shaped and range from 5 to 15 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray and dark brown, friable silty clay loam about 12 inches thick. The subsoil is friable silty clay loam about 31 inches thick. It is mottled. The upper part is dark grayish brown, the next part is brown, and the lower part is light brownish gray. The subsoil to a depth of about 60 inches is light brownish gray silty clay loam. In some places the surface layer is lighter colored and thinner. In other places the subsoil is grayer.

Included with this soil in mapping are small areas of poorly drained soils at the lower elevations and near drainageways. These soils are seasonally wet for longer periods than the Nevin soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Nevin soil. Surface runoff is slow. A seasonal high water table is at a depth of about 2 to 4 feet. The available water capacity is high. The content of organic matter in the surface layer is about 4 to 6 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil generally has good tilth. It tends to puddle if worked when it is wet.

This soil is used mostly for cultivated crops. It is well suited to corn, soybeans, and small grain. Row crops can be grown much of the time. Drainage is adequate, but in wet years tile drains can improve the timeliness of field operations. The need for lime in the surface layer varies, depending on previous liming practices, but generally lime is needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses and legumes for hay and pasture. Most areas that are narrow and subject to flooding are used as permanent pasture. Overgrazing or grazing during wet periods causes surface compaction and puddling. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is I.

93D—Shelby-Adair complex, 9 to 14 percent slopes. This complex consists of a strongly sloping, well drained Shelby soil on the lower convex side slopes and a strongly sloping, moderately well drained Adair soil on the upper convex shoulders in the uplands. Most areas are irregularly shaped and range from 5 to 25 acres in size. They are about 55 percent Shelby soil and 35 percent Adair soil. The two soils occur as areas so small that mapping them separately is impractical.

Typically, the surface layer of the Shelby soil is very dark grayish brown, friable clay loam about 8 inches thick. The subsurface layer is dark brown, friable clay loam about 4 inches thick. The subsoil is clay loam about 31 inches thick. The upper part is brown and friable, the next part is yellowish brown and firm, and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is light olive brown and light brownish gray, mottled, calcareous clay loam. In places the surface layer and subsoil are thinner because of erosion. In some areas, the subsoil is thinner and the calcareous substratum is closer to the surface.

Typically, the surface layer of the Adair soil is very dark gray and very dark grayish brown, friable clay loam about 6 inches thick. The subsurface layer is very dark grayish brown, friable clay loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part is brown, firm clay loam; the next part is reddish brown and strong brown, firm clay; and the lower part is strong brown, mottled, very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the surface layer is thinner because of erosion. In some areas the subsoil is grayer and has clay at a lower depth.

Included with these soils in mapping are small areas of Clarinda soils in coves at the head of drainageways in the uplands. These included soils are grayer than the major soils and contain more clay. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Shelby soil and slow in the Adair soil. Surface runoff is rapid on both soils. The Adair soil has a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is high in both soils. The Adair soil has a high shrink-swell potential at a depth of 1 to 2 feet. The content of organic matter in the surface layer of both soils is about 3 to 4 percent. The subsoil of the Shelby soil generally has a low supply of available phosphorus and a high supply of available potassium. The subsoil of the Adair soil generally has a very low supply of available phosphorus and potassium. Both soils have good tilth, but they tend to puddle if worked when wet.

Most areas are cultivated. Some large areas are used for pasture. In most areas these soils are managed along with adjacent soils. They are poorly suited to corn and soybeans. They are better suited to small grain and to hay and pasture. If cultivated crops are grown, erosion is a hazard. Row crops should be grown only in a rotation to establish seedings for hay or pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping help to minimize soil losses. If terraces are used, keeping cuts to a minimum can prevent unnecessary exposure of the less productive, firm subsoil, which is low in fertility. Medium and large stones interfere with some tillage activities on the Shelby soil. Applying conservation practices upslope, which increases the rate of water infiltration, helps to control erosion on these soils. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

The Adair soil is poorly suited to grasses for hay, but the Shelby soil is suited to grasses. The Adair soil is poorly suited to pasture, but the Shelby soil is well suited. The Adair soil also is poorly suited to legumes because of the seasonal high water table, but it may become droughty in the later part of the growing season. If rainfall is not timely during the growing season, forage production may be reduced. Applying conservation practices on adjacent soils upslope can improve the production of legume crops for hay and of grasses for pasture.

Overgrazing or grazing when the soils are wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

93D2—Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded. This complex consists of a strongly sloping, well drained Shelby soil on the lower convex side slopes and a strongly sloping, moderately well drained Adair soil on the upper convex shoulders in the uplands. Most areas are irregularly shaped and range from 5 to 25 acres in size. They are about 50 percent Shelby soil and 35 percent Adair soil. The two soils occur as areas so small that mapping them separately is impractical.

Typically, the surface layer of the Shelby soil is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is clay loam about 29 inches thick. The upper part is brown and friable, and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is light olive brown and light brownish gray, mottled, calcareous clay loam. In some places the surface layer is thicker and darker. In other places the surface layer and subsoil are thinner because of erosion.

Typically, the surface layer of the Adair soil is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is about 30 inches thick. The upper part is brown, firm clay loam; the next part is reddish brown and strong brown, firm clay; and the lower part is strong brown and grayish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In places the surface layer is thinner because of severe erosion. In some areas the subsoil is grayer and has clay at a lower depth.

Included with these soils in mapping are small areas of Clarinda soils in coves at the head of drainageways in the uplands. These included soils are grayer than the major soils and contain more clay. Also included in mapping are severely eroded areas of Shelby and Adair soils. These areas are ½ to 1 acre in size and are scattered throughout the map unit. The severely eroded Adair soils are on the shoulders of side slopes, and the severely eroded Shelby soils are on the lower parts of the landscape. These severely eroded soils have a low content of organic matter and require additional fertility management practices. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Shelby soil and slow in the Adair soil. Surface runoff is rapid on both soils. The available water capacity is high in both soils. The Adair soil has a high shrink-swell potential at a depth of 1 to 2 feet. The content of organic matter in the surface layer of the Shelby and Adair soils is about 2.2 to 3.2 percent. The subsoil of the Shelby soil generally has a low supply of available phosphorus and a high supply of available potassium. The subsoil of the Adair soil generally has a very low supply of available phosphorus and potassium. Both soils have fair tilth and tend to puddle if worked when wet.

Most areas are cultivated. Some large areas are used for pasture. In most areas these soils are managed along with adjacent soils. They are poorly suited to corn and small grain. They are better suited to hay and pasture. If cultivated crops are grown, further erosion is a hazard. Row crops should be grown only in a rotation to establish seedings for hay or pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping help to minimize soil losses. If terraces are used, keeping cuts to a minimum helps to prevent unnecessary exposure of the less productive, firm subsoil, which is low in fertility. Medium or large stones may also interfere with some tillage activities on the Shelby soil. Applying conservation practices upslope, which increases the rate of water infiltration, helps to control erosion on these soils. More fertilizer management practices are needed on these soils than on the less eroded Adair and Shelby soils. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

The Adair soil is poorly suited to grasses for hay, but the Shelby soil is suited to grasses. The Adair soil is poorly suited to pasture, but the Shelby soil is well suited. The Adair soil also is poorly suited to legumes because of the seasonal high water table, but it may become droughty in the later part of the growing season. If rainfall is not timely during the growing season, forage production may be reduced.

Overgrazing or grazing when the soils are wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains. It is occasionally flooded for very brief to long periods unless it is protected. Most areas are irregularly shaped. Individual areas range mainly from 5 to 100 acres in size, but some are as large as 300 acres.

Typically, the surface layer is black and very dark grayish brown, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 23 inches thick. The subsoil to a depth of about 60 inches is mottled, firm silty clay loam. It is very dark gray in the upper part and dark gray in the lower part. In some places about 12 inches of recently deposited silt loam overlies the surface layer.

Permeability is moderate, and surface runoff is slow. The available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet. The content of organic matter in the surface layer is about 5 to 7 percent. The substratum generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil generally has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. A drainage system is needed to reduce wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if adequate outlets are available. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

133+—Colo silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains. It is occasionally flooded for very brief to long periods unless it is protected. Most areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is recently deposited alluvium about 12 inches thick. It is very dark grayish brown or dark grayish brown silt loam. The substratum to a depth of about 60 inches is very dark gray and very dark grayish brown, firm silty clay loam. In some places the underlying soil is calcareous throughout. In other places it is silt loam throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Ackmore and moderately well drained Nodaway soils. These soils are along drainageways. Nodaway soils dry out more rapidly after rains than the Colo soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Colo soil, and surface runoff is slow. The available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet. The content of organic matter in the surface layer is about 3 to 5 percent. This soil generally has a medium supply of available phosphorus and a very low supply of available potassium. It generally has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. A drainage system is needed to reduce wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if adequate outlets are available. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration. Herbicide application rates should be adjusted because of the low organic matter content in the surface layer.

This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

133B—Colo silty clay loam, 2 to 5 percent slopes. This gently sloping, poorly drained soil is on convex alluvial fans and the lower concave foot slopes near the uplands. Most areas are elongated and range from 5 to 100 acres in size.

Typically, the surface layer is black and very dark grayish brown, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, mottled, friable silty clay loam about 22 inches thick. The upper part of the subsoil is very dark gray, mottled, firm silty clay loam. The lower part to a depth of about 60 inches is dark gray, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the moderately well drained Judson soils on alluvial fans and foot slopes of adjacent upland side slopes. These soils are not so wet as the Colo soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Colo soil, and surface runoff is medium. The available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet. The content of organic matter in the surface layer is about 5 to 7 percent. Reaction in the subsoil typically is neutral. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. A drainage system is needed to improve the timeliness of fieldwork. In places diversion terraces help to control the runoff from adjacent soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table and poor drainage. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

133B+—Colo silt loam, overwash, 2 to 5 percent slopes. This gently sloping, poorly drained soil is on convex alluvial fans and the lower concave foot slopes near the uplands. It is occasionally flooded for very brief to long periods unless it is protected. Most areas are elongated and range from 5 to 100 acres in size.

Typically, the surface layer is recently deposited alluvium about 10 inches thick. It is very dark grayish brown or dark grayish brown, friable silt loam. The subsurface layer is very dark gray, friable silty clay loam about 22 inches thick. The subsoil extends to a depth of about 60 inches. It is very dark gray, mottled, firm silty clay loam in the upper part and dark gray, mottled, firm silty clay in the lower part.

Permeability is moderate in the Colo soil, and surface runoff is medium. The available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet. The content of organic matter in the surface layer is about 3 to 5 percent. Reaction in the subsoil typically is neutral. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. A drainage system is needed to improve the timeliness of fieldwork. In places diversion terraces help to control the runoff from adjacent soils. Tilth generally is good or fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility. Herbicide application rates should be adjusted because of the low organic matter content in the surface layer.

A cover of pasture or hay is effective in controlling erosion. This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

172—Wabash silty clay, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in low areas on flood plains along the major streams. It is occasionally flooded for brief or long periods unless it is protected. Most areas are irregularly shaped and range from 10 to 200 acres in size.

Typically, the surface layer is black, firm silty clay about 8 inches thick. The subsurface layer also is black, firm silty clay. It is about 12 inches thick. The subsoil extends to a depth of about 60 inches. It is black and very dark gray, firm silty clay in the upper part; dark gray and very dark gray, mottled, firm silty clay in the next part; and dark gray and gray, mottled, very firm silty clay in the lower part. In places the surface layer and subsoil contain less clay. In some areas the surface layer is silt loam that has a low content of organic matter. In other areas the surface soil is calcareous.

Included with this soil in mapping are small areas that are ponded for long periods. These areas are shallow surface drains that do not have adequate outlets. Establishing crops is difficult in these areas, and crops that do grow generally drown out in most years. Included areas make up 5 to 10 percent of the unit.

Permeability is very slow in the Wabash soil. Surface runoff also is very slow. A seasonal high water table is at the surface to 1 foot below the surface. The available water capacity is moderate. The shrink-swell potential is very high. Roots are restricted at a depth of 2 to 4 feet. The content of organic matter in the surface layer is about 4 to 6 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has very poor tilth and tends to puddle if worked when wet.

Most areas are cultivated. If drained and protected from flooding, this soil is suited to corn, soybeans, and small grain. In undrained areas the soil is better suited to pasture. Tile drainage is generally not recommended because of the restricted permeability and because outlets are not readily available. A good surface drainage system can remove surface water. In many areas diverting runoff water from soils upslope is beneficial for crop production and reduces siltation on this soil. The soil warms slowly in the spring and dries slowly after rains. In years of heavy rainfall, fieldwork may be delayed. A ridge-till planting system, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and increases soil temperature. Because of the clayey surface layer, this soil is difficult to till. Plowing in the fall improves the timeliness of fieldwork but increases the susceptibility to soil blowing. Leaving a rough plowed surface and alternating plowed and unplowed strips help to control soil blowing. Chisel plowing, which leaves crop residue on the surface, also helps to control soil blowing. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Management may be difficult because the soil is poorly drained and subject to occasional flooding. Using forage species that are tolerant of wetness can help to maintain productivity. Drainage is necessary for alfalfa crops. Diversions or terraces on adjacent soils in the uplands and dikes or levees along major stream channels may be needed to protect this soil from flooding. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIIw.

179D—Gara loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on irregular convex side slopes in the uplands that are dissected by small drainageways. Slopes are typically short. Most areas are irregularly shaped, but some are long and narrow. Individual areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark gray, friable loam about 8 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable loam about 7 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. In some places the surface layer is thicker and darker. In other places the surface layer and subsoil are thinner because of erosion.

Included with this soil in mapping are areas of the somewhat poorly drained Bucknell soils and areas of poorly drained soils. These included soils formed in a gray, clayey paleosol in coves near the head of drainageways and on the upper parts of the landscape. Also included are areas of the moderately well drained Armstrong soils, which formed in a red, clayey paleosol weathered from glacial till, on shoulders in upslope areas. The included soils have a clayey subsoil and are more difficult to till than the Gara soil. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for pasture and hay. This soil is poorly suited to corn and small grain. If cultivated crops are grown, erosion is a hazard. Row crops should be grown only in a rotation to establish seedings for hay and pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping can minimize soil losses. If terraces are used, keeping cuts to a minimum helps to prevent unnecessary exposure of the less productive, firm glacial till, which is low in fertility. Medium and large stones from the subsoil may also interfere with some tillage activities. Applying conservation practices upslope, which increases the rate of water infiltration, helps to control erosion on this soil. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is suited to trees, and some areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IVe.

179D2—Gara clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on irregular convex side slopes in the uplands that are dissected by small drainageways. Slopes are typically short. Most areas are irregularly shaped, but some are long and narrow. Individual areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown and dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the yellowish brown subsoil with the surface layer. The subsoil is about 34 inches thick. The upper part is yellowish brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. In places the surface layer is thicker and darker. In some areas, the subsoil is thinner and the calcareous substratum is closer to the surface.

Included with this soil in mapping are areas of the somewhat poorly drained Bucknell soils and areas of poorly drained soils. These soils formed in a gray, clayey paleosol in coves near the head of drainageways and on the upper parts of the landscape. Also included are the moderately well drained Armstrong soils, which formed in a red, clayey paleosol weathered from glacial till. Armstrong soils are on shoulders in upslope positions on the landscape. All of these included soils have a clayey subsoil and are more difficult to till than the Gara soil. Severely eroded Gara soils are also included in mapping. These soils are in areas about ½ acre in size and are scattered throughout the map unit. They have a low content of organic matter and require more fertility management practices than the major Gara soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The soil has a low supply of available phosphorus and a very low supply of available potassium. It has fair tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Many areas are cultivated. Some areas are used for pasture or hay. Nearly all areas of this soil were cultivated at some time in the past. The soil is poorly suited to corn and small grain. If cultivated crops are grown, further erosion is a severe hazard. Row crops should be grown only in a rotation to establish seedings for hay and pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping can minimize soil losses. If terraces are used, keeping cuts to a minimum helps to prevent exposure of the less productive, firm glacial till, which is low in fertility. A cover of topsoil material is needed in areas where terraces are constructed. In some areas medium and large stones from the subsoil interfere with some tillage activities. Applying conservation practices upslope, which increases the rate of water infiltration, also helps to control erosion on this soil. More fertilizer management practices are needed on this soil than on the less eroded Gara soils. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is suited to trees, and a few scattered small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IVe.

179E—Gara loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on convex side slopes in the uplands that are dissected by small drainageways. Most areas are long and narrow and generally are parallel to intermittent streams. Individual areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark gray, friable loam about 6 inches thick. The subsurface layer is dark grayish brown, friable loam about 5 inches thick. The subsoil is yellowish brown, mottled, firm clay loam about 33 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. In places the surface layer and subsoil are thinner because of erosion.

Included with this soil in mapping are areas of the moderately well drained Armstrong soils. These soils formed in a red, clayey paleosol weathered from glacial till on narrow ridges and shoulders in the upper positions on the landscape. Also included are the somewhat poorly drained Mystic soils. These soils formed in old alluvium on foot slopes on the lower parts of the landscape. They are more difficult to manage than the Gara soil and may become droughty during the later part of the growing season. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The soil has a low supply of available phosphorus and a very low supply of available potassium. It has good tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for pasture or woodland. This soil is unsuited to cultivated crops and small grain. It is poorly suited to grasses and legumes for hay but is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to trees, and a few areas support native hardwoods. The location of logging trails or roads should be carefully considered because of the hazard of erosion. Laying out the trails or roads on the contour or nearly on the contour helps to control erosion. Because of the slope, the use of equipment is limited. Special equipment can be used, but the equipment should be operated carefully. Seedling survival is not a concern in areas of this soil.

The land capability classification is VIe.

179E2—Gara clay loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes in the uplands that are dissected by small drainageways. Most areas are long and narrow and generally are parallel to intermittent streams. Individual areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark gray, friable clay loam about 6 inches thick. Plowing has mixed some of the yellowish brown subsoil with the surface layer. The subsoil is yellowish brown, mottled, firm clay loam about 30 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. In places the surface layer is thicker and darker. In some areas, the subsoil is thinner and the calcareous substratum is closer to the surface.

Included with this soil in mapping are areas of the moderately well drained Armstrong soils. These soils formed in a red, clayey paleosol weathered from glacial till on narrow ridges and shoulders in the upper positions on the landscape. Also included are the somewhat poorly drained Mystic soils. These soils formed in old alluvium on foot slopes in the lower positions on the landscape. They are more difficult to manage than the Gara soil and may become droughty during the later part of the growing season. Severely eroded Gara soils are also included in mapping. These soils are in areas about ½ acre in size and are scattered throughout the map unit. They have a low content of organic matter and require more fertility management practices than the major Gara soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The soil has a low supply of available phosphorus and a very low supply of available potassium. It has fair tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for hay and pasture. Some areas are cultivated. Most areas of this soil have been cultivated at some time in the past. The soil is unsuited to cultivated crops and small grain. It is poorly suited to grasses and legumes for hay but is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to trees. The location of logging trails or roads should be carefully considered because of the hazard of erosion. Laying out the trails or roads on the contour or nearly on the contour helps to control erosion. Because of the slope, the use of equipment is limited. Special equipment can be used, but the equipment should be operated carefully. Seedling survival is not a concern in areas of this soil.

The land capability classification is VIe.

179F—Gara loam, 18 to 25 percent slopes. This steep, well drained soil is on convex side slopes in the uplands that are dissected by small drainageways along the major streams and valleys. Most areas are long and narrow and generally are parallel to intermittent streams. Individual areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark gray, friable loam about 6 inches thick. The subsurface layer is dark grayish brown, friable loam about 5 inches thick. The subsoil is yellowish brown, mottled, firm clay loam about 30 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. In places the surface layer is thicker and darker. In some areas the surface layer and subsoil are thinner because of erosion.

Permeability is moderately slow, and surface runoff is very rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for pasture or woodland. This soil is unsuited to cultivated crops, small grain, and grasses and legumes for hay. It is better suited to pasture, woodland, and wildlife habitat. Maintaining a permanent plant cover is most effective in controlling sheet and gully erosion. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is moderately well suited to pasture, and this use is effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. Because of the slope, special equipment may be needed and cultural measures should be applied on the contour when pasture or hayland is renovated. Brush control is generally needed in areas used for pasture because of overgrazing and low or moderate forage production.

This soil is suited to trees, and many areas support native hardwoods. The location of logging trails or roads should be carefully considered because of the hazard of erosion. Laying out the trails or roads on the contour or nearly on the contour helps to control erosion. Because of the slope, the use of equipment is limited. Special equipment can be used, but the equipment should be operated carefully. Seedling survival is not a concern in areas of this soil.

The land capability classification is VIe.

179F2—Gara clay loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on convex side slopes in the uplands that are dissected by small drainageways and gullies along major stream valleys. Most areas are long and narrow and generally are parallel to intermittent streams. Individual areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 5 inches thick. Plowing has mixed some of the yellowish brown subsoil with the surface layer. The subsoil is about 29 inches thick. The upper part is dark grayish brown and yellowish brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. In some places the surface layer is thicker and darker. In other places the surface layer and subsoil are thinner because of erosion.

Included with this soil in mapping are severely eroded Gara soils. These soils are in areas about ½ acre in size and are scattered throughout the map unit. They have a low content of organic matter and require additional fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and surface runoff is very rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for pasture or woodland. This soil is unsuited to cultivated crops, small grain, and grasses and legumes for hay. It is better suited to pasture, woodland, and wildlife habitat. Maintaining a permanent plant cover is most effective in controlling sheet and gully erosion. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not beer applied in the past 3 or 4 years.

This soil is moderately well suited to pasture, and this use is effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. Because of the slope, special equipment may be needed and cultural measures should be applied on the contour when pasture or hayland is renovated. Brush control is generally needed in areas used for pasture because of overgrazing and low or moderate forage production.

This soil is suited to trees, and a few scattered areas support native hardwoods. The location of logging trails and roads should be carefully considered because of the hazard of erosion. Laying out the trails or roads on the contour or nearly on the contour helps to control erosion. Because of the slope, the use of equipment is limited. Special equipment can be used, but the equipment should be operated carefully. Seedling survival is not a concern in areas of this soil.

The land capability classification is VIIe.

192C—Adair clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the slightly lower narrow convex ridges, short convex side slopes, and shoulders in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 3 to 15 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown, friable clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable clay loam about 5 inches thick. The subsoil is about 38 inches thick. The upper part is brown, firm clay loam that has yellowish red mottles; the next part is reddish brown and strong brown, mottled, very firm clay; and the lower part is mottled yellowish brown and grayish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In places the surface layer is thinner because of erosion. In some areas the subsoil is grayer and has thicker clay layers.

Permeability is slow, and surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a very low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated, and some areas are used for pasture. In most areas this soil is managed along with adjacent soils. It is suited to corn, soybeans, and small grain. If row crops are grown, erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. Constructing terraces on the Adair soil can expose the clayey subsoil, which makes seedbed preparation difficult even when terrace channels are topdressed with material from the surface soil. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. Maintaining a cover of hay or pasture plants, however, is effective in controlling erosion. Management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line can improve the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IIIe.

192C2—Adair clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on the slightly lower convex ridges, on short convex side slopes, and on shoulders in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is about 35 inches thick. The upper part is brown, firm clay loam; the next part is reddish brown and strong brown, mottled, very firm clay; and the lower part is strong brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil is grayer and has clay at a lower depth.

Included with this soil in mapping are severely eroded Adair soils. These soils are in areas about ½ acre in size and are scattered throughout the map unit. They have a low content of organic matter, cannot be easily managed, and require additional fertility management practices. They make up 5 to 10 percent of the unit.

Permeability is slow in the Adair soil, and surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil has a very low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. In most areas this soil is managed along with adjacent soils. It is suited to corn, soybeans, and small grain. If row crops are grown, further erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed on adjacent soils upslope. If terraces are constructed in areas of the Adair soil, exposure of the clayey subsoil can make seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Adair soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture is effective in controlling erosion, but the soil may become droughty in the later part of the growing season. Therefore, if rainfall is not timely during the growing season, forage production may be reduced. Applying conservation practices on adjacent soils upslope helps to control erosion and also benefits the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IIIe.

192D—Adair clay loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on short convex side slopes, on shoulders, and on convex narrow ridges in the uplands. Most areas are irregularly shaped or long and narrow. Individual areas range from 4 to 15 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown, friable clay loam about 6 inches thick. The subsurface layer is very dark grayish brown, mottled, friable clay loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part is brown, firm clay loam; the next part is reddish brown and strong brown, very firm clay; and the lower part is strong brown, very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In places the surface layer is thinner because of erosion. In some areas the subsoil is grayer and has thicker clay layers.

Permeability is slow, and surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a very low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. In most areas this soil is managed along with adjacent soils. It is poorly suited to corn, soybeans, and small grain, mainly because it is subject to erosion. It is better suited to hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed on adjacent soils upslope. If terraces are constructed in areas of the Adair soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. Deferring tillage during wet seasons helps to prevent surface compaction and improves tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture is effective in controlling erosion, but the soil may become droughty in the later part of the growing season. Therefore, if rainfall is not timely during the growing season, forage production may be reduced. Applying conservation practices on adjacent soils upslope helps to control erosion and can also benefit the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

192D2—Adair clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short convex side slopes, on shoulders, and on convex narrow ridges in the uplands. Most areas are irregularly shaped or long and narrow. Individual areas range from 4 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is about 30 inches thick. The upper part is brown, friable clay loam; the next part is reddish brown and strong brown, mottled, very firm clay; and the lower part is strong brown, very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil is grayer and has thicker clay layers.

Included with this soil in mapping are areas of severely eroded Adair soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter, cannot be easily managed, and require additional fertility management practices. They make up as much as 5 to 10 percent of the unit.

Permeability is slow in the Adair soil, and surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil has a very low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. In most areas this soil is managed along with adjacent soils. It is poorly suited to corn, soybeans, and small grain, mainly because it is subject to further erosion. It is better suited to hay and pasture. If row crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes are needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed on adjacent soils upslope. If terraces are constructed in areas of the Adair soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Adair soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture is effective in controlling erosion, but the soil may become droughty in the later part of the growing season. Therefore, if rainfall is not timely during the growing season, forage production may be reduced. Applying conservation practices on adjacent soils upslope helps to control erosion and also benefits the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

212—Kennebec silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains along the major streams. It is occasionally flooded for brief periods unless it is protected. Most areas are elongated and range from 10 to 70 acres in size. The areas may extend for 1 mile or more in length.

Typically, the surface layer is black, friable silt loam about 8 inches thick. The subsurface layer is friable silt loam about 40 inches thick. The upper part is black, the next part is black and very dark gray, and the lower part is very dark gray and is mottled. The substratum to a depth of about 60 inches is very dark grayish brown, mottled silt loam. In some places the surface layer contains less organic matter.

Included with this soil in mapping are small areas of the poorly drained Colo soils at the higher elevations. These soils contain more clay than the Kennebec soil. They make up about 5 percent of the unit.

Permeability is moderate in the Kennebec soil, and surface runoff is slow. A seasonal high water table is at a depth of 3 to 5 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 4 to 6 percent. The subsoil has a low supply of available phosphorus and a medium supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. If it is protected from flooding, this soil is well suited to corn, soybeans, and small grain. It is generally farmed along with adjacent soils that are more poorly suited to row crops. Diverting runoff water from the soils upslope improves crop production and helps to prevent siltation. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to pasture and hay. Most areas that are narrow and are subject to flooding are used as permanent pasture. Overgrazing or grazing during wet periods or after flooding has occurred causes surface compaction and puddling of the soil. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

220—Nodaway silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains along the major streams and small tributaries. These areas generally contain the current stream channel with shallow to deep, old stream meanders. The soil is occasionally flooded for very brief or brief periods unless it is protected. Most areas are elongated and range to several hundred acres in size. Some areas extend for many miles in length.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. It has dark grayish brown strata. The substratum to a depth of about 60 inches is stratified very dark gray, very dark grayish brown, dark grayish brown, and grayish brown silt loam. In some areas the surface layer is loam or sandy loam.

Included with this soil in mapping are scattered small areas of soils that have sandy textures. These soils occur on sandbars and sandy beaches at the higher elevations along stream channels. They are more droughty than the Nodaway soil and contain more sand. They make up about 5 percent of the unit.

Permeability is moderate in the Nodaway soil, and surface runoff is slow. A seasonal high water table is at a depth of 3 to 5 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. If it is protected from flooding, this soil is well suited to corn, soybeans, and small grain. It is generally farmed along with adjacent soils that are more poorly suited to row crops. In some areas water may pond in old stream meanders. This ponding can delay fieldwork. Diverting runoff water from soils upslope improves crop production and helps to prevent siltation. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses for hay and pasture. It is poorly suited to legumes because of flooding. Most areas that are narrow and are subject to flooding are used as permanent pasture. Overgrazing or grazing during wet periods or after flooding has occurred causes surface compaction and puddling of the soil. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

This soil is moderately well suited to trees, and a few small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIw.

222C—Clarinda silty clay loam, 5 to 9 percent slopes. This moderately sloping, poorly drained soil is on short convex side slopes in coves and on the lower narrow ridges near the head of drainageways in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is black and very dark gray, friable silty clay loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. It is dark gray and gray, mottled, firm and very firm silty clay in the upper part and gray and light gray, mottled, firm silty clay and clay in the lower part. In places the surface layer is thinner because of erosion. In some areas the lower part of the subsoil contains less clay.

Included with this soil in mapping are small areas of Clearfield soils in positions upslope near the head of drainageways. These soils formed in 3 to 5 feet of loess underlain by a clayey buried soil. Because they are more permeable than the Clarinda soil, using a tile drainage system in areas of these soils can generally improve the timeliness of fieldwork. Included soils make up 5 to 10 percent of the unit.

Permeability is very slow in the Clarinda soil, and surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of about 1 foot. Roots are restricted at a depth of 1 to 3 feet. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is better suited to small grain, hay, and pasture. If cultivated crops are grown, the wetness is a very serious limitation and erosion is a severe hazard. Because the soil is wet and seepy for long periods, seedbed preparation is difficult. A cover of grasses helps to control erosion. In row-cropped areas, erosion can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil losses. In many areas a narrow, seepy band occurs on the upper part of the side slopes. This band warms slowly in the spring and dries very slowly after rains. Planting is delayed in wet years. Because of the very slow permeability, tile drainage is not feasible in areas of the Clarinda soil. Interceptor tile can be installed on adjacent soils upslope. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Clarinda soil, exposure of the clayey subsoil makes management more difficult, even if the terrace channels are topdressed with material from the surface layer. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table and poor drainage. A cover of hay and pasture is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line can also improve the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVw.

222C2—Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, poorly drained soil is on short convex side slopes and the lower narrow ridges near the head of drainageways in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 6 inches thick. Plowing has mixed some of the dark gray subsoil with the surface layer. The subsoil extends to a depth of about 60 inches. It is dark gray, mottled, firm silty clay in the upper part and gray and light gray, mottled, firm silty clay and clay in the lower part. In some areas the lower part of the subsoil contains less clay.

Included with this soil in mapping are small areas of Clearfield soils in positions upslope near the head of drainageways. These soils formed in 3 to 5 feet of loess underlain by a clayey buried soil. Because they are more permeable than the Clarinda soil, using a tile drainage system in areas of these soils can generally improve the timeliness of fieldwork. Also included in mapping are areas of severely eroded Clarinda soils. These areas are ¼ to ½ acre in size and are on shoulders. The severely eroded soils have a low content of organic matter, are more difficult to manage than the less eroded Clarinda soil, and require more fertility management. Included soils make up 5 to 10 percent of the unit.

Permeability is very slow in the Clarinda soil, and surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of about 1 foot. Roots are restricted at a depth of 1 to 3 feet. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil has a very low supply of available phosphorus and potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is better suited to small grain, hay, and pasture. If cultivated crops are grown, the wetness is a very serious limitation and further erosion is a severe hazard. Because the soil is wet and seepy for long periods, seedbed preparation is difficult. A cover of grasses helps to control erosion. In many areas a narrow, seepy band is on the upper part of the side slopes. This band commonly remains wet until midsummer. The soil warms slowly in the spring and dries very slowly after rains. Planting is delayed in wet years. Because of the very slow permeability, tile drains are not feasible in areas of the Clarinda soil. Interceptor tile can be installed on adjacent soils upslope. In row-cropped areas, erosion can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Clarinda soil, exposure of the clayey subsoil makes management more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Clarinda soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table and poor drainage. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line can also benefit the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVw.

222D2—Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, poorly drained soil is on short convex side slopes in coves near the head of drainageways in the uplands. Most areas are narrow and irregularly shaped. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is black and very dark gray, friable silty clay loam about 7 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. It is dark gray, mottled, friable silty clay in the upper part; dark gray and gray, mottled, firm clay in the next part; and gray, mottled, firm clay in the lower part. In places the surface layer is thinner because of erosion. In some areas the lower part of the subsoil contains less clay.

Included with this soil in mapping are small areas of Clearfield soils in areas upslope near the head of drainageways. These soils formed in 3 to 5 feet of loess underlain by a clayey buried soil. Because they are more permeable than the Clarinda soil, a tile drainage system in areas of these soils can generally improve the timeliness of fieldwork. Also included in mapping are areas of severely eroded Clarinda soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter, are more difficult to manage than the less eroded Clarinda soil, and require more fertility management. Included soils make up 5 to 10 percent of the unit.

Permeability is very slow in the Clarinda soil, and surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of about 1 foot. Roots are restricted at a depth of 1 to 3 feet. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil has a very low supply of available phosphorus and potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain. It is better suited to hay and pasture. If row crops are grown, the wetness is a serious limitation and further erosion is a severe hazard. Erosion can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in upslope areas to minimize soil losses. Because the soil is wet and seepy for long periods, seedbed preparation is difficult. A cover of grasses helps to control erosion. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Clarinda soil, exposure of the clayey subsoil makes management more difficult, even if the terrace channels are topdressed with material from the surface soil. In many areas a narrow, seepy band occurs on the upper part of side slopes. This band commonly remains wet until midsummer. The soil warms slowly in the spring and dries very slowly after rains. Planting is delayed in wet years. Because of the very slow permeability, a tile drainage system is not feasible. Interceptor tile can be installed on adjacent soils upslope. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table and poor drainage. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line can improve the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

248—Wabash silty clay loam, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in the lower areas on flood plains. It is occasionally flooded for brief or long periods unless it is protected. Most areas are irregularly shaped and wide. Individual areas range from 5 to 250 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is about 12 inches thick. The upper part is black, friable silty clay loam, and the lower part is black, friable silty clay. The subsoil extends to a depth of about 60 inches. It is black and very dark gray, firm silty clay in the upper part; dark gray and very dark gray, mottled, firm silty clay in the next part; and dark gray and gray, mottled, very firm silty clay in the lower part. In places the surface layer is overlain by about 12 inches of recently deposited silt loam. In some areas the surface layer is silty clay. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas that are subject to ponding for long periods. These areas are shallow surface drains that generally do not have adequate outlets. Establishing crops is difficult in these areas, and if crops do grow, they generally drown out in most years. Included areas make up about 5 percent of the unit.

Permeability is very slow in the Wabash soil. Surface runoff also is very slow. The available water capacity is moderate. A seasonal high water table is at the surface to 1 foot below the surface. The shrink-swell potential is very high. Roots are restricted at a depth of 2 to 4 feet. The content of organic matter in the surface layer is about 4 to 6 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. If drained and protected from flooding, this soil is suited to corn, soybeans, and small grain. In undrained areas it is better suited to pasture. A drainage system is needed to reduce wetness and provide good aeration and a deep root zone for plants. Tile drains generally work satisfactorily only if they are closely spaced and if adequate outlets are available. Surface drains are needed to remove surface water in some areas. Tilth generally is fair in the surface layer. Returning crop residue to the soil and deferring tillage when the soil is wet help to maintain tilth. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Using forage species that are tolerant of wetness can help to maintain productivity. Drainage is necessary for alfalfa crops. Diversions or terraces on adjacent soils in the uplands and dikes or levees along major stream channels may be needed to protect areas of this soil from flooding. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIIw.

248+—Wabash silt loam, overwash, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in the lower areas on flood plains. It is occasionally flooded for brief or long periods unless it is protected. Most areas are irregularly shaped and wide. Individual areas range from 5 to 250 acres in size.

Typically, the surface layer is recently deposited alluvium about 13 inches thick. It is stratified dark grayish brown or grayish brown, friable silt loam. Below this is about 8 inches of black, friable silty clay loam and 12 inches of black silty clay. The subsoil extends to a depth of about 60 inches. It is black and very dark gray, firm silty clay in the upper part; dark gray and very dark gray, mottled, firm silty clay in the next part; and dark gray and gray, mottled, very firm silty clay in the lower part. In places the surface layer is overlain by about 12 inches of recently deposited silt loam. In some areas the surface layer is silty clay. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ackmore soils. These soils are slightly higher on the landscape than the Wabash soil and dry out earlier after periods of rainfall. They make up 5 to 10 percent of the unit.

Permeability is very slow in the Wabash soil. Surface runoff also is very slow. The available water capacity is moderate. A seasonal high water table is at the surface to 1 foot below the surface. The shrink-swell potential is very high at a depth of 1 to 2 feet. Roots are restricted at a depth of 2 to 4 feet. The content of organic matter in the surface layer is about 2 to 4 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. If drained and protected from flooding, this soil is suited to corn, soybeans, and small grain. In undrained areas it is better suited to pasture. A drainage system is needed to reduce wetness and provide good aeration and a deep root zone for plants. Tile drains generally work satisfactorily only if they are closely spaced and if adequate outlets are available. Surface drains are needed to remove surface water in some areas. Returning crop residue to the soil and deferring tillage when the soil is wet help to maintain tilth. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years. Herbicide application rates should be adjusted because of the lower organic matter content in the surface layer.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Using forage species that are tolerant of wetness can help to maintain productivity. Drainage is necessary for alfalfa crops. Diversions or terraces on adjacent soils in the uplands and dikes or levees along major stream channels may be needed to protect areas of this soil from flooding. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIIw.

269—Humeston silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains along the major streams. It is occasionally flooded for very brief periods unless it is protected. Most areas are irregularly shaped and range from 10 to 400 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 10 inches thick. The subsurface layer is very dark gray and dark gray, mottled, friable silt loam about 14 inches thick. The subsoil extends to a depth of about 60 inches. It is mottled. The upper part is dark gray, firm silty clay loam, and the lower part is very dark gray, firm silty clay. In places the surface layer is silt loam and contains less organic matter. In some areas the subsurface layer is darker and contains more clay. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas that are ponded for long periods. These areas are shallow surface drains that do not have adequate outlets. Establishing crops is difficult in these areas, and if crops do grow, they generally drown out in most years. Included areas make up 5 to 10 percent of the unit.

Permeability is very slow in the Humeston soil. Surface runoff also is very slow. A seasonal high water table is at the surface to 1 foot below the surface. The available water capacity is high. The shrink-swell potential is high at a depth of about 2 feet. Roots are restricted at a depth of 3 to 4 feet. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a medium supply of available phosphorus and a very low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet. Crusting may occur after hard rains if the soil is plowed deeply.

Most areas are cultivated. If drained and protected from flooding, this soil is suited to corn, soybeans, and small grain. In undrained areas it is better suited to pasture. Tile drains generally do not perform satisfactorily because of the restricted permeability and a lack of available outlets. A surface drainage system may be needed in addition to the tile drains. In many areas diverting runoff water from soils upslope improves crop production on this soil and helps to prevent siltation. The soil warms slowly in the spring and dries slowly after rains. In years of heavy rainfall, fieldwork may be delayed. A ridge-till planting system, in which the soil is ridged and row crops are planted on the ridges, helps to overcome wetness and increases soil temperature. Plowing in the fall improves the timeliness of fieldwork but increases the susceptibility to soil blowing. Leaving a rough plowed surface and alternating plowed and unplowed strips help to control soil blowing. Chisel plowing, which leaves crop residue on the surface, also helps to control soil blowing. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is moderately well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIIw.

269+—Humeston silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains along the major streams. It is occasionally flooded for very brief periods unless it is protected. Most areas are irregularly shaped and range from 10 to 100 acres in size.

Typically, the surface layer is stratified dark yellowish brown and dark gray, friable silt loam about 9 inches thick. Below this is a buried layer of very dark gray, friable silty clay loam about 10 inches thick underlying recent, lighter colored sediments. The subsurface layer is very dark gray, dark gray, and gray, mottled, friable silt loam. The subsoil to a depth of about 60 inches is firm silty clay. It is mottled. The upper part is dark gray and gray, and the lower part is very dark gray. In some places the buried layer is darker and contains more clay. In other places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ackmore soils. These soils are at the slightly higher elevations. They dry out earlier after rains than the Humeston soil. They make up 5 to 10 percent of the unit.

Permeability is very slow in the Humeston soil. Surface runoff also is very slow. A seasonal high water table is at the surface to 1 foot below the surface. The available water capacity is high. The shrink-swell potential is high at a depth of 2 to 3 feet. Roots are restricted at a depth of 3 to 4 feet. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil has a medium supply of available phosphorus and a very low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. If drained and protected from flooding, this soil is suited to corn, soybeans, and small grain. In undrained areas it is better suited to pasture. Tile drains may not perform satisfactorily because of the restricted permeability and a lack of adequate outlets. A surface drainage system may be needed in addition to the tile drains. In many areas, diverting runoff water from soils upslope and protecting the soil from flooding improve crop production and help to prevent siltation. The soil warms slowly in the spring and dries slowly after rains. In years of heavy rainfall, fieldwork may be delayed. A ridge-till planting system, in which the soil is ridged and row crops are planted on the ridges, helps to overcome wetness and increases soil temperature. Plowing in the fall improves the timeliness of fieldwork but increases the susceptibility to soil blowing. Leaving a rough plowed surface and alternating plowed and unplowed strips help to control soil blowing. Chisel plowing, which leaves crop residue on the surface, also helps to control soil blowing. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years. Herbicide application rates should be adjusted because of the lower organic matter content in the surface layer.

This soil is moderately well suited to grasses for hay and is suited to pasture. It is poorly suited to legumes because of the seasonal high water table, poor drainage, and flooding. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIIw.

273B—Olmitz loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on the lower, slightly concave foot slopes and convex alluvial fans. It is in areas immediately downslope from moderately steep or steep soils that formed in glacial till. Most areas of this soil are long and narrow and range from 5 to 10 acres in size.

Typically, the surface layer is black, friable loam about 9 inches thick. The subsurface layer is black and very dark grayish brown, friable clay loam about 27 inches thick. The subsoil to a depth of about 60 inches is friable clay loam. The upper part is dark brown, the next part is brown, and the lower part is dark yellowish brown.

Included with this soil in mapping are small areas of the well drained Gara and Shelby soils. These soils are upslope from the Olmitz soil and are on the more sloping side slopes. They formed in glacial till. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Olmitz soil, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a very low supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled in cultivated areas by a system of conservation tillage that leaves crop residue on the surface, diversion terraces, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil loss. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIe.

273C—Olmitz loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the lower, slightly concave foot slopes and on convex alluvial fans. It is in areas immediately downslope from moderately steep and steep soils that formed in glacial till and upslope from the broad, flat alluvial flood plains. Most areas of this soil are long and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is black, friable loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, friable clay loam about 25 inches thick. The subsoil to a depth of about 60 inches is friable clay loam. The upper part is dark brown, the next part is brown, and the lower part is dark yellowish brown.

Included with this soil in mapping are small areas of the well drained Gara and Shelby soils. These soils are upslope from the Olmitz soil and are on the more sloping side slopes. They formed in glacial till. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Olmitz soil, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a very low supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled in cultivated areas by a system of conservation tillage that leaves crop residue on the surface, diversion terraces, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. Because the areas of this soil are relatively small, they are generally farmed along with adjacent soils that are more poorly suited to row crops. Therefore, a combination of conservation practices is needed on this soil and in areas upslope to minimize soil loss. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

286B—Colo-Judson-Nodaway complex, 0 to 5 percent slopes. This nearly level and gently sloping complex is in narrow drainageways in the uplands. The poorly drained Colo soil is in the lower positions on the landscape. The moderately well drained Judson soil is in the higher landscape positions, near upland side slopes. The moderately well drained Nodaway soil is in the lower landscape positions, near upland drainageways. The Nodaway soil is occasionally flooded for very brief or brief periods unless it is protected. Most areas of this map unit are long and narrow and range from 5 to 75 acres in size. They are about 45 percent Colo soil, 30 percent Judson soil, and 25 percent Nodaway soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Colo soil is black silty clay loam about 8 inches thick. The subsurface layer also is black silty clay loam. It is about 23 inches thick. Below this is a transitional layer of very dark gray, firm silty clay loam about 12 inches thick. The substratum to depth of about 60 inches is very dark gray and very dark grayish brown silty clay loam. In places the substratum is silty clay. In some areas the surface layer is overlain by recently deposited silt loam.

Typically, the surface layer of the Judson soil is black, friable silty clay loam about 8 inches thick. The subsurface layer is black, very dark brown, and very dark grayish brown silty clay loam about 25 inches thick. The subsoil to a depth of about 60 inches is dark brown and brown, mottled, friable silty clay loam. In places the soil is silt loam throughout and is dark to a greater depth.

Typically, the surface layer of the Nodaway soil is very dark grayish brown, friable silt loam about 7 inches thick. It has dark grayish brown strata. The substratum to a depth of about 60 inches is stratified very dark grayish brown, grayish brown, and dark grayish brown silt loam.

Permeability is moderate in the Colo, Judson, and Nodaway soils. Surface runoff is medium on the Colo and Judson soils and slow on the Nodaway soil. The available water capacity is high in the Colo and Nodaway soils and very high in the Judson soil. The Colo soil has a seasonal high water table at a depth of 1 to 3 feet. The Nodaway soil has a seasonal high water table at a depth of 3 to 5 feet. The content of organic matter in the surface layer is about 5 to 7 percent in the Colo soil, 3.5 to 4.5 percent in the Judson soil, and 1.5 to 2.5 percent in the Nodaway soil. The supply of available phosphorus and potassium is medium in the subsoil of the Colo and Nodaway soils. The subsoil of the Judson soil has a low supply of available phosphorus and a very low supply of available potassium. The Colo and Nodaway soils have fair tilth, and the Judson soil has good tilth. All three soils tend to puddle if worked when wet.

Most areas are managed along with adjacent soils as cropland, pasture, or hayland. If these soils are drained and protected from runoff water, they are moderately well suited to corn, soybeans, and small grain. Many areas are dissected by waterways that cannot be crossed by machinery. Areas near small streams are subject to short periods of flooding. Returning crop residue to the soils or regularly adding other organic material and deferring tillage when the soils are wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

These soils are well suited to grasses for hay and pasture. The Colo and Nodaway soils are poorly suited to legumes because of flooding, the seasonal high water table, and poor drainage. Overgrazing or grazing when the soils are too wet and during periods of flooding causes surface compaction, which restricts root development, increases puddling, and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

The land capability classification is IIw.

368—Macksburg silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on wide upland divides. Most areas are rounded and range from 60 to several hundred acres in size.

Typically, the surface layer is black, friable silty clay loam about 6 inches thick. The subsurface layer is black and very dark grayish brown, friable silty clay loam about 15 inches thick. The subsoil to a depth of about 60 inches is dark grayish brown, grayish brown, and light brownish gray, friable, mottled silty clay loam.

Included with this soil in mapping are small areas of very poorly drained soils. These soils are in slightly depressional areas upslope from the Macksburg soil. They have a gray subsurface layer. They are subject to ponding for short periods and are more difficult to drain than the Macksburg soil. A surface drainage system is needed in areas of these soils. Included soils make up about 5 percent of the unit.

Permeability is moderately slow in the Macksburg soil, and surface runoff is slow. The available water capacity is very high. A seasonal high water table is at a depth of 2 to 4 feet. The shrink-swell potential is high at a depth of 2 to 3 feet. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A tile drainage system improves the timeliness of fieldwork in years when rainfall is above normal. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to hay and pasture. If the soil is used for pasture, overgrazing or grazing during wet periods causes surface compaction and reduces the rate of water infiltration. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

368B—Macksburg silty clay loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on convex ridgetops and short convex side slopes in the uplands. Most areas are irregularly shaped or long and narrow. Individual areas range from 5 to 160 acres in size. They may extend for several miles in length.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable silty clay loam about 11 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown, mottled, firm silty clay loam; and the lower part is light brownish gray and grayish brown, mottled, friable silty clay loam. In places the subsoil has mottles below a depth of 24 inches. In some areas the upper part of the subsoil is dominantly dark grayish brown.

Included with this soil in mapping are small areas of the poorly drained Clearfield soils. These soils have a grayer subsoil than the Macksburg soil and are underlain by a gray, clayey paleosol. They are seasonally wet and occur near the head of drainageways. They make up about 5 percent of the unit.

Permeability is moderately slow in the Macksburg soil, and surface runoff is medium. The available water capacity is very high. A seasonal high water table is at a depth of 2 to 4 feet. The shrink-swell potential is high at a depth of 2 to 3 feet. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard in the more sloping areas. Row crops can be grown in most years if erosion is controlled. A system of conservation tillage that leaves crop residue on the surface, contour farming, contour stripcropping, and terraces help to prevent excessive soil loss. Using terraces in combination with a system of tile drainage can improve the timeliness of fieldwork in years when rainfall is above normal and can help to control erosion. Grassed waterways help to prevent gully erosion. Because of the restricted permeability, this soil tends to warm slowly in the spring and to dry slowly after rains. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to hay and moderately well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, any seedbed preparation and interseeding should be on the contour because of the hazard of erosion.

The land capability classification is IIe.

369—Winterset silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad upland divides. Most areas are irregularly shaped and range from 5 to 60 acres in size.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer also is black, friable silty clay loam. It is about 10 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, mottled, friable silty clay loam; the next part is dark grayish brown and grayish brown, mottled, firm silty clay; and the lower part is grayish brown and light brownish gray, mottled silty clay loam. The substratum to a depth of about 60 inches is grayish brown silty clay loam. In some areas the subsurface layer is dark gray, friable silt loam.

Included with this soil in mapping are small depressional areas of very poorly drained soils. These soils have a gray subsurface layer. They are seasonally wet and may be subject to ponding for short periods. They are more difficult to drain than the Winterset soil. They make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Winterset soil, and surface runoff is slow. The available water capacity is high. A seasonal high water table is at a depth of 1 to 2 feet. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. A tile drainage system improves the timeliness of fieldwork in years when rainfall is above normal. Fieldwork is usually delayed because the soil warms slowly in the spring and dries out slowly after periods of heavy rainfall. A ridge-till planting system, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and increases soil temperature. Such a system should be arranged so that water will not remain on the soil. Plowing in the fall improves the timeliness of fieldwork but increases the susceptibility to soil blowing. Leaving a rough plowed surface and alternating plowed and unplowed strips help to control soil blowing. Chisel plowing in areas where crop residue has been left on the surface also helps to control soil blowing. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses for hay. It is suited to pasture. It is poorly suited to legumes because of the seasonal high water table and poor drainage. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIw.

370B—Sharpsburg silty clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and short convex side slopes in the uplands. Most areas are long and narrow or irregularly shaped and may extend as much as 1½ miles in length. Individual areas range from 5 to 80 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is very dark brown, friable silty clay loam about 9 inches thick. The subsoil is firm silty clay loam about 29 inches thick. The upper part is brown, the next part is brown and mottled, and the lower part is yellowish brown and mottled. The substratum to a depth of about 60 inches is mottled grayish brown, yellowish brown, strong brown, and brown silty clay loam. In some places the soil is grayish brown and mottled above a depth of 24 inches.

Permeability is moderately slow, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. Erosion is a hazard in cultivated areas. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, a crop rotation that includes grasses and legumes, and stripcropping on the contour or by a combination of these measures. Grassed waterways help to prevent gully erosion. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIe.

370C—Sharpsburg silty clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the slightly lower narrow ridges and short convex side slopes in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 50 acres in size.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is silty clay loam about 28 inches thick. The upper part is brown and firm; the next part is brown, firm, and mottled; and the lower part is yellowish brown, friable, and mottled. The substratum to a depth of about 60 inches is mottled grayish brown, yellowish brown, strong brown, and brown silty clay loam. In places the surface layer is thinner because of erosion. In some areas the soil is grayish brown and mottled at a depth as shallow as 24 inches.

Permeability is moderately slow, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are used for row crops. This soil is suited to corn, soybeans, and small grain. When cultivated crops are grown, erosion is a hazard. It can be controlled by contour farming, contour stripcropping, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

370C2—Sharpsburg silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on the slightly lower narrow ridges and short convex side slopes in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 7 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is silty clay loam about 33 inches thick. The upper part is brown and is friable and firm; the next part is brown, firm, and mottled; and the lower part is yellowish brown, friable, and mottled. The substratum to a depth of about 60 inches is mottled grayish brown, yellowish brown, strong brown, and brown silty clay loam. In some areas the soil is grayish brown and mottled above a depth of 24 inches.

Included with this soil in mapping are small areas of severely eroded Sharpsburg soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter, are more difficult to manage than the major Sharpsburg soil, and require additional fertility management practices. They make up about 5 percent of the unit.

Permeability is moderately slow in the Sharpsburg soil, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2.7 to 3.7 percent. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain. When cultivated crops are grown, further erosion is a hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, a crop rotation that includes grasses and legumes, and contour stripcropping or by a combination of these measures. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. More fertilizer management practices are needed on this soil than on the less eroded Sharpsburg soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, helps to control erosion, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

370D—Sharpsburg silty clay loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Most areas are long and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 3 inches thick. The subsoil is firm silty clay loam about 37 inches thick. The upper part is brown, the next part is brown and mottled, and the lower part is yellowish brown and mottled. The substratum to a depth of about 60 inches is mottled grayish brown, yellowish brown, strong brown, and brown silty clay loam. In places the surface layer is thinner. In some areas the soil is grayish brown and mottled at a depth as shallow as 24 inches.

Permeability is moderately slow, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are used for row crops. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and crop rotations that include meadow crops. Because the areas of this soil are relatively small, they are generally farmed along with adjacent soils that are more poorly suited to row crops. Applying a combination of conservation practices on this soil and in upslope areas can minimize soil losses. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves soil fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

370D2—Sharpsburg silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Most areas are long and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 7 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is silty clay loam about 33 inches thick. The upper part is brown and is friable and firm; the next part is brown, mottled, and firm; and the lower part is yellowish brown, mottled, and friable. The substratum to a depth of about 60 inches is mottled grayish brown, yellowish brown, strong brown, and brown silty clay loam. In some areas the soil is grayish brown and mottled above a depth of 24 inches.

Included with this soil in mapping are small areas of severely eroded Sharpsburg soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter, cannot be easily managed, and require additional fertility management practices. They make up about 5 percent of the unit.

Permeability is moderately slow in the Sharpsburg soil, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are used for row crops. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and crop rotations that include meadow crops. Because the areas of this soil are relatively small, they are generally farmed along with adjacent soils that are more poorly suited to row crops. Applying a combination of conservation practices on this soil and in upslope areas can minimize soil losses. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves soil fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

423C2—Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained soil is on short convex side slopes near the upper end of drainageways and on the lower narrow ridges in the uplands. Most areas are irregularly shaped and range from 4 to 25 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the grayish brown subsoil with the surface layer. The subsoil is about 38 inches thick. The upper part is mottled grayish brown and brown, friable clay loam; the next part is mottled grayish brown and light brownish gray, firm clay; and the lower part is mottled light brownish gray, yellowish brown, and grayish brown, firm clay loam. The substratum to a depth of about 60 inches is mottled light brownish gray, yellowish brown, grayish brown, and light olive brown clay loam.

Included with this soil in mapping are small areas of poorly drained soils that formed in a gray, clayey paleosol. These soils are in the higher positions on the landscape. They are more difficult to manage than the Bucknell soil. Also included are areas of severely eroded Bucknell soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter and have clay mixed in the plow layer. They require additional fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Bucknell soil, and surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. This soil is suited to corn and soybeans, but it is better suited to small grain. If row crops are grown, further erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. Applying a combination of conservation practices on this soil and in upslope areas can minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Bucknell soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Bucknell soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line can improve the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is suited to trees, and a few small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard.

The land capability classification is IIIe.

423D2—Bucknell silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on short convex side slopes near the upper ends of drainageways in the uplands. Most areas are irregularly shaped and range from 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 5 inches thick. Plowing has mixed some of the dark grayish brown subsoil with the surface layer. The subsoil is about 33 inches thick. The upper part is dark grayish brown, mottled, friable clay loam; the next part is dark grayish brown and grayish brown, mottled, firm clay; and the lower part is olive gray, mottled, firm clay. The substratum to a depth of about 60 inches is light olive gray, mottled clay loam.

Included with this soil in mapping are small areas of poorly drained soils that formed in a gray, clayey paleosol. These soils are higher on the landscape than the Bucknell soil and are more difficult to manage. Also included are areas of severely eroded Bucknell soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter and have clay mixed in the plow layer. They require additional fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Bucknell soil. Surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential also is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 0.5 to 1.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. This soil is poorly suited to intensive row cropping. It is better suited to small grain, hay, and pasture. If row crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes are needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Bucknell soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Bucknell soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains in areas of adjacent soils above the seep line also benefits the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is suited to trees, and a few small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard.

The land capability classification is IVe.

428B—Ely silty clay loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on the lower, slightly concave foot slopes and alluvial fans. It is in areas immediately downslope from the soils on moderately sloping side slopes that formed in loess and upslope from the broad, flat flood plains. Most areas of this soil are long and narrow and range from 4 to 10 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable silty clay loam about 19 inches thick. The subsoil is friable silty clay loam about 27 inches thick. It is mottled. The upper part is very dark grayish brown, the next part is dark brown, and the lower part is brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Colo soils in landscape positions downslope, near the main drainageways. These soils are subject to more seasonal wetness than the Ely soil. They make up 5 to 15 percent of the unit.

Permeability is moderate in the Ely soil, and surface runoff is medium. A seasonal high water table is at a depth of 2 to 4 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil generally has a low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. A tile drainage system may be needed to reduce wetness during spring months. Because the soil is subject to erosion, placing diversion terraces in areas upslope helps to control erosion by diverting runoff water. In many areas, diverting runoff water improves crop production and reduces siltation on this soil. Erosion also can be controlled in cultivated areas by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

The land capability classification is IIe.

430—Ackmore silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains and alluvial fans. It is occasionally flooded for very brief or brief periods unless it is protected. Most areas are elongated and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The substratum is stratified very dark gray and grayish brown, mottled silt loam about 22 inches thick. Below this to a depth of about 60 inches is a buried surface layer of black, friable or firm silty clay loam. In places the surface layer is loam. In some areas the buried surface layer is below a depth of 40 inches.

Included with this soil in mapping are small areas of the poorly drained Humeston and very poorly drained Wabash soils. These soils are in the lower areas on flood plains and are subject to more seasonal wetness than the Ackmore soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Ackmore soil, and surface runoff is slow. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is very high. The shrink-swell potential is high at a depth of 2 to 3 feet. The content of organic matter in the surface layer is about 1 to 3 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. If drained and protected from flooding, this soil is moderately well suited to corn, soybeans, and small grain. In undrained areas it is better suited to pasture. Tile drains generally do not function satisfactorily unless the silty alluvial material is thick enough that the tile can be placed on top of the buried soil and unless adequate outlets are available. Tile drains in the buried soil generally do not function satisfactorily because of the restricted permeability. Open ditches and a surface drainage system should be used. In many areas, diverting runoff water from soils upslope can improve crop production and reduce siltation on this soil. The soil warms slowly in the spring and dries slowly after rains. In years of heavy rainfall, fieldwork may be delayed. A ridge-till planting system, in which the soil is ridged and row crops are planted on the ridges, helps to overcome wetness and increases soil temperature. Plowing in the fall improves the timeliness of fieldwork but increases the susceptibility to soil blowing. Leaving a rough plowed surface and alternating plowed and unplowed strips help to control soil blowing. Chisel plowing, which leaves crop residue on the surface, also helps to control soil blowing. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses for hay or pasture. It is poorly suited to legumes because of the seasonal high water table and flooding. Most areas that are narrow and subject to flooding are used as permanent pasture. Overgrazing or grazing during wet periods or after flooding has occurred causes surface compaction and puddling of the soil. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

This soil is moderately well suited to trees, and a few small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIw.

452C—Lineville silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the slightly lower, narrow convex ridges in the uplands. Most areas are long and narrow and range from 3 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown, friable or firm silty clay loam; the next part is brown, mottled, firm silt loam; and the lower part is brown, firm clay. In places the surface soil is thicker and darker.

Included with this soil in mapping are small areas of Armstrong and Ladoga soils. Armstrong soils are downslope from the Lineville soil and are on narrow ridges and side slopes. They formed in weathered glacial till and contain more clay than the Lineville soil. Ladoga soils are upslope from the Lineville soil and are on the broader ridges. They formed in loess. They are more fertile than the Lineville soil and contain less sand. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Lineville soil. Surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 3 to 4 feet. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for hay and pasture. This soil is suited to corn and soybeans. It is better suited to small grain. If cultivated crops are grown, erosion is a severe hazard. It can be controlled in intensively row-cropped areas by a system of conservation tillage that leaves crop residue on the surface, terraces, contour farming, grassed waterways, contour stripcropping, and a crop rotation that includes grasses and legumes. Because areas of this soil are relatively small, they are generally managed along with adjacent soils. Therefore, applying a combination of conservation practices in areas of this soil and in areas upslope helps to minimize soil losses. If terraces are constructed on this soil, the clayey subsoil, which is low in fertility, may be exposed in places at a depth of 2 to 3 feet. Topdressing with topsoil material can help to establish seedings in these areas. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves soil fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is moderately well suited to grasses for hay and is well suited to pasture. It is poorly suited to legumes because of the seasonal high water table. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is suited to trees, and a few small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

452C2—Lineville silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on the slightly lower, narrow convex ridges in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown and very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the dark brown subsoil with the surface layer. The subsoil extends to a depth of about 60 inches. The upper part is brown, friable or firm silty clay loam; the next part is brown, mottled, firm silt loam; and the lower part is brown, firm clay. In places the surface layer is darker.

Included with this soil in mapping are small areas of Armstrong and Ladoga soils. Armstrong soils are downslope from the Lineville soil and are on narrow ridges and side slopes. They formed in weathered glacial till and contain more clay than the Lineville soil. Ladoga soils are upslope from the Lineville soil and are on the broader ridges. They formed in loess. They are more fertile than the Lineville soil and contain less sand. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Lineville soil. Surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 3 to 4 feet. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are used for hay and pasture and have been cultivated at some time in the past. This soil is suited to corn and soybeans. It is better suited to small grain. If cultivated crops are grown, further erosion is a severe hazard. It can be controlled in intensively row-cropped areas by a system of conservation tillage that leaves crop residue on the surface, terraces, contour farming, grassed waterways, contour stripcropping, and a crop rotation that includes grasses and legumes. Because areas of this soil are relatively small, they are generally farmed along with adjacent soils. Therefore, applying a combination of conservation practices on this soil and in areas upslope can minimize soil losses. If terraces are constructed on this soil, the clayey subsoil, which is low in fertility, may be exposed in places at a depth of 2 to 3 feet. Topdressing with topsoil material can help to establish seedings in these areas. More fertilizer management practices are needed on this soil than on the less eroded Lineville soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is moderately well suited to grasses for hay and is well suited to pasture. It is poorly suited to legumes because of the seasonal high water table. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

This soil is suited to trees, and a few small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

470D—Lamoni-Shelby complex, 9 to 14 percent slopes. This map unit consists of a strongly sloping, somewhat poorly drained Lamoni soil on the upper convex to slightly concave side slopes and narrow ridges in the uplands and a strongly sloping, well drained Shelby soil on the lower convex nose slopes and side slopes near the upper ends of drainageways in the uplands. Most areas are irregularly shaped and range from 5 to 10 acres in size. They are about 70 percent Lamoni soil and 30 percent Shelby soil. The two soils occur as areas so small that mapping them separately is impractical.

Typically, the surface layer of the Lamoni soil is black, friable silty clay loam about 7 inches thick. The subsurface layer is dark gray, friable silty clay loam about 4 inches thick. The subsoil is about 40 inches thick. The upper part is dark grayish brown, mottled, firm clay loam; the next part is mottled olive gray and yellowish brown, firm clay; and the lower part is olive gray, mottled, firm clay. The substratum to a depth of about 60 inches is mottled gray, olive gray, strong brown, and dark gray clay loam.

Typically, the surface layer of the Shelby soil is very dark grayish brown, friable clay loam about 8 inches thick. The subsurface layer is dark brown, friable clay loam about 4 inches thick. The subsoil is about 31 inches thick. The upper part is brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is light olive brown and light brownish gray, mottled, calcareous clay loam. It has white nodules of calcium carbonates. Stones and pebbles are throughout the soil. In some places the surface layer is thicker and darker. In other places the surface layer is thinner because of erosion. In some areas, the subsoil is thinner and the calcareous substratum is closer to the surface.

Permeability is slow in the Lamoni soil and moderately slow in the Shelby soil. Surface runoff is rapid on both soils. The Lamoni soil has a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is high in both soils. The Lamoni soil has a high shrink-swell potential at a depth of about 1 foot. The content of organic matter in the surface layer is about 2.5 to 3.5 percent in the Lamoni soil and 3 to 4 percent in the Shelby soil. The subsoil of the Lamoni soil has a very low supply of available phosphorus and potassium, and the subsoil of the Shelby soil generally has a low supply of available phosphorus and a high supply of available potassium. The Lamoni and Shelby soils have good tilth. Both soils tend to puddle if worked when wet.

Most areas are cultivated. Some areas are used for pasture. In most areas these soils are managed along with adjacent soils. They are poorly suited to corn and small grain. They are better suited to hay and pasture. If cultivated crops are grown, erosion is a hazard. Row crops should be grown only in a rotation to establish seedings for hay and pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface, grassed waterways, and contour stripcropping help to minimize soil losses. If terraces are used, keeping cuts to a minimum helps to prevent unnecessary exposure of the less productive, firm subsoil, which is low in fertility. Medium and large stones may also interfere with some tillage activities on the Shelby soil. Applying conservation practices on these soils and in areas upslope helps to control erosion. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

These soils are suited to grasses for hay. The Lamoni soil is poorly suited to pasture, but the Shelby soil is well suited to this use. The Lamoni soil also is poorly suited to legumes because of the seasonal high water table. Management may be difficult because the Lamoni soil is wet and seepy during wet periods. In areas of the Lamoni soil, using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains in areas of adjacent soils above the seep line can improve the production of legume crops for hay and of grasses for pasture in areas of the Lamoni soil. In both soils, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

470D2—Lamoni-Shelby complex, 9 to 14 percent slopes, moderately eroded. This map unit consists of a strongly sloping, somewhat poorly drained Lamoni soil on the upper convex to slightly concave side slopes and narrow ridges in the uplands and a strongly sloping, well drained Shelby soil on the lower convex nose slopes and side slopes near the upper end of drainageways in the uplands. Most areas of this unit are irregularly shaped and range from 5 to 10 acres in size. They are about 65 percent Lamoni soil and 30 percent Shelby soil. The two soils occur as areas so small that mapping them separately is impractical.

Typically, the surface layer of the Lamoni soil is very dark gray and very dark grayish brown, friable silty clay loam about 5 inches thick. Plowing has mixed some of the dark grayish brown subsoil with the surface layer. The subsoil is about 33 inches thick. The upper part is dark grayish brown, firm, mottled clay loam; the next part is olive gray, firm, mottled clay loam; and the lower part is olive gray, firm, mottled clay. The substratum to a depth of about 60 inches is mottled gray, olive gray, strong brown, and dark gray clay loam.

Typically, the surface layer of the Shelby soil is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is about 29 inches thick. The upper part is brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. It has white nodules of calcium carbonates. Stones and pebbles are on the surface and throughout the soil. In places the surface layer is thicker and darker. In some areas, the subsoil is thinner and the calcareous substratum is closer to the surface.

Included with these soils in mapping are areas of severely eroded Lamoni and Shelby soils. These areas are ½ to 1 acre in size and are scattered throughout the map unit. The severely eroded Lamoni soils are on shoulders of side slopes, and the severely eroded Shelby soils are on the lower parts of the landscape. These included soils have a low content of organic matter and require additional fertility management practices. They make up 5 percent of the unit.

Permeability is slow in the Lamoni soil and moderately slow in the Shelby soil. Surface runoff is rapid on both soils. The Lamoni soil has a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is high in both soils. The Lamoni soil has a high shrink-swell potential at a depth of about 1 foot. The content of organic matter in the surface layer is about 1.5 to 2.5 percent in the Lamoni soil and 1 to 2 percent in the Shelby soil. The subsoil of the Lamoni soil has a very low supply of available phosphorus and potassium, and the subsoil of the Shelby soil generally has a low supply of available phosphorus and a high supply of available potassium. Both soils have fair tilth but tend to puddle if worked when wet.

Most areas are cultivated. Some areas are used for pasture. In most areas these soils are managed along with adjacent soils. They are poorly suited to corn and small grain. They are better suited to hay and pasture. If cultivated crops are grown, further erosion is a hazard. Row crops should be grown only in a rotation to establish seedings for hay and pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface, grassed waterways, and contour stripcropping help to minimize soil losses. If terraces are used, keeping cuts to a minimum helps to prevent unnecessary exposure of the less productive, firm subsoil, which is low in fertility. Medium and large stones may also interfere with some tillage activities in areas of the Shelby soil. Applying conservation practices in areas of these soils and in areas upslope helps to control erosion. More fertilizer management practices are needed on these soils than on the less eroded Lamoni and Shelby soils. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

These soils are suited to grasses for hay. The Lamoni soil is poorly suited to pasture, but the Shelby soil is well suited to this use. The Lamoni soil also is poorly suited to legumes because of the seasonal high water table. Management may be difficult because the soil is wet and seepy during wet periods. In areas of the Lamoni soil, using forage species that are tolerant of wetness can help to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line can improve the production of legume crops for hay and of grasses for pasture in areas of the Lamoni soil. In both soils, overgrazing or grazing during wet periods causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

570C—Nira silty clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the lower narrow ridges and short convex side slopes at the slightly lower elevations that surround the gently sloping ridgetops in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer also is very dark gray, friable silty clay loam. It is about 7 inches thick. The subsoil is mottled, friable silty clay loam about 28 inches thick. The upper part is light olive brown, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam. In some areas the surface layer is thinner because of erosion.

Included with this soil in mapping are small areas of the poorly drained Clarinda and somewhat poorly drained Lamoni soils. These soils contain more clay in the subsoil than the Nira soil. They are on the lower side slopes and narrow convex ridges. They are low in fertility and are more difficult to manage than the Nira soil. They make up 5 percent of the unit.

Permeability is moderately slow in the Nira soil, and surface runoff is medium. The available water capacity is high. A seasonal high water table is at a depth of 4 to 6 feet. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. Some areas are used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface (fig. 6), contour farming, contour stripcropping, terraces, and crop rotations that include meadow crops help to prevent excessive soil loss. If rainfall is above normal, the soil may become seasonally wet on the lower slopes and near drainageways. A combination of tile drainage and terraces improves the timeliness of fieldwork and helps to control erosion. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

570C2—Nira silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on narrow ridges and short convex side slopes at the slightly lower elevations that surround the gently sloping ridgetops in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the brown subsoil with the surface layer. The subsoil is friable silty clay loam about 25 inches thick. It is mottled. The upper part is light olive brown and light brownish gray, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay

Figure 6.—No-till soybeans planted in corn stubble in an area of Nira silty clay loam, 5 to 9 percent slopes.

loam. In places the upper part of the subsoil is dark grayish brown.

Included with this soil in mapping are small areas of the poorly drained Clarinda and somewhat poorly drained Lamoni soils. These soils contain more clay in the subsoil than the Nira soil. They are on the lower side slopes and narrow convex ridges. They are low in fertility and more difficult to manage than the Nira soil. Also included are areas of severely eroded Nira soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter and require additional fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Nira soil, and surface runoff is medium. The available water capacity is high. A seasonal high water table is at a depth of 4 to 6 feet. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. This soil generally has a low supply of available phosphorus and potassium. It has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. Some areas are used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, contour stripcropping, terraces, and crop rotations that include meadow crops help to prevent excessive soil loss. If rainfall is above normal, the soil becomes seasonally wet on the lower slopes and near drainageways. A combination of tile drainage and terraces improves the timeliness of fieldwork and helps to control erosion. More fertilizer management practices are needed on this soil than on the less eroded Nira soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

570D—Nira silty clay loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Most areas are long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown, friable silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is friable silty clay loam about 26 inches thick. It is mottled. The upper part is light olive brown and light brownish gray, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam. In places the upper part of the subsoil is dark grayish brown. In some areas the surface layer is thinner because of erosion.

Included with this soil in mapping are small areas of the poorly drained Clarinda and somewhat poorly drained Lamoni soils on the lower side slopes and narrow convex ridges. These soils contain more clay in the subsoil than the Nira soil. They are low in fertility and are more difficult to manage than the Nira soil. They make up about 5 percent of the unit.

Permeability is moderately slow in the Nira soil, and surface runoff is rapid. The available water capacity is high. A seasonal high water table is at a depth of 4 to 6 feet. The content of organic matter in the surface layer is about 3 to 4 percent. The soil generally has a low supply of available phosphorus and potassium. It has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. Some areas are used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, crop rotations that include meadow crops, and contour stripcropping help to prevent excessive soil loss. Because the soil tends to be wet and seepy near drainageways and on the lower slopes, a combination of tile drainage and terraces improves the timeliness of fieldwork and helps to control erosion. Applying a combination of conservation practices in upslope areas also helps to control erosion on this soil. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

570D2—Nira silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Most areas are long and narrow and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed part of the brown subsoil with the surface layer. The subsoil is friable silty clay loam about 26 inches thick. It is mottled. The upper part is light olive brown and light brownish gray, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam. In places the upper part of the subsoil is dark grayish brown.

Included with this soil in mapping are small areas of the poorly drained Clarinda and somewhat poorly drained Lamoni soils on the lower side slopes and narrow convex ridges. These soils contain more clay in the subsoil than the Nira soil. They are low in fertility and are more difficult to manage than the Nira soil. Also included are areas of severely eroded Nira soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter and require additional fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Nira soil, and surface runoff is rapid. The available water capacity is high. A seasonal high water table is at a depth of 4 to 6 feet. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. This soil generally has a low supply of available phosphorus and potassium. It has fair tilth but tends to puddle if worked when wet.

Most areas are cultivated. Some areas are used for hay and pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, a crop rotation that includes meadow crops, and contour stripcropping help to prevent excessive soil loss. Because the soil tends to be wet and seepy near drainageways and on the lower slopes during spring months, a combination of tile drainage and terraces improves the timeliness of fieldwork and helps to control erosion. Applying a combination of these conservation practices in areas upslope also helps to control erosion on this soil. More fertilizer management practices are needed on this soil than on the less eroded Nira soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

592C—Mystic silt loam, 5 to 9 percent slopes. This moderately sloping, somewhat poorly drained soil is on narrow convex ridges, on short convex to slightly concave side slopes, and on foot slopes in the uplands and on escarpments of high stream benches. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 10 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 9 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown and strong brown, mottled, firm clay; the next part is mottled strong brown, dark yellowish brown, grayish brown, light gray, and yellowish red, firm clay loam; and the lower part is mottled strong brown, yellowish red, light brownish gray, and light gray, friable sandy clay loam and clay loam. In places the soil contains more silt and less sand. In some areas the surface layer is thinner because of erosion.

Included with this soil in mapping are small areas of the moderately well drained Ladoga soils. These soils are at the higher elevations. They formed in loess and contain less clay than the Mystic soil. They make up about 5 percent of the unit.

Permeability is slow in the Mystic soil, and surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil has a very low supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

This soil is used mostly for pasture, hay, or woodland. It is suited to corn and soybeans. It is better suited to small grain. If the soil is used for crops, the hazard of further erosion is severe. Because areas of this soil are relatively small, they are generally managed along with adjacent soils that are more suited to row crops. A system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes help to control erosion. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It also is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion.

This soil is suited to trees, and a few areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

592C2—Mystic silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained soil is on narrow convex ridges, on short convex to slightly concave side slopes, and on foot slopes in the uplands and on escarpments of high stream benches. Most areas are long and narrow or irregularly shaped. Individual areas range from 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 5 inches thick. Plowing has mixed some of the brown and strong brown, clayey subsoil with the surface layer. The subsoil is about 45 inches thick. The upper part is brown, firm silty clay; the next part is mottled brown and strong brown silty clay loam; and the lower part is brown, friable silty clay loam. The substratum to a depth of about 60 inches is mottled brown and strong brown silty clay loam. In places the soil contains more silt and less sand. In some areas the surface layer is thinner because of severe erosion.

Included with this soil in mapping are small areas of the moderately well drained Ladoga soils. These soils are at the higher elevations. They formed in loess and contain less clay than the Mystic soil. Also included are areas of severely eroded Mystic soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter and require additional fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Mystic soil, and surface runoff is medium. A seasonal high water table is at a depth of 3 to 5 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil has a very low supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

This soil is used mostly for pasture, hay, or row crops. It is suited to corn and soybeans. It is better suited to small grain. If the soil is used for crops, the hazard of further erosion is severe. Because the areas of this soil are relatively small, they are generally managed along with adjacent soils that are more suited to row crops. A system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes are needed on this soil and on adjacent soils to minimize soil losses. More fertilizer management practices are needed on this soil than on the less eroded Mystic soils. Deferring tillage during wet periods helps to prevent surface compaction and improves tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is generally suited to grasses for hay but is poorly suited to pasture. It also is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay and of grasses for pasture.

Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion.

This soil is suited to trees. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IIIe.

592D—Mystic silt loam, 9 to 14 percent slopes. This strongly sloping, somewhat poorly drained soil is on short convex nose slopes, side slopes, and foot slopes in the uplands and on escarpments of high stream benches. Slopes dominantly face south and east. Most areas are long and narrow or irregularly shaped. Individual areas range from 4 to 20 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 45 inches thick. The upper part is mottled brown, strong brown, dark yellowish brown, and grayish brown, firm clay; the next part is mottled strong brown, dark yellowish brown, grayish brown, light gray, and yellowish red, firm clay loam; and the lower part is mottled strong brown, yellowish red, light brownish gray, and light gray, friable sandy clay loam and clay loam. The substratum to a depth of about 60 inches is strong brown, mottled clay loam. In places the soil contains more silt and less sand. In areas dominated by prairie vegetation, the subsurface layer is thicker and darker. In some places the surface layer is thinner because of erosion.

Included with this soil in mapping are small areas of the well drained Gara and moderately well drained Ladoga soils. Gara soils are upslope or on adjacent side slopes and formed in glacial till. Ladoga soils are in concave landscape positions and formed in loess. The included soils are better drained than the Mystic soil and are easier to till. They make up about 5 percent of the unit.

Permeability is slow in the Mystic soil, and surface runoff is rapid. A seasonal high water table is at a depth of 3 to 5 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil has a very low supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

This soil is used mostly for pasture, hay, or woodland. It is generally poorly suited to corn, soybeans, and small grain. It is better suited to hay and pasture. If row crops are grown, the hazard of further erosion is very severe. Because areas of this soil are relatively small, they are generally managed along with adjacent soils that are more suited to row crops. Contour farming, grassed waterways, a crop rotation that includes grasses and legumes, and a system of conservation tillage that leaves crop residue on the surface are needed on this soil and on adjacent soils to minimize soil losses. Deferring tillage during wet periods helps to prevent surface compaction and improves tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It also is poorly suited to legumes because of the seasonal high water table. Management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is fairly suited to trees, and a few areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IVe.

592D2—Mystic silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on short convex nose slopes, side slopes, and foot slopes in the uplands and on escarpments of high stream benches. Slopes dominantly face south and east. Most areas are long and narrow or irregularly shaped. Individual areas range from 4 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the brown and dark brown silty clay subsoil with the surface layer. The subsoil is about 45 inches thick. The upper part is brown, firm silty clay; the next part is mottled brown and strong brown, firm silty clay loam; and the lower part is brown, firm silty clay loam. The substratum to a depth of about 60 inches is mottled strong brown and brown silty clay loam. In places the soil contains more silt and less sand. In areas dominated by prairie grass vegetation, the surface layer is darker. In some places the surface layer is thinner because of severe erosion.

Included with this soil in mapping are small areas of the well drained Gara and moderately well drained Ladoga soils. Gara soils are in upslope areas or on adjacent side slopes. They formed in glacial till. Ladoga soils are in concave landscape positions. They formed in loess. Gara and Ladoga soils are better drained than the Mystic soil and are easier to till. Also included are areas of severely eroded Mystic soils. These areas are ¼ to ½ acre in size and are scattered throughout the map unit. The severely eroded soils have a low content of organic matter and require additional fertility management practices. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Mystic soil, and surface runoff is rapid. A seasonal high water table is at a depth of 3 to 5 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil has a very low supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

This soil is used mostly for pasture, hay, or row crops. It is poorly suited to corn, soybeans, and small grain. It is better suited to hay and pasture. If row crops are grown, the hazard of further erosion is very severe. Because areas of this soil are relatively small, they are generally managed along with adjacent soils that are more suitable for row crops. Contour farming, grassed waterways, a crop rotation that includes grasses and legumes, and a system of conservation tillage that leaves crop residue on the surface are needed on this soil and in areas of adjacent soils to minimize soil losses. More fertilizer management practices are needed on this soil than on the less eroded Mystic soils. Deferring tillage during wet periods helps to prevent surface compaction and improves tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It also is poorly suited to legumes because of the seasonal high water table. Management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improve the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is suited to trees. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is IVe.

792C—Armstrong loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the lower convex narrow ridges and short convex side slopes in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 3 to 25 acres in size.

Typically, the surface layer is very dark gray, friable loam about 8 inches thick. The subsurface layer is dark grayish brown, friable loam about 4 inches thick. The subsoil is about 40 inches thick. The upper part is strong brown, mottled, friable clay; the next part is strong brown, mottled, firm clay; and the lower part is yellowish brown, mottled, firm clay. The substratum to a depth of 60 inches is light brownish gray clay loam. In places the surface layer is thinner because of erosion. In some areas the subsoil is grayer and has thicker clay layers.

Permeability is slow in the Armstrong soil, and surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are used for pasture or woodland. This soil is poorly suited to row crops. It is better suited to small grain and to hay and pasture. If cultivated crops are grown, erosion is a severe hazard. It can be controlled in intensively row-cropped areas by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope. If terraces are constructed in areas of this soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and minimizes crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is suited to trees, but natural and planted seedlings may not survive well. Planted seedlings should be closely spaced, and the surviving trees can later be thinned until the desired stand density is achieved. No other major concerns affect the planting or harvesting of trees. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard.

The land capability classification is IIIe.

792C2—Armstrong clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on the lower narrow convex ridges and short convex side slopes in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 3 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the strong brown subsoil with the surface layer. The subsoil is about 38 inches thick. The upper part is strong brown, mottled, friable clay loam; the next part is strong brown, mottled, firm clay; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is light brownish gray clay loam. Stones and pebbles are throughout the soil. In some areas the subsoil is grayer and has thicker clay layers.

Included with this soil in mapping are small areas of severely eroded Armstrong soils. These areas are ¼ to ½ acre in size and are scattered throughout the unit. The severely eroded soils have a low content of organic matter and have clay mixed in the plow layer. They are more difficult to manage than the major Armstrong soil and require additional fertility management practices. They make up 5 to 10 percent of the unit.

Permeability is slow in the Armstrong soil, and surface runoff is medium. A seasonal high water table is at a depth of 3 to 5 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer typically is about 2 to 3 percent. The soil generally has a very low supply of available phosphorus and potassium. It has fair tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. This soil is suited to row crops, but it is better suited to small grain and to hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. Applying a combination of these conservation practices on this soil and in areas upslope helps to minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Armstrong soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Armstrong soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and minimizes crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is suited to trees, but most woodland is limited to groves and areas around farmsteads. Natural and planted seedlings do not survive well. Planted seedlings should be closely spaced, and the surviving trees can later be thinned until the desired stand density is achieved. No other major concerns affect the planting or harvesting of trees. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard.

The land capability classification is IIIe.

792D—Armstrong loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on short convex shoulders of side slopes and on narrow ridges in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 3 to 25 acres in size.

Typically, the surface layer is very dark gray, friable loam about 7 inches thick. The subsurface layer is dark grayish brown, friable loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is strong brown, mottled, friable clay loam; the next part is strong brown, firm clay; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is mottled, light brownish gray clay loam. In places the surface layer is thinner because of erosion. In some areas the subsoil is grayer and has clay at a lower depth.

Permeability is slow, and surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The soil generally has a very low supply of available phosphorus and potassium. It has fair tilth but tends to puddle if worked when wet.

Most areas are used for pasture or woodland. This soil is poorly suited to intensive row cropping. It is better suited to small grain and to hay and pasture. If row crops are grown, erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope. Terraces should generally be placed on adjacent soils upslope. If terraces are constructed in areas of this soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and minimizes crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is suited to trees. Natural and planted seedlings may not survive well. Planted seedlings should be closely spaced, and the surviving trees can later be thinned until the desired stand density is achieved. No other major concerns affect the planting or harvesting of trees. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard.

The land capability classification is IVe.

792D2—Armstrong clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short convex shoulders of side slopes and on narrow ridges in the uplands. Most areas are long and narrow or irregularly shaped. Individual areas range from 3 to 25 acres in size.

Typically, the surface layer is dark grayish brown and very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the subsoil with the surface layer. The subsoil is clay loam about 36 inches thick. The upper part is strong brown and friable; the next part is strong brown, mottled, and firm; and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some areas the subsoil is grayer and has clay at a lower depth.

Included with this soil in mapping are areas of severely eroded Armstrong soils. These areas are ¼ to ½ acre in size and are scattered throughout the unit. The severely eroded soils have a low content of organic matter and have clay mixed in the plow layer. They are more difficult to manage than the major Armstrong soil and require more fertility management practices. They make up 5 to 10 percent of the unit.

Permeability is slow in the Armstrong soil, and surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of 1 to 2 feet. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil typically has a very low supply of available phosphorus and potassium. This soil has fair tilth but tends to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. This soil is poorly suited to intensive row cropping. It is better suited to small grain and to hay and pasture. If row crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes are needed in areas of this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Armstrong soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Armstrong soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and minimizes crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

This soil is suited to trees. Natural and planted seedlings may not survive well. Planted seedlings should be closely spaced, and the surviving trees can later be thinned until the desired stand density is achieved. No other major concerns affect the planting or harvesting of trees. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard.

The land capability classification is IVe.

822C—Lamoni silty clay loam, 5 to 9 percent slopes. This moderately sloping, somewhat poorly drained soil is on short convex side slopes near the upper ends of drainageways and on the lower narrow ridges in the uplands. Most areas are irregularly shaped and range from 4 to 25 acres in size.

Typically, the surface layer is black and very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is dark gray, friable silty clay loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is dark grayish brown, mottled, firm clay loam; the next part is olive gray, mottled, firm clay; and the lower part is olive gray, mottled, firm clay loam. In places the subsoil is clayey throughout.

Included with this soil in mapping are small areas of Shelby soils on the lower side slopes. These soils are better drained than the Lamoni soil. Also, they contain less clay in the subsoil and are easier to till. They make up 5 to 10 percent of the unit.

Permeability is slow in the Lamoni soil. Surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of about 1 foot. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and a low or medium supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are used for pasture. This soil is suited to corn and soybeans, but it is better suited to small grain and to hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are constructed on the Lamoni soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IIIe.

822C2—Lamoni silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained soil is on short convex side slopes near the upper ends of drainageways and on the lower narrow ridges in the uplands. Most areas are irregularly shaped and range from 4 to 25 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 6 inches thick. Plowing has mixed some of the dark grayish brown subsoil with the surface layer. The subsoil is about 42 inches thick. The upper part is dark grayish brown, mottled, firm clay; the next part is olive gray, mottled, firm clay; and the lower part is olive gray, mottled, firm clay loam. The substratum to a depth of about 60 inches is mottled gray, olive gray, strong brown, and dark gray clay loam. In places the subsoil is clayey throughout.

Included with this soil in mapping are small areas of Shelby soils on the lower side slopes. These soils are better drained than the Lamoni soil. Also, they contain less clay in the subsoil and are easier to till. Also included in mapping are areas of severely eroded Lamoni soils. These areas are ¼ to ½ acre in size and are scattered throughout the unit. The severely eroded soils have a low content of organic matter and require more fertility management practices than the major Lamoni soil. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Lamoni soil. Surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of about 1 foot. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil generally has a very low supply of available phosphorus and a low or medium supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. This soil is suited to corn and soybeans, but it is better suited to small grain and to hay and pasture. If row crops are grown, the hazard of further erosion is severe. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Lamoni soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Lamoni soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IIIe.

822D—Lamoni silty clay loam, 9 to 14 percent slopes. This strongly sloping, somewhat poorly drained soil is on short convex side slopes near the upper ends of drainageways in the uplands. Most areas are irregularly shaped and range from 4 to 25 acres in size.

Typically, the surface layer is black and very dark gray, friable silty clay loam about 7 inches thick. The subsurface layer is dark gray, friable silty clay loam about 5 inches thick. The subsoil is about 40 inches thick. The upper part is dark grayish brown and olive gray, mottled, firm clay; the next part is olive gray, mottled, firm clay loam; and the lower part is light brownish gray, olive gray, and yellowish brown, firm clay. The substratum to a depth of about 60 inches is mottled olive gray and yellowish brown loam.

Included with this soil in mapping are small areas of Shelby soils on the lower side slopes. These soils are better drained than the Lamoni soil. Also, they contain less clay in the subsoil and are easier to till. They make up 5 to 10 percent of the unit.

Permeability is slow in the Lamoni soil. Surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of about 1 foot. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and a low or medium supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are used for pasture. This soil is poorly suited to intensive row cropping. It is better suited to small grain and to hay and pasture. If row crops are grown, the hazard of further erosion is severe. It can be controlled in row-cropped areas by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed on adjacent soils upslope. If terraces are constructed on the Lamoni soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management is difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity.

Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

822D2—Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on short convex side slopes near the upper ends of drainageways in the uplands. Most areas are irregularly shaped and range from 4 to 25 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 5 inches thick. Plowing has mixed some of the dark grayish brown subsoil with the surface layer. The subsoil is about 38 inches thick. The upper part is dark grayish brown, mottled, firm clay loam; the next part is olive gray, mottled, firm clay loam; and the lower part is olive gray, mottled, firm clay. The substratum to a depth of about 60 inches is mottled gray, olive gray, strong brown, and dark gray clay loam.

Included with this soil in mapping are small areas of Shelby soils on the lower side slopes. These soils are better drained than the Lamoni soil. Also, they contain less clay in the subsoil and are easier to till. Also included are areas of severely eroded Lamoni soils. These areas are ¼ to ½ acre in size and are scattered throughout the unit. The severely eroded soils have a low content of organic matter and require more fertility management practices than the major Lamoni soil. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Lamoni soil. Surface runoff is rapid. A seasonal high water table is at a depth of 1 to 3 feet. The available water capacity is high. The shrink-swell potential is high at a depth of about 1 foot. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil generally has a very low supply of available phosphorus and a low or medium supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Most areas are cultivated. This soil is poorly suited to intensive row cropping. It is better suited to small grain and to hay and pasture. If row crops are grown, the hazard of further erosion is severe. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and a crop rotation that includes grasses and legumes. A combination of these conservation practices is needed on this soil and in areas upslope to minimize soil losses. If terraces are needed, they should generally be placed in areas of adjacent soils upslope. If terraces are constructed in areas of the Lamoni soil, exposure of the clayey subsoil makes seedbed preparation more difficult, even if the terrace channels are topdressed with material from the surface soil. More fertilizer management practices are needed on this soil than on the less eroded Lamoni soils. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is suited to grasses for hay but is poorly suited to pasture. It is poorly suited to legumes because of the seasonal high water table. A cover of hay or pasture plants is effective in controlling erosion, but management may be difficult because the soil is wet and seepy during wet periods. Using forage species that are tolerant of wetness helps to maintain productivity. Proper placement of tile drains on adjacent soils above the seep line improves the production of legume crops for hay. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

The land capability classification is IVe.

870B—Sharpsburg silty clay loam, bench, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on broad, loess-covered stream benches. Most areas are long and irregularly shaped. Individual areas range from 5 to 25 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is very dark brown, friable silty clay loam about 9 inches thick. The subsoil is firm silty clay loam about 36 inches thick. The upper part is brown, the next part is brown and mottled, and the lower part is yellowish brown and mottled. The substratum to a depth of about 60 inches is grayish brown, yellowish brown, and gray, mottled silty clay loam. Stratified, loamy alluvium is at a depth of 10 to 12 feet. In places the surface soil is very dark grayish brown and grayish brown.

Permeability is moderately slow, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is 3 to 4 percent. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, a crop rotation that includes grasses and legumes, contour stripcropping, or a combination of these practices. Grassed waterways help to prevent gully erosion. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIe.

870C2—Sharpsburg silty clay loam, bench, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on the side slopes of loess-covered stream benches. Most areas are narrow and irregularly shaped. Individual areas range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 8 inches thick. Plowing has mixed some streaks and pockets of brown silty clay loam subsoil material into the surface layer. The subsoil is silty clay loam about 35 inches thick. The upper part is brown and firm; the next part is brown, mottled, and firm; and the lower part is yellowish brown, mottled, and friable. The substratum to a depth of about 60 inches is mottled grayish brown and light brownish gray silty clay loam. Stratified, loamy alluvium is at a depth of 8 to 10 feet. In places the plow layer is mixed very dark grayish brown and grayish brown.

Permeability is moderately slow, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is 2.7 to 3.7 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has only fair tilth and tends to puddle if worked when wet.

Included with this soil in mapping are small areas of Mystic soils. These soils are scattered on the lower parts of the mapped areas. They are more clayey than the Sharpsburg soil. Also, they are seepy during the spring and droughty during the later part of the growing season. Also included are areas of severely eroded Sharpsburg soils. These areas are generally ¼ to ½ acre in size and are scattered throughout the unit. The severely eroded soils have a low content of organic matter and require more fertility management practices than the major Sharpsburg soil. Included soils make up as much as 5 percent of the unit.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, a crop rotation that includes grasses and legumes, contour stripcropping, or a combination of these practices. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. More fertilizer management practices are needed on this soil than on the less eroded Sharpsburg soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, helps to control erosion, and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is moderately well suited to grasses and legumes for hay and is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, seedbed preparation, and interseeding should be on the contour because of the hazard of erosion. In some places terraces and diversions may be needed to protect critically seeded areas.

The land capability classification is IIIe.

993D—Gara-Armstrong complex, 9 to 14 percent slopes. This map unit consists of strongly sloping soils in the uplands. The well drained Gara soil is on the lower convex side slopes, and the moderately well drained Armstrong soil is on the upper convex shoulders of side slopes. Most areas of this unit are irregularly shaped and range from 5 to 15 acres in size. They are about 60 percent Gara soil and 40 percent Armstrong soil. The two soils occur as areas so small that mapping them separately is impractical.

Typically, the surface layer of the Gara soil is very dark gray, friable loam about 8 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable loam about 7 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown and brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. In places the surface layer is thicker and darker. In some areas the surface layer is thinner because of erosion. In other areas, the subsoil is thinner and the calcareous substratum is closer to the surface.

Typically, the surface layer of the Armstrong soil is very dark gray, friable loam about 7 inches thick. The subsurface layer is dark grayish brown, friable loam about 4 inches thick. The subsoil is clay loam about 38 inches thick. The upper part is strong brown and friable, the next part is strong brown and firm, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is light brownish gray, mottled clay loam. In places the surface layer is thinner because of erosion. In some areas the subsoil is grayer and has deep clay layers.

Permeability is moderately slow in the Gara soil and slow in the Armstrong soil. Surface runoff is rapid on both soils. The Armstrong soil has a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is high in both soils. The Armstrong soil has a high shrink-swell potential at a depth of 1 to 2 feet. The content of organic matter in the surface layer of both soils is about 2.5 to 3.5 percent. The subsoil of the Gara soil generally has a very low or low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Armstrong soil generally has a very low supply of available phosphorus and potassium. The Gara soil has good tilth, but the Armstrong soil has only fair tilth. Both soils tend to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. Some large areas are used for pasture. In most areas these soils are managed along with adjacent soils. They are poorly suited to row crops. They are better suited to small grain and to hay and pasture. If cultivated crops are grown, erosion is a hazard. Row crops should be grown only in a rotation to establish seedings for hay or pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping help to prevent excessive soil loss. If terraces are used, keeping cuts to a minimum helps to prevent unnecessary exposure of the less productive, firm subsoil, which is low in fertility. Medium and large stones may also interfere with some tillage activities on the Gara soil. Applying conservation practices in areas upslope, which increases the rate of water infiltration, also helps to control erosion on these soils. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and minimizes crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

These soils are suited to grasses for hay. The Armstrong soil is poorly suited to pasture, but the Gara soil is well suited to this use. The Armstrong soil is poorly suited to legumes because of the seasonal high water table. A cover of legumes can be effective in controlling erosion, but the Armstrong soil may become droughty in the later part of the growing season. Therefore, if rainfall is not timely during the growing season, forage production may be reduced. Applying conservation practices in upslope areas of adjacent soils improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soils are wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding and seedbed preparation should be on the contour because of the hazard of erosion.

These soils are suited to trees, and most small areas support native hardwoods. On the Armstrong soil, natural and planted seedlings do not survive well. Planted seedlings should be closely spaced, and the surviving trees can later be thinned until the desired stand density is achieved. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard on the Armstrong soil. No other major concerns affect the planting or harvesting of trees.

The land capability classification is IVe.

993D2—Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded. This map unit consists of strongly sloping soils in the uplands. The well drained Gara soil is on the lower convex side slopes, and the moderately well drained Armstrong soil is on the upper convex shoulders of side slopes. Most areas of this unit are irregularly shaped and range from 5 to 15 acres in size. They are about 55 percent Gara soil and 40 percent Armstrong soil. The two soils occur as areas so small that mapping them separately is impractical.

Typically, the surface layer of the Gara soil is very dark grayish brown and dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the dark grayish brown subsoil with the surface layer. The subsoil is about 34 inches thick. The upper part is yellowish brown and brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown, calcareous clay loam. In places the surface layer is thicker and darker. In some areas, the subsoil is thinner and the calcareous substratum is closer to the surface.

Typically, the surface layer of the Armstrong soil is dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the dark yellowish brown subsoil with the surface layer. The subsoil is clay loam about 36 inches thick. The upper part is strong brown, mottled, friable clay loam; the next part is brown, mottled, firm clay; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is brownish gray, mottled clay loam. In some areas the subsoil is grayer and has thicker clay layers.

Included with these soils in mapping are areas of severely eroded Armstrong and Gara soils. These areas are ½ to 1 acre in size and are scattered throughout the unit. The severely eroded Armstrong soils are on shoulders, and the severely eroded Gara soils are on the lower parts of the landscape. These included soils have a low content of organic matter and require more fertility management practices than the major soils. They make up as much as 5 percent of the unit.

Permeability is moderately slow in the Gara soil and slow in the Armstrong soil. Surface runoff is rapid on both soils. The Armstrong soil has a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is high in both soils. The Armstrong soil has a high shrink-swell potential at a depth of 1 to 2 feet. The content of organic matter in the surface layer of both soils is about 2 to 3 percent. The subsoil of the Gara soil generally has a very low or low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Armstrong soil generally has a very low supply of available phosphorus and potassium. Both soils have only fair tilth and tend to puddle if worked when wet and to crust after hard rains. Seedling development is retarded if crusting occurs prior to emergence.

Most areas are cultivated. Some large areas are used for pasture. In most areas these soils are managed along with adjacent soils. They are poorly suited to row crops. They are better suited to small grain and to hay and pasture. If cultivated crops are grown, further erosion is a hazard. Row crops should be grown only in a rotation to establish seedings for hay and pasture. If cultivated crops are grown, a system of conservation tillage that leaves crop residue on the surface and contour stripcropping help to prevent excessive soil loss. If terraces are used, keeping cuts to a minimum helps to prevent unnecessary exposure of the less productive, firm subsoil, which is low in fertility. Medium and large stones may also interfere with some tillage activities on the Gara soil. Applying conservation practices upslope, which increases the rate of water infiltration, also helps to control erosion on these soils. More fertilizer management practices are needed on these soils than on the less eroded Gara and Armstrong soils. Deferring tillage during wet seasons helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and minimizes crusting. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 or 4 years.

These soils are suited to grasses for hay. The Armstrong soil is poorly suited to pasture, but the Gara soil is well suited to this use. The Armstrong soil is poorly suited to legumes because of the seasonal high water table. A cover of legumes can be effective in controlling erosion, but the Armstrong soil may become droughty in the later part of the growing season. Therefore, if rainfall is not timely during the growing season, forage production may be reduced. Applying conservation practices on adjacent soils upslope helps to control erosion on these soils and improves the production of legume crops for hay and of grasses for pasture. Overgrazing or grazing when the soils are wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted equipment use during wet periods help to keep the pasture in good condition. Also, fertility maintenance, weed and brush control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, all cultural practices, interseeding, and seedbed preparation should be on the contour because of the hazard of erosion.

These soils are suited to trees, and most small areas support native hardwoods. On the Armstrong soil, natural and planted seedlings do not survive well. Planted seedlings should be closely spaced, and the surviving trees can later be thinned until the desired stand density is achieved. Using silvicultural practices that do not leave the individual trees widely spaced reduces the windthrow hazard on the Armstrong soil. No other major concerns affect the planting or harvesting of trees.

The land capability classification is IVe.

1220—Nodaway silt loam, channeled, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains along the major streams. It is dissected by many deep, old stream meanders. It is frequently flooded for very brief or brief periods. Most areas are elongated and range from 50 to 200 acres in size.

Typically, the surface layer is very dark gray and dark grayish brown silt loam about 7 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, dark grayish brown, and grayish brown silt loam. In some areas the surface layer is loam or sandy loam.

Included with this soil in mapping are small areas of soils that contain sandy material. These soils are on sandbars and sandy beaches along stream channels. They are more droughty than the Nodaway soil and contain more sand. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Nodaway soil, and surface runoff is slow. A seasonal high water table is at a depth of 3 to 5 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a medium supply of available phosphorus and a very low supply of potassium. This soil has fair tilth but tends to puddle if worked when wet.

Most areas are used for woodland or permanent pasture. A few small areas between old channels are cultivated in some years. Because of the flooding and the numerous old stream channels and oxbows, this soil is generally unsuited to cultivated crops and hay. If protected from flooding, it is moderately well suited to pasture and trees (fig. 7). Cultivation is difficult on this soil, even if trees are removed, channels are straightened and filled, levees or dikes are built, and drainage ditches are installed. Fertilizer management and weed control are of greater concern in areas that are cleared and renovated than in other areas.

This soil is poorly suited to pasture because of the flooding. Most areas are used as permanent pasture and support scattered trees and brush. Overgrazing or grazing during wet periods or after flooding has occurred causes surface compaction and puddling of the soil. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland.

This soil is suited to trees, and most small areas support native hardwoods. No particular problems affect the planting of new stands of trees if proper species are selected and proper management is applied.

The land capability classification is Vw.

1368B—Macksburg silty clay loam, bench, 0 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on broad loess-covered stream benches. Most areas are irregularly shaped and range from 5 to 30 acres in size.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable silty clay loam about 11 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown, mottled, firm silty clay loam; and the lower part is light brownish gray and grayish brown, mottled, friable silty clay loam. In some places the subsoil is mottled below a depth of 24 inches. In other places the upper part of the subsoil is dominantly dark grayish brown. Stratified, loamy alluvium is at a depth of 10 to 12 feet.

Included with this soil in mapping are areas of Winterset soils. These soils are upslope in nearly level areas on the landscape. They are poorly drained and remain wet for longer periods after rains than the Macksburg soil. Also included are very poorly drained soils in small depressional areas. These soils have a gray subsurface layer. They are seasonally wetter than the Macksburg soil, are difficult to drain, and may be subject to ponding for short periods. Included soils

Figure 7.—This wooded area of Nodaway silt loam, channeled, 0 to 2 percent slopes, provides excellent cover for wildlife.

make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Macksburg soil, and surface runoff is medium. The available water capacity is very high. A seasonal high water table is at a depth of 2 to 4 feet. The shrink-swell potential is high at a depth of 2 to 3 feet. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth but tends to puddle if worked when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard in the more sloping areas. Row crops can be grown in most years if erosion is controlled. A system of conservation tillage that leaves crop residue on the surface, contour farming, contour stripcropping, and terraces help to prevent excessive soil losses. A combination of terraces and tile drains improves the timeliness of fieldwork in years when rainfall is above normal and helps to control erosion. Grassed waterways help to prevent gully erosion. The soil tends to warm slowly in the spring and to dry slowly after rains. Deferring tillage during wet periods helps to prevent surface compaction and improves soil tilth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration. The need for lime in the surface layer varies, depending on previous liming practices, but lime is generally needed if it has not been applied in the past 3 to 5 years.

This soil is well suited to hay and moderately well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture in good condition. Also, suitable forage selection, fertility maintenance, weed control, and timely applications of lime improve the productivity of pasture or hayland. When pasture or hayland is renovated, any seedbed preparation and interseeding should be on the contour because of the hazard of erosion.

The land capability classification is IIe.

5030—Pits, limestone quarry. This map unit consists of pits from which limestone has been quarried for use in road construction and for agricultural lime. The pits are 60 to more than 70 feet deep, and some contain water. They are surrounded by steep-sided piles of spoil 20 to more than 30 feet high. The pits are irregularly shaped and range to as much as 50 acres in size.

The spoil surrounding the pits varies in texture, but it generally is loamy and contains varying amounts of limestone fragments. It is derived from glacial till, loess material, or a mixture of these. In some areas it has been leveled and smoothed, but in other areas it is very uneven. In the level areas, grasses or trees grow reasonably well. The spoil ranges from medium acid to mildly alkaline.

The quarries are well suited to wildlife habitat. Those containing water could support fish. Because of the steepness of the sides and the variable depth of the water, however, they could be dangerous as sites for recreation or wildlife habitat. Onsite investigation is needed to determine the suitability for these uses.

No land capability classification is assigned.

5040—Orthents, loamy. These nearly level to strongly sloping soils are used as borrow areas for construction. In some areas the original soil has been removed to a depth of 5 to more than 20 feet. In other areas, 4 to 10 inches of topsoil has been redistributed, commonly in an uneven pattern. The soils range from excessively drained to somewhat poorly drained, depending on the kind of material from which the soils were derived and the extent to which the borrow areas are restored. Areas typically range from 6 to 50 acres in size.

Typically, the upper 60 inches is yellowish brown, friable and firm loam. In many places cobbles and pebbles are common on the surface. In some places the texture is sandy loam. The color of the surface layer ranges from very dark gray to dark brown.

Included with these soils in mapping are small areas of sand. Also included are a few areas that were formerly dumps or landfills and have now been covered.

Permeability of the Orthents varies, depending on the texture and density. Surface runoff is slow to rapid. The available water capacity is moderate or low. Soil material that was formerly buried 5 to more than 20 feet beneath the surface has less pore space and a higher density than the original surface layer. It has not been appreciably affected by the processes of soil formation, such as freezing and thawing. The content of organic matter is very low unless the topsoil has been redistributed throughout the area. As a result, preparing a good seedbed is difficult and drought is a hazard. Reaction typically is moderately alkaline. In most areas these soils have a very low supply of available phosphorus and potassium.

Many areas near small towns have been used as building sites. Other delineations of this unit have been used primarily as borrow areas.

These soils are better suited to small grain and to grasses and legumes for hay and pasture than to row crops. They are suited to row crops only in some areas where the topsoil has been redistributed. Corn and soybeans are grown in these areas. If cultivated crops are grown, erosion is a moderate or severe hazard in the more sloping areas. A system of conservation tillage that turns over as little soil as possible and leaves crop residue on the surface helps to control erosion and stabilizes the soils.

No land capability classification is assigned.

Prime Farmland

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

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

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

About 104,280 acres in the survey area, or about 31 percent of the total acreage, meets the soil requirements for prime farmland. Nearly all of this prime farmland is used for crops. Crops grown on this land, mainly corn and soybeans, account for an estimated 50 to 60 percent of the county's total agricultural income each year. Most of the corn grown in the county is fed to livestock.

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

Soils that have a seasonal high water table qualify as prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

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Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

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

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

In 1985, according to agricultural statistics, about 186,350 acres in Taylor County, or 55 percent of the total acreage, was cropland. The main crops grown in the county are corn and soybeans. Alfalfa or alfalfa-grass is the major hay crop. The acreage used for row crops has increased in recent years. Productivity could be increased and soil conservation enhanced if the latest crop production technology were applied on most of the cropland in the county. This soil survey can aid in the application of this technology.

The main management needs on the cropland and pasture in Taylor County are measures that help to control erosion, that provide drainage of naturally wet soils and seepy areas, and that maintain or improve soil fertility, weed control, and soil tilth.

Erosion is the major problem on about two-thirds of the cropland and pasture in Taylor County. It is a hazard in areas where the slope is more than 2 percent. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils having a firm subsoil that is low in fertility, such as Shelby soils, and on soils having a firm, clayey subsoil, such as Adair, Lamoni, and Clarinda soils. Preparing a good seedbed and tilling are difficult on eroded soils because the original friable surface layer has been removed or thinned and the more weakly structured subsoil commonly is hard and cloddy after rains or after it has been tilled when wet. Runoff water from eroding soils commonly deposits sediments in streams, drainageways, and road ditches. Controlling erosion not only helps to maintain the productivity of soils but also improves the quality of water for municipal and recreational uses and for fish and wildlife by minimizing the pollution of streams.

Because of the diversity of soils and landscape features in the county, various erosion-control measures are needed. These measures should reduce the impact of raindrops on bare soil, reduce the runoff rate, and increase the rate of water infiltration. Conservation tillage, contour farming, contour stripcropping, grassed waterways, cover crops, terraces and diversions, and crop rotations that include grasses and legumes are appropriate erosion-control methods. Generally, a combination of several measures is needed.

A permanent cover of hay or pasture that is well managed can hold soil losses to an amount that will not reduce the productive capacity of the soils. On livestock farms, where part of the acreage is hayland or pasture, forage crops of grasses and legumes not only provide nitrogen and improve tilth for the subsequent crop but also provide a protective plant cover.

A conservation tillage system that leaves a protective amount of crop residue on the surface after planting is effective in controlling erosion, especially on the more sloping soils. Examples of the major kinds of conservation tillage include no-till farming, slot tillage, or zero tillage. In these systems, the seedbed is prepared and the seed planted in one operation. The surface is disturbed only in the immediate area of the planted seed row. A protective cover of crop residue is left on at least 90 percent of the surface. Strip-till or till-plant also is a system in which the seedbed is prepared and the seed planted in one operation. Tillage is limited to a strip not wider than one-third of the row. A protective cover of crop residue is left on two-thirds of the surface. Chisel-disk or rotary tillage is a system in which the soil is loosened throughout the field and part of the crop residue is incorporated into the soil. Seedbed preparation and planting can be one operation or separate operations.

Terraces and diversions control runoff and erosion by reducing the length of slopes. They are most effective on gently sloping to moderately sloping soils that have smooth slopes. They are less effective in areas where slopes are irregular or too steep. Terraces built in Taylor County are more effective if intakes and tile outlets are installed to remove excess water from terrace channels. Terraces function satisfactorily on the loess soils, such as Nira and Ladoga soils. Topdressing the exposed subsoil with surface soil material helps to maintain the productivity of the soil after construction. If terraces are constructed in eroded areas where the topsoil is generally less than 6 inches thick, the exposed subsoil cannot be adequately covered with soil material for sufficient plant growth. As a result soil tilth, seedling establishment, fertility, and crop yields are reduced. Terraces function poorly on paleosols that weathered from glacial till, such as Clarinda, Lamoni, and Adair soils. These soils have a firm, clayey subsoil and low productivity. If these soils are terraced along with the more productive soils upslope, keeping cuts to a minimum helps to prevent unnecessary exposure of the subsoil. Topdressing the exposed subsoil with material from the surface soil helps to maintain the productivity of these soils, even though productivity is low. Terraces function satisfactorily on the glacial till soils, such as Shelby and Gara soils. Slopes should be long and smooth and should have slopes of less than 14 percent. If terraces are constructed in areas of these soils, cuts should be kept to a minimum because the firm subsoil is low in fertility. Medium and large stones from the subsoil may also interfere with some tillage operations.

Contour farming, terraces, diversions, and contour stripcropping can effectively control erosion in areas where slopes are long and smooth enough. These measures are most effective on soils that have smooth, uniform slopes, such as Sharpsburg and Nira soils. Gully-control structures, grassed waterways, and farm ponds held to control erosion in watercourses. The farm ponds also provide a supply of water for livestock and for recreation.

Soil blowing is a hazard on soils that have a surface layer of very fine sandy loam or coarser textures. These soils are in scattered areas along the major streams. If the winds are strong and the soils are dry and bare, soil blowing can damage these soils in a short period. Row crops on these soils and on adjacent soils may also be damaged by the blowing sand. Maintaining a protective cover of vegetation, surface mulching, establishing windbreaks, and using conservation tillage methods help to minimize the effects of soil blowing.

Information about the specifications and design of conservation practices that help to control erosion on each kind of soil is provided at the local office of the Natural Resources Conservation Service.

Drainage is a major management concern on about 23 percent of the acreage in Taylor County. Installing an artificial drainage system on somewhat poorly drained, poorly drained, and very poorly drained soils improves the timeliness of fieldwork, increases soil temperature in the spring, expands the choice of crops that can be grown, and increases productivity. An artificial drainage system typically is needed on the Wabash, Humeston, Colo, and Ackmore soils on flood plains and the Winterset and Clearfield soils on uplands. Tile drains generally do not function satisfactorily in the very slowly permeable Wabash and

Humeston soils. Ackmore soils can be drained by tile if the silty alluvial material is of sufficient depth that the tile can be placed on top of the buried, clayey soil and if outlets are available. Sidehill seep areas are common in the county. They are caused by rainwater percolating through the loess soils in the uplands. This water perches at the point where the loess comes in contact with the less permeable paleosol weathered from glacial till. This perched water travels laterally until it reaches the point where the contact between loess and till is exposed at the surface. A wet, seepy area develops between the loess soils, such as Clearfield and Nira soils, and the paleosols, such as Clarinda and Lamoni soils. Installing lateral interceptor tile in the more permeable loess soils, slightly upslope from this wet seepy area, helps to drain excess moisture.

Fertility is determined by the supply of available phosphorus and potassium in the subsoil, by the pH level, and by the content of organic matter in the surface layer. The fertility level varies widely in the soils of Taylor County. In most of the soils, the supply of available phosphorus and potassium is low or very low and reaction ranges from neutral to strongly acid.

On acid soils, applications of ground limestone are needed to promote good plant growth. On all soils, the kinds and amounts of lime and fertilizer needed should be determined by the results of soil tests, the needs of the crop, and the expected level of yields. Soil tests generally provide the most beneficial information. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime that should be applied.

Tilth is an important factor in the germination of seeds and in the infiltration of water. Soils that have good tilth generally have a high content of organic matter and are granular and porous. In most of the uneroded upland soils that formed under prairie grasses, the content of organic matter in the surface layer is about 3.0 to 4.5 percent. In the eroded soils, it ranges from less than 1 percent to 3 percent, depending on the degree of erosion that has taken place. It also ranges from less than 1 percent to 3 percent in Gara, Armstrong, and Ladoga soils, which formed under a mixture of prairie grasses and deciduous trees. Generally, the soils on flood plains have the highest content of organic matter of all the soils in the county. The content of organic matter is 4 to 7 percent in the flood-plain soils that have a surface layer of silty clay loam or silty clay. It is 1 to 3 percent in the stratified soils that have a surface layer of silt loam, such as Nodaway soils. Regular additions of crop residue, manure, and other organic material improve soil structure and tilth and help to prevent the formation of a surface crust.

The soils that formed in glacial till, such as Gara and Shelby soils, may have accumulations of large stones on the surface, especially in eroded areas. These stones can hinder fieldwork unless they are removed.

Bluegrass is the most common pasture grass in the county. Some pastures are renovated and support birdsfoot trefoil or crownvetch. In recent years, many of the pastures have been planted with fescue. Other suitable species that are common in the pastured areas are bromegrass, reed canarygrass, orchardgrass, switchgrass, big bluestem, indiangrass, alfalfa, red clover, and ladino clover. Most of the bluegrass pastures are not used as cropland because the soils are too steep for cultivation. Measures that prevent overgrazing are needed, especially on steep slopes, to increase the rate of water infiltration and to prevent surface compaction and gully erosion. Maximum production of grasses and legumes can be achieved if the pasture is properly managed. Applications of fertilizer, weed and brush control, rotation grazing, deferred grazing, proper stocking rates, and adequate livestock watering facilities help to keep the pasture in good condition.

Erosion is accelerated if the plant cover is destroyed when the more sloping pastures are renovated. Interseeding the grasses and legumes into the existing sod eliminates the need for destroying the plant cover during seedbed preparation.

Many field crops suited to the soils and climate in Taylor County are not commonly grown. These include sorghum, used mainly for silage; wheat; barley; various pasture grasses; various native grasses, such as bluestem, switchgrass, and indiangrass, which can be used to produce grass seed; sweet corn; nursery stock; early vegetables; and certain orchard crops. The latest information about managing the soils for these crops can be obtained from local offices of the Cooperative Extension Service and the Natural Resources Conservation Service.

Yields per Acre

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

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

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

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

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

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (USDA, 1961). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Corn Suitability Rating (CSR)

The corn suitability rating for each soil is given in table 6. Corn suitability ratings provide a relative ranking of all soils mapped in the state of Iowa based on their potential to be utilized for the intensive production of row crops. The CSR is an index that can be used to rate the potential production of one soil compared with another over a period of time. The CSR considers average weather conditions and frequency of use of the soil for row crops. Ratings range from 5 for soils that have severe limitations affecting the production of row crops to 100 for soils that have no physical limitations, have minimal slopes, and can be continuously row cropped. The ratings listed in table 6 assume adequate management, natural weather conditions (no irrigation), artificial drainage where required, and no land leveling or terracing. They also assume that soils lower on the landscape are not affected by frequent, damaging floods. The weighted CSR for a given field can be modified by the occurrence of sandy spots, local deposits, rock and gravel outcrops, field boundaries, and noncrossable drainageways. Even though predicted average yields will change with time, the CSR's are expected to remain relatively constant in relation to one another.

The CSR's in Taylor County range from 5 for Gara clay loam, 18 to 25 percent slopes, moderately eroded, to 90 for Macksburg silty clay loam, 0 to 2 percent slopes. No ratings are provided for miscellaneous areas because of the variability of properties and use of these areas.

Woodland Management and Productivity

The original land survey of Iowa, made during the period 1832 to 1859, indicated that about 50,030 acres in Taylor County, or nearly half of the total acreage, was woodland when the first settlers arrived. The early settlers felled a large quantity of timber when they cleared the land, primarily for farming. Some of the timber was felled for construction, firewood, and fenceposts. Woodland further declined to about 15,000 acres by 1958 but had increased to 21,000 acres by 1989, according to a Taylor County Soil Conservation District inventory. Most of the timber removed during the last 30 years was taken from strongly sloping to steep, highly erodible soils that were converted from woodland to agricultural uses. More recently, however, this trend has been somewhat reversed because of low economic returns in agriculture.

The principal species on the upland slopes in the county are white oak, northern red oak, black oak, bur oak, shagbark hickory, bitternut hickory, honeylocust, and eastern redcedar. Those in the lowlands and along drainageways include eastern cottonwood, silver maple, willow, green ash, basswood, and black walnut. Black cherry is common but not plentiful. American elm and red elm grow in the county, but they are of limited extent because of the effects of Dutch elm disease. Most of the upland timber grows in areas of Gara, Ladoga, and Armstrong soils. Most of the timber on flood plains grows in areas of the Nodaway-Humeston-Wabash association, which is described under the heading "General Soil Map Units."

High grading of woodland is a common occurrence in Taylor County. High grading occurs when woodland owners cut the better trees or the more desirable species for lumber and furniture. After this high grading, the woodland is of poorer quality because it is regenerated by the poorer trees and the less desirable species that were left behind. Scientific management of a stand of trees can result in the production of an increased volume of more valuable wood and in yields of a consistent amount of firewood from year to year. It also can greatly reduce soil losses and improve the habitat for wildlife.

Woodland can produce the best wood crop only if it is well managed. It should be protected from fire and from grazing. The trees with the highest potential should be allowed to grow. The undesirable trees and vines that compete with desirable species for moisture, nutrients, and light should be removed. After some of the best trees are harvested, their growing space can be occupied by younger trees. The volume harvested during a designated period should not exceed the growth of the remaining trees during the same period.

Most of the woodland in the county is lightly to heavily pastured. Allowing livestock to graze in the woodland can damage the base of the larger trees, damage or destroy young trees, and compact the surface of the soil. Also, the animals selectively browse on certain young trees.

The soils in Taylor County range from generally suited to well suited to the production of trees. Some tree species can grow under a variety of soil conditions, but others are more site specific. For example, eastern redcedar can grow in a poorly drained soil and in a droughty soil on a south-facing slope, but black walnut grows better in deep, moderately well drained, fertile soils. Generally, the deep, well drained or moderately well drained soils that are moderately fertile or highly fertile are well suited to trees. If the subsoil is slowly permeable, however, root development is restricted.

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

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

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

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

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

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

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

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

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

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

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

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

Further information about woodland management, tree planting, and insect and disease control can be obtained from the Taylor County Soil Conservation District and from the Iowa Department of Natural Resources.

Windbreaks and Environmental Plantings

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

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

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

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

Recreation

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

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

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

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

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas (fig. 8).

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be

Figure 8.—This picnic area in Lake of Three Fires State Park is on Ladoga silt loam, 5 to 9 percent slopes.

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

Wildlife Habitat

Taylor County supports many kinds of wildlife. These wildlife resources have a positive effect on the local economy, mainly because of the opportunities for hunting and fishing resulting from the kind and abundance of wildlife in the county. Also, songbirds and hawks, owls, snakes, and other predators are beneficial because they control rodents and undesirable insects.

The soils in the county indirectly influence the kind and abundance of wildlife through their effect on vegetation and land use. Topography affects wildlife through its effect on land use. The undisturbed vegetation in moderately steep and steep areas, such as most areas of Gara soils, is valuable to wildlife. Planting suitable vegetation where needed on the more sloping prairie soils, such as Shelby soils, can improve the habitat for the desirable kinds of wildlife. The nearly level Macksburg and Winterset soils generally are cropped intensively. They provide only limited shelter and nesting areas for wildlife, but they also provide corn and small grain for feed. Much of the wildlife in the county inhabits areas of the strongly sloping to steep Gara, Shelby, Bucknell, Lamoni, Armstrong, and Adair soils in the uplands. Because these soils are along the streams throughout the county, the wildlife is well distributed.

Raccoon, coyote, skunk, opossum, squirrel, and cottontail rabbit generally are abundant in the uplands and are especially abundant in the Gara-Armstrong-Ladoga association, which is described under the heading "General Soil Map Units." White-tailed deer frequent all areas of the Gara-Armstrong-Ladoga and Nodaway-Humeston-Wabash associations and the adjacent wooded areas. Muskrat, mink, and beaver frequent the creeks throughout the county. They are most numerous in areas of the Nodaway-Humeston-Wabash association.

Quail and pheasants are plentiful throughout the county. Quail are most abundant in the Gara-Armstrong-Ladoga association, and the number of pheasants is highest in areas of the Lamoni-Nira-Shelby association. Wild turkeys are increasing in the county and are mainly in the wooded areas of the Gara-Armstrong-Ladoga association. Quail, pheasants, and turkeys provide excellent hunting during years of favorable weather and habitat conditions.

Ponds and reservoirs provide good habitat for waterfowl, particularly mallards, teal, and Canada geese. The larger streams support good populations of wood ducks. Wabash and Nodaway soils provide potential sites for dikes and impoundments, which would improve the habitat for waterfowl. These areas are suitable sites for hunting blinds. The soils also provide food and cover for wildlife.

Fish, mainly catfish, bullheads, carp, and various minnows, are fairly plentiful in the major streams. Many privately owned artificial ponds ranging from ½ acre to 15 acres in size are well distributed throughout the county. Some that are well managed provide excellent fishing for bass, bluegill, and catfish. Internal drainage, available water capacity, texture of the subsoil, and permeability are important factors affecting the selection of sites for stocked farm ponds and the development of habitat for waterfowl. City water-supply reservoirs provide excellent fishing and enhance the habitat for wildlife. Many areas of the Lamoni-Nira-Shelby and Gara-Armstrong-Ladoga associations adjacent to the reservoirs are suitable for food plantings that improve the habitat for waterfowl.

Although many areas in the county are suitable as wildlife habitat, many more could be improved or developed. Generally, some soils on each farm can support good wildlife habitat if they are properly managed. Small, irregularly shaped areas of limited value for other uses can be developed as wildlife habitat. Examples are many areas of the strongly sloping to steep Adair, Armstrong, and Gara soils. Brushy or wooded areas can be fenced so that food and cover are not destroyed by livestock. The borders of fields can be planted to grasses and legumes. These areas should not be clipped, especially during the nesting season for upland birds.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Engineering

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

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

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

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

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

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

Building Site Development

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

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

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

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

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

Sanitary Facilities

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

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

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

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

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

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

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

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

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

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

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

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

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

Construction Materials

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Water Management

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

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

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

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

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

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

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

Soil Properties

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

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

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

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

Engineering Index Properties

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

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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

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

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

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical and Chemical Properties

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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

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

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

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

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

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

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

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

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

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

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

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

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

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

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Soil and Water Features

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

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

The four hydrologic soil groups are:

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

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

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

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

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

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

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

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

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

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

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone. Only saturated zones within a depth of about 6 feet are indicated.

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

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludolls.

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Ackmore Series

The Ackmore series consists of somewhat poorly drained, moderately permeable soils on flood plains and alluvial fans and in narrow drainageways on uplands. These soils formed in silty alluvium. The native vegetation was tall prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Ackmore silt loam, 0 to 2 percent slopes, in a cultivated field on a nearly level flood plain; 1,300 feet north and 345 feet west of the southeast corner of sec. 15, T. 67 N., R. 32 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam (25 percent clay), very dark grayish brown (10YR 3/2) dry; weak medium granular structure; friable; light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine roots; neutral; clear smooth boundary.

C—8 to 30 inches; stratified very dark gray (10YR 3/1) and grayish brown (10YR 5/2) silt loam (25 percent clay), dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2) dry; few fine prominent dark brown (7.5YR 4/4) mottles; massive; friable; few fine roots; neutral; clear smooth boundary.

Ab1—30 to 35 inches; black (10YR 2/1) silty clay loam (28 percent clay), weak very fine subangular blocky structure; friable; neutral; clear smooth boundary.

2Ab2—35 to 42 inches; black (N 2/0) silty clay loam (35 percent clay); weak medium subangular blocky structure parting to moderate fine and very fine subangular blocky; firm; neutral; gradual smooth boundary.

2Ab3—42 to 60 inches; black (N 2/0) silty clay loam (38 percent clay); weak medium subangular blocky structure parting to moderate fine and very fine subangular blocky; firm; neutral.

The thickness of the A and C horizons ranges from 20 to 36 inches. The A horizon ranges from dark brown (10YR 3/3) to black (10YR 2/1). The texture ranges from silt loam to silty clay loam. The 2Ab horizon ranges from black (N 2/0) or very dark brown (10YR 2/2) to very dark gray (N 3/0 or 10YR 3/1).

Adair Series

The Adair series consists of moderately well drained, slowly permeable soils on the slightly lower convex ridges and shoulders of side slopes in the uplands. These soils formed in a reddish brown, loamy and clayey paleosol weathered from glacial till. The native vegetation was tall prairie grasses. Slope ranges from 5 to 14 percent.

Typical pedon of Adair clay loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field in a southeast-facing, convex shoulder position; 2,260 feet east and 195 feet south of the northwest corner of sec. 35, T. 70 N., R. 35 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) clay loam (30 percent clay), dark gray (10YR 4/1) dry, very dark grayish brown (10YR 3/2) crushed; mixed with pockets of brown (7.5YR 4/4) material; weak and moderate fine subangular blocky structure; friable; very few fine roots; few fine pebbles; slightly acid; abrupt smooth boundary.

BA—6 to 11 inches; dark grayish brown (10YR 4/2) clay loam (34 percent clay); few fine distinct dark brown (7.5YR 3/2) and few fine prominent brown (7.5YR 4/4) mottles; weak fine subangular blocky structure parting to weak fine granular; friable; pores filled with very dark gray (10YR 3/1) material; few fine roots; few fine pebbles; medium acid; clear smooth boundary.

2Bt1—11 to 16 inches; brown (7.5YR 4/4) clay loam (38 percent clay); weak medium and fine subangular blocky structure; firm; common distinct dark grayish brown (10YR 4/2) clay films; few fine roots; common fine pebbles; medium acid; clear smooth boundary.

2Bt2—16 to 22 inches; reddish brown (5YR 5/3) clay (44 percent clay); common fine faint reddish brown (5YR 4/4) and few fine prominent yellowish red (5YR 5/8) mottles; moderate fine subangular blocky structure; very firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine roots; few fine dark concretions; few fine pebbles; slightly acid; gradual smooth boundary.

2Bt3—22 to 28 inches; strong brown (7.5YR 5/6) clay (42 percent clay); many fine prominent grayish brown (10YR 5/2) and reddish brown (5YR 4/4) mottles; weak medium and fine subangular blocky structure; very firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine and medium dark concretions; few fine pebbles; neutral; gradual smooth boundary.

2Bt4—28 to 43 inches; strong brown (7.5YR 5/8) and grayish brown (10YR 5/2) clay loam (37 percent clay); weak coarse prismatic structure; very firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common medium dark concretions; few fine pebbles; neutral; gradual smooth boundary.

2C—43 to 60 inches; yellowish brown (10YR 5/6) clay loam (32 percent clay); few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm; common medium dark concretions; few fine pebbles; neutral.

The thickness of the solum ranges from 40 to more than 65 inches. Carbonates are leached to a depth of at least 48 inches and typically to a depth of about 50 inches or more. A few stones and pebbles are throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The texture is typically loam or clay loam, but the range includes silty clay loam. The A horizon is 10 to 16 inches thick, except in eroded areas. The upper part of the 2Bt horizon dominantly has hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 3 to 6 and has mottles with the same range in colors. The content of clay typically is 38 to 46 percent but ranges to 55 percent.

The Adair soils in map units 192C2 and 192D2 are taxadjuncts because they do not have a mollic epipedon.

Armstrong Series

The Armstrong series consists of moderately well drained, slowly permeable soils on the slightly lower convex ridges and shoulders of side slopes in the uplands. These soils formed in a red, loamy and clayey paleosol weathered from glacial till. The native vegetation was mixed trees and grasses. Slope ranges from 5 to 14 percent.

Typical pedon of Armstrong clay loam, 9 to 14 percent slopes, moderately eroded, in a brushy pasture on a northwest-facing, convex ridge; 680 feet north and 380 feet west of the southeast corner of sec. 16, T. 70 N., R. 35 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) clay loam (27 percent clay), grayish brown (10YR 5/2) dry; mixed with pockets of brown (10YR 5/3) and strong brown (7.5YR 5/6) subsurface material; very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderate fine subangular blocky and angular blocky structure; friable; common fine and medium roots; medium acid; abrupt smooth boundary.

BE—6 to 10 inches; strong brown (7.5YR 5/6) clay loam (31 percent clay); dark grayish brown (10YR 4/2) organic coatings on faces of peds; weak fine subangular blocky structure; friable; common distinct brown (7.5YR 5/4) clay films on faces of peds; common very fine and fine roots; medium acid; clear smooth boundary.

Bt1—10 to 16 inches; strong brown (7.5YR 5/6) clay loam (34 percent clay); few fine distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky and angular blocky structure; friable; common distinct brown (7.5YR 5/4) clay films; dark brown (7.5YR 4/2) coatings in root channels; few fine and medium roots; few fine dark concretions of manganese oxide; few fine pebbles; strongly acid; gradual smooth boundary.

2Bt2—16 to 21 inches; strong brown (7.5YR 5/6) clay (44 percent clay); few fine prominent grayish brown (10YR 5/2) and few fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure parting to moderate fine angular blocky; firm; common distinct brown (7.5YR 5/4) clay films; common fine roots; few fine dark concretions of manganese oxide; common fine pebbles; strongly acid; gradual smooth boundary.

2Bt3—21 to 31 inches; yellowish brown (10YR 5/6) clay (40 percent clay); common fine prominent grayish brown (10YR 5/2) and few fine prominent strong brown (7.5YR 5/8) mottles; weak fine prismatic structure parting to weak medium subangular blocky and angular blocky; firm; common distinct brown (10YR 5/3) clay films; few fine roots; few fine dark concretions; few fine pebbles; strongly acid; gradual smooth boundary.

2BC—31 to 42 inches; mottled yellowish brown (10YR 5/8), grayish brown (10YR 5/2), and strong brown (7.5YR 5/8) clay loam (38 percent clay); weak medium prismatic structure; firm; few distinct brown (10YR 5/3) clay films; few fine roots; common medium dark concretions; few fine pebbles; strongly acid; gradual smooth boundary.

2C—42 to 60 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/8), and strong brown (7.5YR 5/8) clay loam (35 percent clay); massive; firm; very few fine roots; common medium dark concretions of manganese oxide; few fine pebbles; strongly acid.

The thickness of the solum and the depth to free carbonates commonly range from about 42 to 65 inches. A few stones and pebbles are throughout the profile.

The A or Ap horizon has chroma of 1 or 2. It typically is 6 to 8 inches thick. It is loam or clay loam. The E horizon, if it occurs, has value of 4 or 5 and chroma of 2 or 3. It is 2 to 5 inches thick. The 2Bt horizon is commonly 18 to 32 inches thick. It typically has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6 and has reddish mottles. The content of clay is 36 to 45 percent. The 2BC and 2C horizons typically have hue of 2.5Y or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

Bucknell Series

The Bucknell series consists of somewhat poorly drained, slowly permeable soils on short convex side slopes and narrow ridges near the upper ends of drainageways in the uplands. These soils formed in a gray, loamy and clayey paleosol weathered from glacial till. The native vegetation was mixed grasses and trees. Slope ranges from 5 to 14 percent.

Typical pedon of Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded, in a pasture on south- to southeast-facing convex side slopes; 1,220 feet west and 780 feet north of the southeast corner of sec. 24, T. 67 N., R. 33 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam (32 percent clay), dark grayish brown (10YR 4/2) dry; mixed with some streaks and pockets of brown (10YR 5/3) subsoil material; very dark gray (10YR 3/1) organic coatings on faces of peds; weak very fine subangular blocky structure; friable; common fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 14 inches; mottled grayish brown (10YR 5/2) and brown (10YR 5/3) silty clay loam (34 percent clay); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderate fine and very fine subangular blocky structure; firm; very few fine roots; medium acid; gradual smooth boundary.

2Bt2—14 to 24 inches; grayish brown (2.5Y 5/2) clay (43 percent clay); common medium distinct gray (10YR 5/1) and common medium prominent yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; firm; few fine roots; few fine pebbles; medium acid; gradual smooth boundary.

2Bt3—24 to 33 inches; mottled grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) clay (41 percent clay); common medium prominent yellowish brown (10YR 5/8) mottles; weak medium and fine subangular blocky structure; firm; very few fine roots; few fine pebbles; medium acid; gradual smooth boundary.

2BC—33 to 44 inches; mottled light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/8), and grayish brown (2.5Y 5/2) clay loam (39 percent clay); weak medium prismatic structure parting to weak medium subangular blocky; firm; very few fine roots; few fine pebbles; slightly acid; gradual smooth boundary.

2C—44 to 60 inches; mottled light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/8), grayish brown (2.5Y 5/2), and light olive brown (2.5Y 5/6) clay loam (38 percent clay); massive; firm; few fine pebbles; neutral.

The thickness of the solum typically ranges from 40 to 60 inches. Carbonates do not occur above a depth of 60 inches. In cultivated or eroded areas, the E horizon has been incorporated into the plow layer and occurs only as silt coatings on peds. A few stones and pebbles are throughout the profile.

The A or Ap horizon typically has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is typically 6 to 9 inches thick. The texture typically is silty clay loam, but the range includes clay loam and loam. The E horizon, if it occurs, has value of 4 or 5 and chroma of 2 or 3. It is 2 to 5 inches thick. It is silty clay or silty clay loam. The Bt2 and Bt3 horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 8. The clay part of the Bt horizon typically is 12 to 24 inches thick. The maximum content of clay, which generally occurs within a depth of 10 to 18 inches, is about 50 percent.

Clarinda Series

The Clarinda series consists of poorly drained, very slowly permeable soils on short convex side slopes and in coves at the head of drainageways on uplands. These soils formed in a gray, clayey paleosol weathered from glacial till. The native vegetation was tall prairie grasses. Slope ranges from 5 to 14 percent.

Typical pedon of Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded, in a set-aside field on a northeast-facing, narrow convex ridge near the head of a drainageway in the uplands; 620 feet west and 330 feet north of the southeast corner of sec. 36, T. 70 N., R. 32 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam (37 percent clay), dark gray (10YR 4/1) dry; mixed with 10 percent streaks and pockets of dark gray (10YR 4/1) subsoil material; weak medium subangular blocky structure parting to weak fine granular; friable; many fine and very fine roots; medium acid; abrupt smooth boundary.

2Bt—6 to 12 inches; dark gray (10YR 4/1) silty clay (48 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds; few fine prominent strong brown (7.5YR 4/6) and few fine faint dark grayish brown (10YR 4/2) mottles; weak medium prismatic structure parting to moderate medium and fine subangular blocky; firm; common fine and very fine roots; medium acid; gradual smooth boundary.

2Btg1—12 to 27 inches; gray (5Y 5/1) silty clay (49 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds in the upper part; few fine prominent strong brown (7.5YR 4/8) mottles in the upper part; weak medium and coarse prismatic structure parting to moderate medium and fine subangular blocky; firm; many prominent dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few fine black (10YR 2/1) concretions of manganese oxide; neutral; gradual smooth boundary.

2Btg2—27 to 39 inches; gray (5Y 5/1) clay (53 percent clay); common medium distinct light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; many prominent gray (5YR 5/1) clay films on faces of peds; common medium very dark gray (10YR 3/1) concretions of manganese oxide; few fine strong brown (7.5YR 4/6) concretions of iron oxide; neutral; gradual smooth boundary.

2Btg3—39 to 53 inches; gray (5Y 5/1) silty clay (47 percent clay); few medium distinct light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; many prominent gray (10YR 5/1) clay films on faces of peds; light gray (10YR 6/1), uncoated sand grains on faces of peds; common medium very dark gray (10YR 3/1) concretions of manganese oxide; common medium strong brown (7.5Y 4/8) concretions of iron oxide; neutral; gradual smooth boundary.

2BCg—53 to 60 inches; light gray (5Y 6/1) clay (42 percent clay); weak coarse and medium prismatic structure; firm; common distinct gray (5Y 5/1) clay films on faces of peds; light gray (5Y 6/1), uncoated sand grains on faces of peds; common medium very dark gray (10YR 3/1) concretions of manganese oxide; few fine strong brown (7.5YR 5/8) concretions of iron oxide; neutral.

The thickness of the solum and the depth to carbonates are commonly more than 5 feet. The A horizon is typically 10 to 15 inches thick, except in eroded areas. The 2Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma dominantly of 1. The 2B horizon is silty clay or clay. The content of clay ranges between 45 and 60 percent.

The Clarinda soils in map units 222C2 and 222D2 are taxadjuncts because they do not have a mollic epipedon.

Clearfield Series

The Clearfield series consists of poorly drained soils on short convex side slopes and in coves at the head of drainageways on uplands. These soils formed in 3 to 5 feet of deoxidized loess over a gray, clayey paleosol. The native vegetation was tall prairie grasses. Permeability is moderately slow in the loess and very slow in the clayey paleosol. Slope ranges from 5 to 9 percent.

Typical pedon of Clearfield silty clay loam, 5 to 9 percent slopes, in a cultivated field on a southeast-facing, convex side slope near the head of a drainageway; 466 feet east and 670 feet south of the northwest corner of sec. 15, T. 70 N., R. 32 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (39 percent clay), very dark gray (10YR 3/1) dry, black (10YR 2/1) rubbed; weak very fine subangular blocky structure parting to weak fine granular; friable; common fine and very fine roots; medium acid; clear smooth boundary.

A—8 to 13 inches; very dark gray (10YR 3/1) silty clay loam (38 percent clay), dark gray (10YR 4/1) dry, very dark gray (10YR 3/1) rubbed; dark grayish brown (10YR 4/2) organic coatings on faces of peds in the lower part; moderate very fine and fine subangular blocky structure; friable; few very fine roots; slightly acid; clear smooth boundary.

Btg1—13 to 18 inches; dark gray (10YR 4/1) silty clay loam (39 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds; common fine faint grayish brown (10YR 5/2) and common fine prominent light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; firm; many prominent dark gray (10YR 4/1) clay films; few fine roots; few very fine strong brown (7.5YR 5/6) concretions of iron oxide; neutral; clear smooth boundary.

Btg2—18 to 26 inches; olive gray (5Y 5/2) silty clay loam (37 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds; common fine prominent yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure parting to weak fine subangular blocky; firm; common distinct gray (10YR 5/1) clay films; few very fine roots; few fine strong brown (7.5YR 5/6) concretions of iron oxide; neutral; gradual smooth boundary.

Bg1—26 to 35 inches; mottled light brownish gray (2.5Y 6/2) and reddish yellow (7.5YR 6/8) silty clay loam (35 percent clay); weak fine prismatic structure parting to weak medium subangular blocky; firm; dark gray (10YR 4/1) coatings along root channels; very few very fine roots; few fine dark concretions of manganese oxide; neutral; gradual smooth boundary.

Bg2—35 to 41 inches; light gray (5Y 6/1) silty clay loam (34 percent clay); common fine prominent reddish yellow (7.5YR 6/8) mottles; weak medium prismatic structure; firm; very dark gray (10YR 3/1) coatings on faces of peds; very few very fine roots; neutral; abrupt smooth boundary.

2Ab—41 to 49 inches; dark gray (N 4/0) clay (66 percent clay); a black (N 2/0) layer at a depth of 44 inches; few distinct black (N 2/0) coatings on cleavage faces; appears massive but has some vertical cleavage; very firm; few fine strong brown (7.5YR 5/6) concretions of iron oxide; neutral; gradual smooth boundary.

2Bb—49 to 60 inches; gray (N 5/0) clay (60 percent clay); few fine prominent yellowish brown (10YR 5/6) mottles; massive; very firm; neutral.

The A horizon is typically black (10YR 2/1 or N 2/0) in the upper part and very dark gray (10YR 3/2 or N 3/0) in the lower part. It is typically 10 to 18 inches thick, except in eroded areas. The Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2.

Colo Series

The Colo series consists of poorly drained, moderately permeable soils on flood plains, alluvial fans, and the lower foot slopes and in narrow drainageways on uplands. These soils formed in silty alluvium. The native vegetation was tall prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, in a cultivated field on a northwest-facing, nearly level flood plain; 170 feet east and 1,570 feet south of the center of sec. 8, T. 70 N., R. 35 W.

Ap—0 to 8 inches; black (10YR 2/1) and very dark grayish brown (10YR 3/2) silty clay loam (29 percent clay), very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; neutral; clear smooth boundary.

A1—8 to 13 inches; very dark gray (10YR 3/1) silty clay loam (29 percent clay), very dark gray (10YR 3/1) dry; black (10YR 2/1) organic coatings on faces of peds; few fine distinct very dark grayish brown (2.5Y 3/2) mottles; weak very fine subangular blocky structure parting to weak fine granular; friable; common fine roots; medium acid; gradual smooth boundary.

A2—13 to 20 inches; very dark gray (10YR 3/1) silty clay loam (31 percent clay), very dark gray (10YR 3/1) dry; black (10YR 2/1) organic coatings on faces of peds; few fine distinct dark brown (10YR 3/3) mottles; weak fine and very fine subangular blocky structure; friable; common fine roots; slightly acid; gradual smooth boundary.

A3—20 to 31 inches; very dark gray (10YR 3/1) silty clay loam (32 percent clay), dark gray (10YR 4/1) dry; very dark gray (N 3/0) organic coatings on faces of peds; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky and moderate fine subangular blocky structure; friable; few fine roots; slightly acid; gradual smooth boundary.

Bw1—31 to 39 inches; very dark gray (10YR 3/1) silty clay loam (34 percent clay); very dark gray (N 3/0) organic coatings on faces of peds; common medium distinct brown (10YR 4/3) mottles; weak fine prismatic and weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; few fine roots; slightly acid; gradual smooth boundary.

Bw2—39 to 48 inches; very dark gray (10YR 3/1) silty clay loam (32 percent clay); very dark gray (N 3/0) organic coatings on faces of peds; common medium distinct brown (10YR 4/3) and few fine faint dark grayish brown (10YR 4/2) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few fine roots; slightly acid; diffuse smooth boundary.

BCg—48 to 60 inches; dark gray (10YR 4/1) silty clay loam (33 percent clay); very dark gray (N 3/0) organic coatings on faces of peds; many coarse distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure; firm; few fine roots; slightly acid.

The thickness of the solum ranges from about 40 to more than 60 inches. The mollic epipedon is 36 or more inches thick.

The A horizon has value of 2 or 3 and chroma of 0 or 1. The Bw horizon has value of 2 to 4. The BCg horizon and the Cg horizon, if it occurs, have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or less.

Ely Series

The Ely series consists of somewhat poorly drained, moderately permeable soils on low slightly concave foot slopes, on alluvial fans, and in drainageways. These soils formed in silty local alluvium. The native vegetation was tall prairie grasses. Slope ranges from 2 to 5 percent.

Typical pedon of Ely silty clay loam, 2 to 5 percent slopes, on a foot slope in a cultivated field; 2,460 feet west and 2,200 feet north of the southeast corner of sec. 6, T. 69 N., R. 35 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam (29 percent clay), dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common very fine roots; neutral; abrupt smooth boundary.

A1—8 to 16 inches; very dark gray (10YR 3/1) silty clay loam (30 percent clay), dark grayish brown (10YR 4/2) dry; moderate fine and very fine subangular blocky structure; friable; few very fine roots; neutral; clear smooth boundary.

A2—16 to 27 inches; very dark grayish brown (10YR 3/2) silty clay loam (31 percent clay), dark grayish brown (10YR 4/2) dry; very dark gray (10YR 3/1) organic coatings on faces of peds; moderate fine subangular blocky structure parting to weak very fine subangular blocky; friable; few very fine roots; neutral; clear smooth boundary.

Bw1—27 to 35 inches; dark grayish brown (10YR 4/2) silty clay loam (32 percent clay); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; few distinct dark brown (10YR 4/3) coatings in pores and root channels; few very fine roots; neutral; gradual smooth boundary.

Bw2—35 to 48 inches; dark brown (10YR 4/3) silty clay loam (33 percent clay); common medium faint yellowish brown (10YR 5/4) and few fine distinct grayish brown (2.5Y 5/2) mottles; weak fine prismatic structure parting to medium and fine subangular blocky; friable; few distinct dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; gradual smooth boundary.

Bw3—48 to 54 inches; brown (10YR 5/3) silty clay loam (30 percent clay); common medium distinct yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; weak medium and fine prismatic structure; friable; few distinct brown (10YR 4/3) coatings in root channels; few very fine roots; neutral; gradual smooth boundary.

C—54 to 60 inches; mottled yellowish brown (10YR 5/4), brown (10YR 4/3), and grayish brown (2.5Y 5/2) silty clay loam (29 percent clay); massive; friable; few very fine roots; neutral.

The thickness of the solum typically is about 48 inches but ranges from about 40 to 70 inches. The thickness of the mollic epipedon ranges from 20 to 34 inches.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The texture of the A horizon is typically silty clay loam, but the range includes silt loam. The BA horizon, if it occurs, has value of 3 and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. The content of clay in the Bw horizon ranges from 28 to 35 percent. The C horizon is silt loam or silty clay loam.

Gara Series

The Gara series consists of well drained, moderately slowly permeable soils on convex side slopes in the uplands. These soils formed in loamy glacial till. The native vegetation was mixed trees and grasses. Slope ranges from 9 to 25 percent.

Typical pedon of Gara clay loam, 14 to 18 percent slopes, moderately eroded, in an area of permanent pasture on a west-facing, convex side slope; 520 feet west and 860 feet north of the southeast corner of sec. 17, T. 69 N., R. 35 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) clay loam (28 percent clay), dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) dry; mixed with 20 percent streaks and pockets of brown (10YR 4/3) and dark yellowish brown (10YR 4/4) subsoil material; very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderate very fine subangular blocky structure; friable; few very fine roots; few fine pebbles; neutral; abrupt smooth boundary.

BE—6 to 12 inches; yellowish brown (10YR 5/4) clay loam (32 percent clay); dark grayish brown (10YR 4/2) coatings on faces of peds; moderate very fine and fine subangular blocky structure; friable; few very dark gray (10YR 3/1) filled pores; few very fine roots; few fine pebbles; slightly acid; clear smooth boundary.

Bt1—12 to 22 inches; yellowish brown (10YR 5/4) clay loam (35 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common distinct brown (10YR 5/3) clay films; few dark gray (10YR 4/1) filled pores; few very fine roots; few fine dark concretions of manganese oxide; few fine pebbles; medium acid; gradual smooth boundary.

Bt2—22 to 32 inches; yellowish brown (10YR 5/4) clay loam (38 percent clay); few fine prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; common distinct brown (10YR 5/3) clay films; dark gray (10YR 4/1) filled root channels; common fine dark concretions of manganese oxide; few fine pebbles; slightly acid; gradual smooth boundary.

BC—32 to 40 inches; yellowish brown (10YR 5/6) clay loam (36 percent clay); weak medium prismatic structure parting to weak medium and coarse subangular; firm; common distinct brown (10YR 5/3) clay films; dark gray (10YR 4/1) filled root channels; common fine dark concretions of manganese oxide; few fine pebbles; neutral; gradual smooth boundary.

C—40 to 60 inches; yellowish brown (10YR 5/6) clay loam (35 percent clay); appears massive but has some vertical cleavage; firm; light brownish gray (10YR 6/2) silt coatings on vertical faces of peds; few fine brownish yellow (10YR 6/8) silt pockets at a depth of 56 to 59 inches; few fine dark concretions of manganese oxide; few fine soft accumulations of calcium carbonate at a depth of 41 inches; few fine pebbles; slightly effervescent; mildly alkaline.

The thickness of the solum typically ranges from 38 to more than 65 inches, but it may be thinner in eroded areas. The thickness of the solum and the depth to carbonates typically are the same. A few stones and pebbles are throughout the profile.

The A or Ap horizon typically has chroma of 1 or 2 and is loam or clay loam. It is 6 to 9 inches thick. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The content of clay in the Bt horizon ranges from 32 to 35 percent. The BC and C horizons typically have value of 4 or 5 and chroma of 4 to 6.

Humeston Series

The Humeston series consists of poorly drained, very slowly permeable soils on flood plains. These soils formed in alluvium. The native vegetation was tall prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Humeston silty clay loam, 0 to 2 percent slopes, in a cultivated field on a second bottom; 2,115 feet west and 2,160 feet north of the southeast corner of sec. 31, T. 70 N., R. 34 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam (30 percent clay), gray (10YR 5/1) dry; weak medium angular blocky structure parting to weak fine subangular blocky; friable; common medium and fine roots; neutral; abrupt smooth boundary.

E1—10 to 17 inches; very dark gray (10YR 3/1) and dark gray (10YR 4/1) silt loam (25 percent clay), gray (10YR 5/1) dry; common medium prominent strong brown (7.5YR 4/6) mottles; weak thin platy structure; friable; few fine roots; slightly acid; clear smooth boundary.

E2—17 to 24 inches; dark gray (10YR 4/1) and gray (10YR 5/1) silt loam (25 percent clay), gray (10YR 5/1) dry; few fine prominent strong brown (7.5YR 4/6) mottles; weak thin platy structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bt1—24 to 33 inches; very dark gray (10YR 3/1) silty clay (43 percent clay); weak medium subangular blocky structure; firm; distinct common black (10YR 2/1) clay films on faces of peds; few fine roots; medium acid; gradual smooth boundary.

Bt2—33 to 46 inches; very dark gray (10YR 3/1) silty clay (47 percent clay); few medium faint grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; firm; many distinct black (10YR 2/1) clay films on faces of peds; very few fine roots; medium acid; gradual smooth boundary.

Bt3—46 to 60 inches; very dark gray (10YR 3/1) silty clay (47 percent clay); few fine faint grayish brown (10YR 5/2) mottles; weak medium and fine prismatic structure parting to weak medium subangular blocky; firm; many distinct very dark gray (10YR 3/1) clay films on faces of peds; very few fine roots; slightly acid.

The A or Ap horizon has value of 2 or 3. It is silt loam or silty clay loam. The E horizon has value of 4 or 5. The Bt horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or silty clay and has a maximum clay content of 35 to 48 percent. The BC horizon, if it occurs, has hue of 10YR, value of 2 to 4, and chroma of 1.

Judson Series

The Judson series consists of moderately well drained, moderately permeable soils on slightly concave foot slopes, on alluvial fans, and in drainageways in the uplands. These soils formed in silty local alluvium. The native vegetation was tall prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Judson silty clay loam, 2 to 5 percent slopes, in a cultivated field on a west-facing foot slope; 1,640 feet east and 640 feet north of the southwest corner of sec. 17, T. 70 N., R. 35 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (27 percent clay), dark gray (10YR 4/1) dry; weak medium granular structure parting to weak very fine subangular blocky; friable; very fine roots; neutral; abrupt smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) silty clay loam (29 percent clay), dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

A2—16 to 25 inches; very dark brown (10YR 2/2) silty clay loam (30 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

AB—25 to 33 inches; very dark grayish brown (10YR 3/2) silty clay loam (32 percent clay), grayish brown (10YR 5/2) dry, dark brown (10YR 3/3) rubbed; weak fine subangular blocky structure; friable; few medium roots; slightly acid; gradual smooth boundary.

Bw1—33 to 42 inches; dark brown (10YR 3/3) silty clay loam (34 percent clay); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; weak fine and medium subangular blocky structure; friable; very few fine roots; neutral; gradual smooth boundary.

Bw2—42 to 50 inches; dark brown (10YR 3/3) silty clay loam (32 percent clay); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; very few fine roots; neutral; gradual smooth boundary.

Bw3—50 to 60 inches; brown (10YR 4/3) silty clay loam (30 percent clay); dark brown (10YR 3/3) organic coatings on faces of peds; few fine distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; appears massive but has some vertical cleavage faces; friable; very few fine and medium roots; neutral.

The thickness of the solum typically ranges from 40 to more than 60 inches. Carbonates do not occur above a depth of 5 feet. The thickness of the mollic epipedon ranges from 24 to 36 inches.

The A or Ap horizon has chroma of 1 or 2. The AB horizon, if it occurs, has value of 2 or 3. The texture of the A horizon typically is silty clay loam, but the range includes silt loam. The Bw horizon has value and chroma of 3 or 4. The BC and C horizons have value of 3 to 5 and chroma of 3 or 4.

Kennebec Series

The Kennebec series consists of moderately well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. The native vegetation was tall prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Kennebec silt loam, 0 to 2 percent slopes, in a cultivated field on a nearly level flood plain; 4,260 feet north and 1,840 feet west of the southeast corner of sec. 30, T. 70 N., R. 35 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam (24 percent clay), dark grayish brown (10YR 4/2) dry; moderate fine angular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) silt loam (24 percent clay), dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A2—16 to 26 inches; black (10YR 2/1) and very dark gray (10YR 3/1) silt loam (25 percent clay), dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

A3—26 to 36 inches; very dark gray (10YR 3/1) silt loam (24 percent clay), grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few fine and medium roots; neutral; gradual smooth boundary.

AC—36 to 48 inches; very dark gray (10YR 3/1) silt loam (22 percent clay), grayish brown (10YR 5/2) dry; common medium distinct dark brown (10YR 3/3) mottles; appears massive but has some vertical cleavage faces; friable; light gray (10YR 6/1) silt coatings on faces of peds; few fine and medium roots; neutral; gradual smooth boundary.

C—48 to 60 inches; very dark grayish brown (10YR 3/2) silt loam (22 percent clay); common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; light gray (10YR 6/1) silt coatings on faces of peds; few medium roots; neutral.

The thickness of the solum and of the mollic epipedon ranges from 36 to more than 60 inches. The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Overwash, if it occurs, has hue of 10YR, value of 3 or 4, and chroma of 2. In some pedons, value increases below a depth of 20 inches.

Ladoga Series

The Ladoga series consists of moderately well drained, moderately slowly permeable soils on ridges and side slopes in the uplands. These soils formed in more than 60 inches of loess. The native vegetation was mixed trees and grasses. Slope ranges from 5 to 14 percent.

Typical pedon of Ladoga silt loam, 5 to 9 percent slopes, in a park area on a west- to southwest-facing ridge; 2,130 feet west and 200 feet north of the southeast corner of sec. 6, T. 68 N., R. 33 W.

A—0 to 6 inches; very dark gray (10YR 3/1) silt loam (22 percent clay), grayish brown (10YR 5/2) dry; about 10 percent streaks and pockets of dark grayish brown (10YR 4/2) subsurface material; weak fine subangular blocky structure parting to weak medium granular; friable; many fine roots; slightly acid; clear smooth boundary.

E—6 to 11 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam (25 percent clay), pale brown (10YR 6/3) dry; very dark gray (10YR 3/1) organic coatings on faces of peds; weak thick platy structure parting to weak fine subangular blocky; friable; many prominent grayish brown (10YR 5/2) clay films; light gray (10YR 6/1) silt coatings on faces of peds; many fine roots; medium acid; clear smooth boundary.

Bt1—11 to 16 inches; brown (10YR 5/3) silty clay loam (36 percent clay); dark gray (10YR 4/1) organic coatings on faces of peds; weak fine subangular blocky structure parting to moderate very fine subangular blocky; friable; many prominent dark grayish brown (10YR 4/2) clay films; common fine and few medium roots; medium acid; clear smooth boundary.

Bt2—16 to 24 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) silty clay (42 percent clay); few medium prominent olive gray (5Y 5/2) mottles; weak medium subangular blocky structure parting to moderate fine and very fine subangular blocky and very fine angular blocky; firm; many prominent brown (10YR 4/3) clay films; common fine roots; few fine dark concretions of manganese oxide; strongly acid; clear smooth boundary.

Bt3—24 to 35 inches; yellowish brown (10YR 5/4) silty clay (42 percent clay); common medium prominent olive gray (5Y 5/2) and light olive gray (5Y 6/2) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; many prominent brown (10YR 4/3) clay films; common fine and medium roots; common fine and medium dark concretions of manganese oxide; strongly acid; gradual smooth boundary.

Bt4—35 to 45 inches; yellowish brown (10YR 5/4) silty clay loam (38 percent clay); common medium prominent light olive gray (5Y 6/2), olive gray (5Y 5/2), and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium and fine subangular blocky; firm; many prominent dark brown (10YR 4/3) clay films; few fine and medium roots; common medium dark concretions of manganese oxide; strongly acid; gradual smooth boundary.

Bt5—45 to 53 inches; yellowish brown (10YR 5/4) silty clay loam (36 percent clay); common medium prominent light olive gray (5Y 6/2) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; common prominent dark grayish brown (10YR 4/2) clay films; common medium roots; common medium dark concretions of manganese oxide; strongly acid; gradual smooth boundary.

Bt6—53 to 60 inches; mottled yellowish brown (10YR 5/4), light olive gray (5Y 6/2), and light brownish gray (2.5Y 6/2) silty clay loam (34 percent clay); weak medium prismatic structure; friable; few distinct dark grayish brown (10YR 4/2) and grayish brown (2.5Y 5/2) clay films; few fine roots; common medium dark concretions of manganese oxide; medium acid.

The thickness of the solum ranges from 36 to 72 inches. Carbonates do not occur in the upper part of the C horizon.

The Ap horizon typically is silt loam, but in eroded areas it is silty clay loam. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 6 to 9 inches thick. The E horizon, if it occurs, has value of 4 or 5 and chroma of 2. It is as much as 5 inches thick. In cultivated areas, it is incorporated into the Ap horizon.

Lamoni Series

The Lamoni series consists of somewhat poorly drained, slowly permeable soils on short convex side slopes and narrow ridges in the uplands. These soils formed in a truncated, olive gray, clayey paleosol weathered from glacial till. The native vegetation was tall prairie grasses. Slope ranges from 5 to 14 percent.

Typical pedon of Lamoni silty clay loam, 9 to 14 percent slopes, in an area of permanent pasture on a southeast-facing, convex side slope; 1,870 feet east and 430 feet north of the southwest corner of sec. 1, T. 68 N., R. 32 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine roots; neutral; clear smooth boundary.

A—7 to 11 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; few fine roots; neutral; clear smooth boundary.

2Bt1—11 to 16 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) clay; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; few fine distinct very dark gray (10YR 3/1) clay films on faces of peds; few fine roots; few fine pebbles; slightly acid; gradual smooth boundary.

2Bt2—16 to 23 inches; olive gray (5Y 5/2) clay; few fine prominent light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; firm; few fine distinct dark gray (10YR 4/1) clay films on faces of peds; few fine roots; few fine pebbles; slightly acid; gradual smooth boundary.

2Bt3—23 to 27 inches; mottled olive gray (5Y 5/2), gray (5Y 6/1), and yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine distinct gray (10YR 5/1) clay films on faces of peds; few fine roots; few fine pebbles; slightly acid; gradual smooth boundary.

2Bt4—27 to 34 inches; light brownish gray (2.5Y 6/2) clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine prominent clay films on faces of peds; dark gray (10YR 4/1) coatings in pores and root channels; few fine roots; dark krotovinas at a depth of 32 inches; few fine pebbles; slightly acid; gradual smooth boundary.

2BC—34 to 42 inches; mottled light olive gray (5Y 6/2) and yellowish brown (10YR 5/6) clay loam; dark gray (10YR 4/1) organic coatings in filled root channels; weak coarse prismatic structure; firm; few fine roots; few fine pebbles; medium acid; gradual smooth boundary.

2C—42 to 60 inches; mottled light olive gray (5Y 6/2) and yellowish brown (10YR 5/6) clay loam; massive; firm; few fine pebbles; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. Carbonates do not occur above a depth of 50 inches. A few stones and pebbles are throughout the profile.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is typically silty clay loam. The A horizon is 10 to 14 inches thick. The 2Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 6. The part of the B horizon that has clay texture is typically 12 to 24 inches thick, and the finest textured part contains between 40 and 50 percent clay. The upper part of the solum contains between 10 and 30 percent sand, and the C horizon contains between 30 and 45 percent sand.

Lineville Series

The Lineville series consists of moderately well drained soils on the slightly lower, narrow convex ridges in the uplands. Permeability is moderately slow. These soils formed in loess and pedisediments over a red, clayey paleosol weathered from glacial till. The native vegetation was mixed trees and grasses. Slope ranges from 5 to 9 percent.

Typical pedon of Lineville silty clay loam, 5 to 9 percent slopes, moderately eroded, in a pastured area on a southeast-facing, narrow convex ridge; 1,680 feet north and 290 feet east of the southwest corner of sec. 13, T. 69 N., R. 35 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam (35 percent clay, 3 percent sand), brown (10YR 5/3) and light yellowish brown (10YR 6/4) dry; mixed with 10 percent streaks and pockets of brown (10YR 4/3) subsoil material; weak medium subangular blocky structure parting to moderate fine granular; friable; many fine roots; medium acid; abrupt smooth boundary.

BE—6 to 10 inches; brown (10YR 4/3) silty clay loam (35 percent clay, 3 percent sand); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; weak fine subangular blocky structure parting to moderate very fine subangular blocky; friable; common fine and very fine roots; medium acid; clear smooth boundary.

Bt1—10 to 16 inches; brown (10YR 4/3) silty clay loam (33 percent clay, 3 percent sand); few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure parting to moderate fine and very fine subangular blocky; friable; few distinct dark brown (10YR 3/3) clay films on faces of peds; common fine and very fine roots; few fine black (10YR 2/1) concretions of manganese oxide; slightly acid; clear smooth boundary.

Bt2—16 to 21 inches; brown (10YR 4/3) silty clay loam (29 percent clay, 7 percent sand); few fine faint yellowish brown (10YR 5/4) and few fine distinct light brownish gray (2.5Y 6/2) mottles; moderate medium and fine subangular blocky structure; firm; common distinct dark brown (10YR 3/3) clay films on faces of peds; few fine and very fine roots; few fine black (10YR 2/1) concretions of manganese oxide; slightly acid; clear smooth boundary.

2Bt3—21 to 34 inches; brown (10YR 4/3) silt loam (23 percent clay, 19 percent sand); few fine faint yellowish brown (10YR 5/4) and few fine distinct light brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure parting to moderate fine and medium subangular blocky; firm; common distinct dark brown (10YR 3/3) clay films on faces of peds; few very fine roots; common fine black (10YR 2/1) concretions of manganese oxide; slightly acid; gradual smooth boundary.

2Bt4—34 to 45 inches; brown (10YR 4/3) silt loam (25 percent clay, 23 percent sand); common medium distinct yellowish brown (10YR 5/6) and few fine distinct light brownish gray (2.5Y 6/2) mottles; moderate coarse and medium subangular blocky structure; firm; few distinct dark brown (10YR 3/3) clay films on faces of peds; few very fine roots; common fine very dark gray (10YR 3/1) concretions of manganese oxide; neutral; clear smooth boundary.

3Bt5—45 to 58 inches; brown (7.5YR 4/4) clay (45 percent clay, 22 percent sand); common medium prominent yellowish red (5YR 4/6) and grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; common prominent dark brown (10YR 3/3) clay films on faces of peds; common medium very dark gray (10YR 3/1) concretions of manganese oxide; few fine pebbles; neutral; gradual smooth boundary.

3Bt6—58 to 66 inches; brown (7.5YR 4/4) clay (49 percent clay, 26 percent sand); common medium prominent yellowish red (5YR 4/6) and few fine prominent grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure; firm; common prominent dark brown (10YR 3/3) clay films on faces of peds; common medium very dark gray (10YR 3/1) concretions of manganese oxide; few fine pebbles; slightly acid.

The thickness of the solum ranges from about 60 to 72 inches. A few stones and pebbles are throughout the profile.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2. It is 6 to 9 inches thick. It is silty clay loam or silt loam. The BE horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4 and has higher chroma mottles. It is loam or clay loam. The 3Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam or clay.

Macksburg Series

The Macksburg series consists of somewhat poorly drained, moderately slowly permeable soils on divides, slightly convex ridgetops, and side slopes in the uplands and on stream benches. These soils formed in loess. The native vegetation was tall prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Macksburg silty clay loam, 0 to 2 percent slopes, in a cultivated field on a nearly level upland divide; 820 feet south and 740 feet west of the northeast corner of sec. 9, T. 70 N., R. 32 W.

Ap—0 to 6 inches; black (10YR 2/1) silty clay loam (32 percent clay), dark gray (10YR 4/1) dry, very dark gray (10YR 3/1) kneaded; weak medium subangular blocky structure parting to weak fine granular; friable; common fine roots; neutral; abrupt smooth boundary.

A1—6 to 12 inches; black (10YR 2/1) silty clay loam (34 percent clay), dark gray (10YR 4/1) dry, very dark gray (10YR 3/1) kneaded; weak medium and fine subangular blocky structure parting to weak fine granular; friable; common fine roots; neutral; gradual smooth boundary.

A2—12 to 21 inches; very dark grayish brown (10YR 3/2) silty clay loam (36 percent clay), dark gray (10YR 4/1) and brown (10YR 5/3) dry, very dark grayish brown (10YR 3/2) kneaded; black (10YR 2/1) organic coatings on faces of peds; weak medium and fine subangular blocky structure parting to moderate fine granular; friable; few fine roots; slightly acid; gradual smooth boundary.

BA—21 to 27 inches; dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) silty clay loam (38 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; few fine and medium roots; medium acid; clear smooth boundary.

Btg1—27 to 36 inches; grayish brown (2.5Y 5/2) silty clay (40 percent clay); very dark grayish brown (10YR 3/2) organic coatings in root channels; common fine distinct brown (10YR 4/3) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; many prominent dark grayish brown (10YR 4/2) clay films on faces of peds; few fine and medium roots; few fine very dark gray (10YR 3/1) concretions of manganese oxide; medium acid; gradual smooth boundary.

Btg2—36 to 49 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (38 percent clay); common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; firm; many prominent grayish brown (10YR 5/2) clay films on faces of peds; very few fine roots; common fine very dark gray (10YR 3/1) concretions of manganese oxide; common medium distinct strong brown (7.5YR 4/6) iron stains; slightly acid; gradual smooth boundary.

BCg—49 to 60 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (32 percent clay); weak coarse prismatic structure; friable; very few faint grayish brown (10YR 5/2) clay films on vertical faces of peds; very few medium roots; common fine very dark gray (10YR 3/1) concretions of manganese oxide; common medium distinct strong brown (7.5YR 5/6) iron stains; slightly acid.

The thickness of the solum ranges from 48 to more than 75 inches. Carbonates do not occur within a depth of 6 feet.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silty clay loam. The Bt horizon dominantly has hue of 2.5Y, value of 5 or 6, and chroma of 2 to 4. It is dominantly silty clay loam, but the range includes silty clay. The content of clay in this horizon averages between 36 and 42 percent.

Mystic Series

The Mystic series consists of somewhat poorly drained, slowly permeable soils on narrow convex ridges, on side slopes and concave foot slopes in the uplands, and on escarpments of high stream benches. These soils formed in ancient clayey alluvium. The native vegetation was mixed grasses and trees. Slope ranges from 5 to 14 percent.

Typical pedon of Mystic silty clay loam, 9 to 14 percent slopes, moderately eroded, in an area of hayland on a south-facing, convex side slope; 2,420 feet south and 2,040 feet east of the center of sec. 30, T. 68 N., R. 32 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silty clay loam (32 percent clay), light brownish gray (10YR 6/2) dry; mixed with streaks and pockets of dark brown (10YR 4/3) subsurface material; weak fine subangular blocky structure; friable; common fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—5 to 13 inches; brown (7.5YR 5/4) silty clay (42 percent clay); moderate medium prominent red (2.5YR 4/6) and common fine prominent grayish brown (10YR 5/2) mottles; weak very fine and fine subangular blocky structure; firm; few fine and very fine roots; few fine pebbles; medium acid; clear smooth boundary.

Bt2—13 to 21 inches; brown (7.5YR 5/4) silty clay (40 percent clay); common medium prominent red (2.5YR 4/8) and grayish brown (10YR 5/2) mottles; weak very fine and fine subangular blocky structure; firm; few very fine roots; medium acid; clear smooth boundary.

Bt3—21 to 32 inches; mottled brown (7.5YR 5/4) and strong brown (7.5YR 5/6) silty clay loam (37 percent clay); few fine prominent red (2.5Y 4/8) and grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; few fine and very fine roots; medium acid; gradual smooth boundary.

Bt4—32 to 43 inches; brown (7.5YR 5/4) silty clay loam (34 percent clay); common fine distinct grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to weak fine and medium subangular blocky; firm; few distinct brown (10YR 4/3) clay films in root channels; medium acid; gradual smooth boundary.

BC—43 to 50 inches; brown (7.5YR 5/4) silty clay loam (32 percent clay); common medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few distinct brown (10YR 4/3) clay films in root channels; common medium roots; neutral; gradual smooth boundary.

C—50 to 60 inches; mottled brown (7.5YR 5/4) and strong brown (7.5YR 5/6) silty clay loam (31 percent clay); common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; common medium roots; neutral.

The Ap horizon has chroma of 1 or 2. It is 6 to 9 inches thick. It is dominantly silty clay loam or silt loam. The E horizon, if it occurs, has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or loam. The Bt horizon typically has hue of 2.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 6.

Nevin Series

The Nevin series consists of somewhat poorly drained, moderately permeable soils on low stream terraces. These soils formed in silty alluvium. The native vegetation was tall prairie grasses. The slope ranges from 0 to 2 percent.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, in a cultivated field; 3,100 feet south and 1,040 feet east of the northwest corner of sec. 6, T. 69 N., R. 35 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam (30 percent clay), dark gray (10YR 4/1) dry, very dark gray (10YR 3/1) rubbed; weak very fine subangular blocky structure parting to weak fine granular; friable; few fine and medium roots; medium acid; abrupt smooth boundary.

A—8 to 14 inches; very dark gray (10YR 3/1) silty clay loam (30 percent clay), dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine roots; medium acid; clear smooth boundary.

AB—14 to 20 inches; dark brown (10YR 3/3) silty clay loam (31 percent clay), dark grayish brown (10YR 4/2) dry; very dark gray (10YR 3/1) organic coatings on faces of peds; weak fine subangular blocky structure parting to moderate very fine granular; friable; few fine roots; slightly acid; clear smooth boundary.

Bt1—20 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam (36 percent clay); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; few fine roots; medium acid; gradual smooth boundary.

Bt2—24 to 32 inches; brown (10YR 5/3) silty clay loam (32 percent clay); very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few prominent dark grayish brown (10YR 4/2) clay films on faces of peds; very few fine roots; medium acid; gradual smooth boundary.

Bt3—32 to 43 inches; light brownish gray (2.5Y 6/2) silty clay loam (32 percent clay); few fine prominent light olive brown (2.5Y 5/6) and strong brown (7.5YR 4/6 and 5/8) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few distinct grayish brown (2.5Y 5/2) clay films; very few fine roots; slightly

acid; gradual smooth boundary.
BC—43 to 51 inches; light brownish gray (2.5Y 6/2) silty clay loam (30 percent clay); common fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure; firm; few faint dark gray (10YR 4/1) clay films in pores; very few fine roots; slightly acid; gradual smooth boundary.
C—51 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam (29 percent clay); common fine prominent strong brown (7.5YR 4/6) mottles; massive; friable; few faint gray (10YR 5/1) coatings; neutral.

The A horizon commonly has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam. The content of clay is about 27 to 32 percent. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6.

Nira Series

The Nira series consists of moderately well drained, moderately permeable soils on ridges and side slopes in the uplands. These soils formed in silty, deoxidized and leached loess. The native vegetation was tall prairie grasses. Slope ranges from 5 to 14 percent.

Typical pedon of Nira silty clay loam, 5 to 9 percent slopes, in a cultivated field on a west- to northwest-facing, convex side slope; 180 feet east and 2,140 feet south of the northwest corner of sec. 5, T. 69 N., R. 33 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam (30 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; very few fine roots; neutral; clear smooth boundary.
A—8 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam (33 percent clay), grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; very few fine roots; neutral; clear smooth boundary.
Bw1—15 to 20 inches; light olive brown (2.5Y 5/4) silty clay loam (33 percent clay); few fine distinct yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; moderate fine subangular blocky structure; friable; brown (10YR 4/3) coatings on faces of peds; very few fine roots; slightly acid; gradual smooth boundary.
Bw2—20 to 28 inches; light olive brown (2.5Y 5/4) silty clay loam (32 percent clay); common fine faint grayish brown (2.5Y 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; very dark grayish brown (2.5Y 3/2) coatings in root channels; few fine roots; few fine dark concretions of manganese oxide; slightly acid; clear smooth boundary.
Bw3—28 to 34 inches; light brownish gray (2.5Y 6/2) silty clay loam (30 percent clay); common fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine dark concretions of manganese oxide; slightly acid; gradual smooth boundary.
BC—34 to 43 inches; light brownish gray (2.5Y 6/2) silty clay loam (28 percent clay); common fine prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few fine roots; few fine dark concretions of manganese oxide; few fine strong brown (7.5YR 5/6) concretions of iron oxide; slightly acid; gradual smooth boundary.
C—43 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam (27 percent clay); few fine prominent yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; few fine dark concretions of manganese oxide; common fine strong brown (7.5YR 5/6) concretions of iron oxide; neutral.

The thickness of the solum typically ranges from 36 to 50 inches, but in some pedons on the steeper slopes it ranges from 30 to 50 inches. Carbonates do not occur in the solum and typically do not occur in the C horizon.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 10 to 15 inches thick, except in eroded areas. The upper part of the B horizon has hue of 2.5Y, value of 3 to 5, and chroma of 3 or 4. It has relict gray mottles. The lower part of the B horizon and the C horizon to a depth of 30 inches have hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2.

The Nira soils in map units 570C2 and 570D2 are taxadjuncts because they do not have a mollic epipedon.

Nodaway Series

The Nodaway series consists of moderately well drained, moderately permeable soils on flood plains and in the lower positions in drainageways. These soils formed in recent stratified silty alluvium. The native vegetation was mixed grasses and trees. Slope ranges from 0 to 2 percent.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, in a cultivated field on a flood plain; 2,420 feet west and 1,470 feet south of the center of sec. 8, T. 70 N., R. 35 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam (25 percent clay), brown (10YR 5/3) dry; weak very fine subangular blocky structure; friable;

many thin dark grayish brown (10YR 4/2) strata; neutral; clear smooth boundary.

C1—8 to 27 inches; stratified grayish brown (10YR 5/2) and very dark grayish brown (10YR 3/2) silt loam (26 percent clay); few fine distinct light olive brown (2.5Y 5/6) mottles; appears massive but parts to weak thin platy fragments; friable; few very fine roots; neutral; gradual smooth boundary.

C2—27 to 38 inches; stratified very dark grayish brown (10YR 3/2) and grayish brown (10YR 5/2) silt loam (24 percent clay) and about 20 percent grayish brown (10YR 5/2) fine sandy loam; few fine distinct light olive brown (2.5Y 5/6) mottles; appears massive but parts to weak thin platy fragments; friable; few fine roots; neutral; gradual smooth boundary.

C3—38 to 60 inches; stratified dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and grayish brown (10YR 5/2) silt loam (24 percent clay); few fine distinct light olive brown (2.5Y 5/6) mottles; appears massive but parts to weak thin platy fragments; friable; few fine roots; neutral.

The Ap horizon has chroma of 1 or 2. Some strata have value of 3 to 5 and chroma of 2 to 4.

Olmitz Series

The Olmitz series consists of moderately well drained, moderately permeable soils on slightly concave foot slopes and alluvial fans. These soils formed in loamy local alluvium. The native vegetation was tall prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Olmitz loam, 5 to 9 percent slopes, in a cultivated field on a northeast-facing, convex foot slope; 1,100 feet south and 66 feet east of the northwest corner of sec. 24, T. 69 N., R. 35 W.

Ap—0 to 8 inches; black (10YR 2/1) loam (28 percent clay, 34 percent sand), very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; few fine roots; neutral; clear smooth boundary.

A1—8 to 15 inches; black (10YR 2/1) clay loam (28 percent clay, 25 percent sand), very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

A2—15 to 24 inches; very dark brown (10YR 2/2) clay loam (30 percent clay, 25 percent sand), dark gray (10YR 4/1) dry; black (10YR 2/1) organic coatings on faces of peds; moderate and strong fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

A3—24 to 31 inches; very dark grayish brown (10YR 3/2) clay loam (32 percent clay, 25 percent sand), dark gray (10YR 4/1) dry; very dark gray (10YR 3/1) organic coatings on faces of peds; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; very few fine roots; slightly acid; gradual smooth boundary.

Bw1—31 to 42 inches; dark brown (10YR 3/3) clay loam (30 percent clay, 27 percent sand); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; very few fine roots; slightly acid; diffuse smooth boundary.

Bw2—42 to 55 inches; brown (10YR 4/3) clay loam (34 percent clay, 30 percent sand); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; weak medium and coarse prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual smooth boundary.

Bw3—55 to 60 inches; dark yellowish brown (10YR 4/4) clay loam (35 percent clay, 30 percent sand); dark brown (10YR 3/3) organic coatings on faces of peds; weak coarse prismatic structure parting to weak medium subangular blocky; friable; neutral.

The thickness of the solum ranges from 36 to 65 inches. The thickness of the mollic epipedon ranges from 24 to 36 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have recent deposition as much as 12 inches thick with value of 3 or 4 and chroma of 2.

Sharpsburg Series

The Sharpsburg series consists of moderately well drained, moderately slowly permeable soils on convex ridgetops, ridges, and side slopes in the uplands and on loess-covered benches. These soils formed in loess. The native vegetation was tall prairie grasses. Slope ranges from 2 to 14 percent.

Typical pedon of Sharpsburg silty clay loam, 2 to 5 percent slopes, in a hay field on a south- to southeast-facing, convex, moderately wide ridgetop; 1,870 feet east and 540 feet south of the northwest corner of sec. 10, T. 69 N., R. 33 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (30 percent clay), dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; few fine very dark brown (10YR 2/2) peds; few fine roots; slightly acid; abrupt smooth boundary.

A—8 to 17 inches; very dark brown (10YR 2/2) silty clay loam (32 percent clay), dark grayish brown (10YR

4/2) dry; moderate very fine subangular blocky structure; friable; very few fine roots; slightly acid; clear smooth boundary.

Bt1—17 to 24 inches; brown (10YR 4/3) silty clay loam (36 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds; moderate fine subangular blocky structure parting to weak very fine subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films; very few fine roots; medium acid; gradual smooth boundary.

Bt2—24 to 31 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) silty clay loam (37 percent clay); few fine prominent light brownish gray (2.5Y 6/2) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; many distinct dark grayish brown (10YR 4/2) clay films; very few fine and medium roots; few very fine dark concretions of manganese oxide; medium acid; gradual smooth boundary.

Bt3—31 to 38 inches; brown (10YR 5/3) silty clay loam (35 percent clay); common medium prominent light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; many prominent grayish brown (10YR 5/2) clay films; very few fine and medium roots; few fine dark concretions of manganese oxide; medium acid; gradual smooth boundary.

BC—38 to 46 inches; yellowish brown (10YR 5/4) silty clay loam (32 percent clay); many fine and medium prominent grayish brown (2.5Y 5/2) and common medium prominent strong brown (7.5YR 5/8) mottles; weak medium prismatic structure; firm; common distinct grayish brown (10YR 5/2) clay films; very few fine roots; few fine dark concretions of manganese oxide; medium acid; gradual smooth boundary.

C—46 to 60 inches; mottled grayish brown (2.5Y 5/2), yellowish brown (10YR 5/4), strong brown (7.5YR 5/8), and brown (7.5YR 4/4) silty clay loam (30 percent clay); appears massive but has some vertical cleavage; firm; very few fine roots; common fine dark concretions of manganese oxide; slightly acid.

The thickness of the solum is typically 4 to 6 feet on the more stable divides but ranges from 3 to 6 feet on the steeper slopes. Carbonates do not occur in the solum to a depth of many feet.

The A horizon is typically 10 to 24 inches thick, except in eroded areas. The lower part of Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The BC and C horizons have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4.

The Sharpsburg soils in map units 370C2, 370D2, and 870C2 are taxadjuncts because they do not have a mollic epipedon.

Shelby Series

The Shelby series consists of well drained, moderately slowly permeable soils on convex side slopes. These soils formed in loamy glacial till. The native vegetation was tall prairie grasses. Slope ranges from 9 to 18 percent.

Typical pedon of Shelby clay loam, 9 to 14 percent slopes, moderately eroded, in a pasture on a northwest-facing, convex side slope; 410 feet west and 1,070 feet north of the southeast corner of sec. 26, T. 68 N., R. 32 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam (29 percent clay), grayish brown (10YR 5/2) dry; about 20 percent pockets of brown (10YR 4/3) and dark yellowish brown (10YR 4/6) subsoil material; very dark gray (10YR 3/1) organic coatings on faces of peds; weak very fine subangular blocky structure parting to weak fine granular; friable; few fine pebbles; slightly acid; abrupt smooth boundary.

BA—6 to 10 inches; brown (10YR 4/3) clay loam (30 percent clay), dark grayish brown (10YR 4/2) rubbed; very dark gray (10YR 3/1) organic coatings on faces of peds; weak fine subangular blocky structure; friable; few very fine roots; few fine pebbles; medium acid; clear smooth boundary.

Bt1—10 to 16 inches; yellowish brown (10YR 5/4) clay loam (34 percent clay); moderate fine subangular blocky structure; firm; common distinct brown (10YR 4/3) clay films and brown (10YR 4/3) coatings along root channels; few fine roots; few fine pebbles; strongly acid; clear smooth boundary.

Bt2—16 to 25 inches; yellowish brown (10YR 5/4) clay loam (36 percent clay); few fine faint yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; many distinct dark grayish brown (10YR 4/2) clay films; very few fine roots; very few fine dark concretions of iron and manganese oxide; few fine pebbles; strongly acid; gradual smooth boundary.

Bt3—25 to 35 inches; yellowish brown (10YR 5/6) clay loam (34 percent clay); few fine faint strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; many prominent dark grayish brown (2.5Y 4/2) clay films; few fine roots; few fine dark concretions of iron and manganese oxide; few fine pebbles; slightly acid; clear smooth boundary.

C1—35 to 48 inches; light olive brown (2.5Y 5/6) clay loam (32 percent clay); appears massive but has vertical cleavage faces; firm; few distinct light brownish gray (2.5Y 6/2) coatings on cleavage faces; few fine roots; few fine dark concretions of iron and manganese oxide; few fine soft accumulations of calcium carbonate; strongly effervescent; few fine pebbles; mildly alkaline; gradual smooth boundary.

C2—48 to 60 inches; mottled light yellowish brown (2.5Y 6/4), light brownish gray (2.5Y 6/2), and light olive brown (2.5Y 5/6) clay loam (30 percent clay); massive; firm; common fine dark concretions of iron and manganese oxide; common fine soft accumulations of calcium carbonate; strongly effervescent; few fine pebbles; mildly alkaline.

The thickness of the solum ranges from 30 to 60 inches. The depth to free carbonates also ranges from 30 to 60 inches, except in eroded areas, where it may range to less than 30 inches. A few stones and pebbles are throughout the profile.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 10 to 14 inches thick, except in eroded areas. It is typically clay loam but the range includes loam in some pedons. The upper part of the Bt horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4.

The Shelby soils in map units 24D2, 24E2, and 93D2 are taxadjuncts because they do not have a mollic epipedon.

Vesser Series

The Vesser series consists of somewhat poorly drained, moderately permeable soils on flood plains, alluvial fans, and the lower concave foot slopes. These soils formed in silty alluvium. The native vegetation was tall prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Vesser silt loam, 0 to 2 percent slopes, in a cultivated field on a second bottom; 1,095 feet east and 2,096 feet north of the southwest corner of sec. 8, T. 70 N., R. 35 W.

Ap—0 to 6 inches; black (10YR 2/1) silt loam (25 percent clay), dark gray (10YR 4/1) and gray (10YR 5/1) dry; weak fine and medium subangular blocky structure parting to weak fine granular; friable; few fine roots; medium acid; abrupt smooth boundary.

A—6 to 12 inches; black (10YR 2/1) silt loam (24 percent clay), dark gray (10YR 4/1) and gray (10YR 5/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; medium acid; clear smooth boundary.

E1—12 to 22 inches; very dark gray (10YR 3/1) silt loam (27 percent clay), dark gray (10YR 4/1) and gray (10YR 5/1) dry; weak thin platy structure parting to moderate fine subangular blocky; friable; light gray (10YR 6/1 dry) silt coatings on faces of peds; few fine and very fine roots; medium acid; gradual smooth boundary.

E2—22 to 30 inches; very dark gray (10YR 3/1) silt loam (27 percent clay), gray (10YR 6/1) dry; few fine prominent strong brown (7.5YR 4/6) mottles; weak thin platy structure parting to moderate fine subangular blocky; friable; light gray (10YR 6/1 dry) silt coatings on faces of peds; few very fine roots; medium acid; clear smooth boundary.

Btg1—30 to 39 inches; dark gray (10YR 4/1) silty clay loam (31 percent clay); few fine prominent strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; many prominent very dark gray (10YR 3/1) clay films on faces of peds; few very fine roots; few fine black (10YR 2/1) concretions of manganese oxide; medium acid; gradual smooth boundary.

Btg2—39 to 47 inches; dark gray (10YR 4/1) and gray (10YR 5/1) silty clay loam (31 percent clay); common fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; many prominent very dark gray (10YR 3/1) clay films on faces of peds; few fine and very fine roots; common fine black (10YR 2/1) concretions of manganese oxide; slightly acid; gradual smooth boundary.

Btg3—47 to 60 inches; gray (10YR 5/1) and dark gray (10YR 4/1) silty clay loam (33 percent clay); common fine prominent yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine prismatic; friable; common distinct very dark gray (10YR 3/1) clay films on faces of peds; few fine and very fine roots; common fine and few medium black (10YR 2/1) concretions of manganese oxide; medium acid.

The solum typically is more than 60 inches thick. The thickness of the surface layer ranges from 10 to 14 inches.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 3 to 5 and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2.

Wabash Series

The Wabash series consists of very poorly drained, very slowly permeable soils on flood plains. These soils formed in clayey alluvium. The native vegetation was tall prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Wabash silty clay loam, 0 to 1 percent slopes, in a cultivated field on a flood plain; 843 feet west and 333 feet north of the southeast corner of sec. 18, T. 70 N., R. 35 W.

Ap—0 to 8 inches; black (5Y 2/1) silty clay loam (35 percent clay), very dark gray (5Y 3/1) dry; weak fine granular and subangular blocky structure; friable; few very fine roots; neutral; clear smooth boundary.

A1—8 to 14 inches; black (5Y 2/1) silty clay loam (38 percent clay), very dark gray (5Y 3/1) dry; moderate fine granular and weak fine subangular blocky structure; friable; few very fine roots; few fine dark concretions of iron oxide; slightly acid; gradual smooth boundary.

A2—14 to 20 inches; black (N 2/0) silty clay (44 percent clay), very dark gray (5Y 3/1) dry; moderate fine subangular blocky structure; friable; few very fine roots; common fine dark concretions of iron oxide; slightly acid; gradual smooth boundary.

Bg1—20 to 27 inches; black (5Y 2/2) and very dark gray (5Y 3/1) silty clay (47 percent clay); moderate fine and medium subangular blocky structure; firm; very few fine roots; many fine dark concretions of iron oxide; slightly acid; gradual smooth boundary.

Bg2—27 to 39 inches; very dark gray (10YR 3/1) silty clay (47 percent clay); few fine prominent light olive brown (2.5Y 5/6) mottles; moderate coarse subangular blocky structure; firm; very few fine roots; common fine dark concretions of iron oxide; slightly acid; gradual smooth boundary.

Bg3—39 to 48 inches; dark gray (10YR 4/1) and very dark gray (10YR 3/1) silty clay (44 percent clay); few fine prominent light olive brown (2.5Y 5/6) mottles; moderate coarse prismatic structure; very firm; common fine dark concretions of iron oxide; slightly acid; gradual smooth boundary.

Bg4—48 to 60 inches; dark gray (10YR 4/1) and gray (10YR 5/1) silty clay (45 percent clay); few fine prominent light olive brown (2.5Y 5/6) mottles; moderate coarse prismatic structure; extremely firm; few fine dark concretions of manganese oxide; slightly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to free carbonates is more than 40 inches. The thickness of the mollic epipedon ranges from 18 to 26 inches.

The A or Ap horizon has hue of 10YR to 5Y, value of 2 or 3, and chroma of 2 or less. It is dominantly silty clay loam, but the range includes silty clay. The Bg horizon to a depth of 36 inches or more has matrix colors similar to those of the A horizon. Below a depth of 36 inches or more, it may have matrix colors with value of 4 or 5. The Bg horizon has mottles with hue of 10YR to 2.5Y, value of 4 or 5, and chroma of 2 to 8. This horizon is commonly silty clay or clay. The content of clay ranges from 46 to 60 percent.

Winterset Series

The Winterset series consists of poorly drained, moderately slowly permeable soils on broad upland divides. These soils formed in loess. The native vegetation was tall prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Winterset silty clay loam, 0 to 2 percent slopes, in a cultivated field on a broad upland divide; 650 feet west and 1,710 feet north of the southeast corner of sec. 2, T. 69 N., R. 32 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam (29 percent clay), very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

A—7 to 17 inches; black (10YR 2/1) silty clay loam (34 percent clay), dark gray (10YR 4/1) dry; weak fine subangular blocky and moderate very fine subangular blocky structure; friable; few fine roots; medium acid; clear smooth boundary.

Btg1—17 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay loam (38 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds; few fine distinct yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; friable; few fine roots; medium acid; gradual smooth boundary.

Btg2—22 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay (44 percent clay); common medium distinct olive brown (2.5Y 4/4) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure parting to weak very fine subangular blocky; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; few fine roots; medium acid; gradual smooth boundary.

Btg3—29 to 36 inches; grayish brown (2.5Y 5/2) silty clay (42 percent clay); common medium prominent light olive brown (2.5Y 5/6) and few medium prominent yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) mottles; weak fine prismatic and weak medium subangular blocky structure parting to weak fine subangular blocky; firm; common distinct gray (10YR 5/1) clay films on faces of peds; few fine roots; slightly acid; gradual smooth boundary.

Btg4—36 to 46 inches; grayish brown (2.5Y 5/2) silty clay loam (39 percent clay); common medium prominent strong brown (7.5YR 4/6) and common medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; common distinct gray (10YR 5/1) clay films on faces of peds; few fine roots; few fine dark concretions of manganese oxide; slightly acid; gradual smooth boundary.

BCg—46 to 55 inches; light brownish gray (2.5Y 6/2) silty clay loam (36 percent clay); common medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) and few medium prominent strong brown (7.5YR 4/6) mottles; very weak coarse prismatic structure; friable; few distinct gray (10YR 5/1) clay films on vertical faces of peds; few fine and medium dark concretions of manganese oxide; slightly acid; diffuse smooth boundary.

Cg—55 to 60 inches; mottled light brownish gray (2.5Y 6/2), strong brown (7.5YR 5/6), and yellowish red (5YR 5/6) silty clay loam (33 percent clay); massive; friable; few fine and medium dark concretions of manganese oxide; slightly acid.

The thickness of the solum ranges from 48 to 72 inches. The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or less. It is 16 to 22 inches thick. It is typically silty clay loam. The Bt horizon has hue of 10YR to 5Y, value of 3 or 4, and chroma of 1 or 2. It has mottles with hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The average content of clay in the upper 20 inches of the argillic horizon is 38 to 42 percent. The BC horizon and the upper part of the C horizon have hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2.

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Formation of the Soils

In this section, the factors of soil formation as they relate to the soils of Taylor County are described and the processes of horizon differentiation are explained. Detailed descriptions of soil profiles that are considered representative of the series in the county are provided under the heading "Soil Series and Their Morphology."

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil materials (Jenny, 1941).

Climate and plant and animal life, chiefly plants, are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil that has a distinct profile. The amount of time required for horizon differentiation may vary, but a long period generally is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent Material

The accumulation of parent material is the first step in the development of a soil. Most of the soils, however, formed in material that was transported from the site of the parent rock and redeposited at a new location through the action of glacial ice, water, wind, or gravity. The principal parent materials in Taylor County are loess, alluvium, and glacial drift (fig. 9).

Loess, a silty material deposited by wind, covers about 33 percent of Taylor County. It ranges in depth from about 12 to 16 feet on the more stable ridges to a thin mantle of 4 to less than 8 feet on the side slopes. It overlies paleosols that weathered from glacial till, and in some areas it overlies both glacial till and valley fill. The base of the Wisconsin-age loess in Iowa ranges in age from 14,000 to 16,500 years (Ruhe, 1969; Ruhe and others, 1967). Loess consists mostly of silt and some clay. It does not contain coarse sand or gravel because those materials were too large to be moved by the wind, but it does contain small amounts, generally less than 5 percent, of fine sand and very fine sand. The major source of loess in the survey area was probably the flood plains along the Missouri River and its tributaries in western Iowa. The thickness of the loess and the content of clay in the loess are related to the distance from the source of the loess.

Glacial till is unsorted and unstratified glacial drift that consists of a heterogeneous mixture of clay, sand, gravel, and boulders. Glacial till is the second most important parent material in the survey area. The first of the glacial advances in the area was the Pre-Illinoian (Nebraskan) glaciation, which occurred about 750,000 years ago (Kay and Graham, 1943; Simonson, 1959). It was followed by the Pre-Illinoian (Kansan) glaciation, which began about 500,000 years ago. When each of the glaciers retreated, it left behind a vast deposit of glacial till. The Pre-Illinoian (Nebraskan) till can be identified in a few places in the county. The Pre-Illinoian (Kansan) till is exposed on the steeper slopes in all parts of the county and forms an extensive part of the landscape.

Soils on the Pre-Illinoian (Nebraskan) till plain formed during the Aftonian interglacial periods, before the Pre-Illinoian (Kansan) glaciation. These soils are called the "Aftonian paleosol." This paleosol is strongly weathered, very slowly permeable, gray clay. It ranges from a few feet to several feet in thickness. Small areas

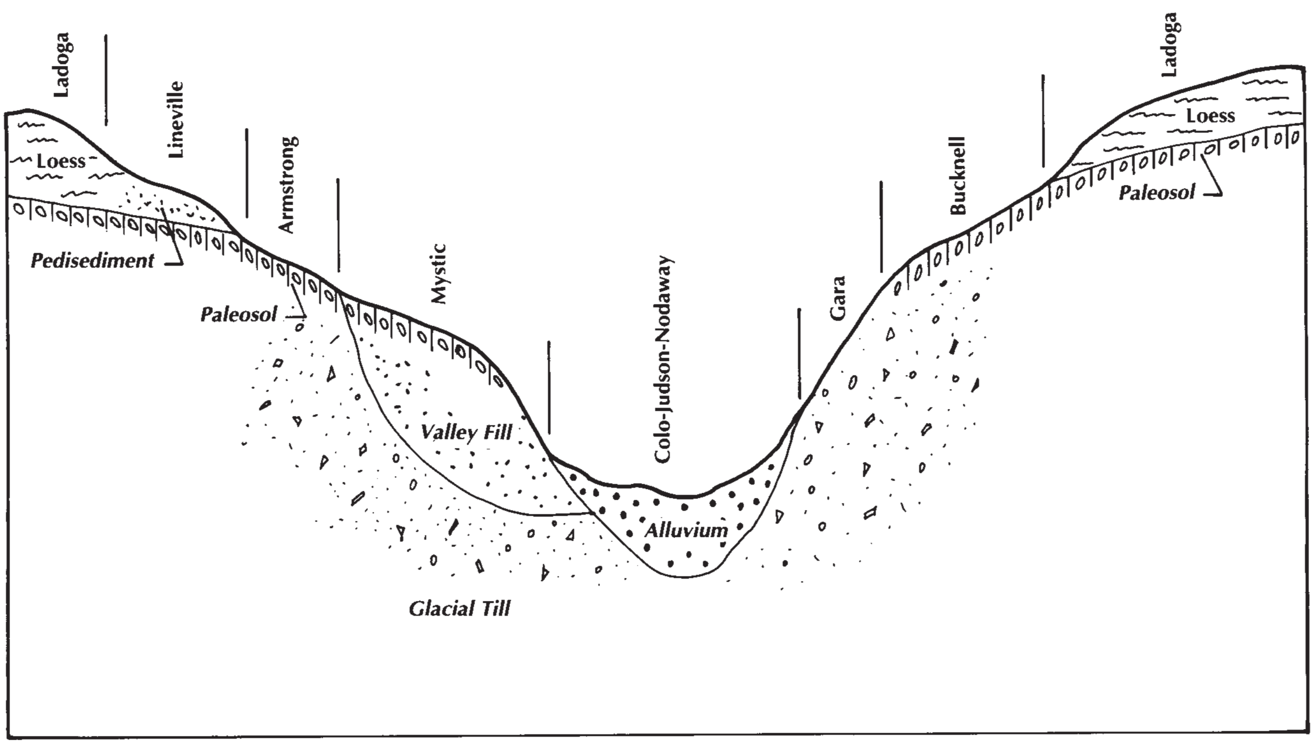

Figure 9.—The relationship of some major soils in Taylor County to their parent material and to their position on the landscape.

of the Aftonian paleosol are exposed in the central portion of the county. Only a few areas are large enough to be delineated separately. Most are shown by gray clay spot symbols on the soil maps, but some are mapped as Lamoni-Shelby complexes.

Soils on the Pre-Illinoian (Kansan) till plain formed during the Yarmouth and Sangamon interglacial periods, before the loess was deposited. In nearly level areas, the soils are strongly weathered and have a thick, gray, plastic, clayey subsoil called "gumbotil." These soils also are called paleosols, or "ancient soils" (Ruhe, 1969; Ruhe and Daniels, 1958; Simonson, 1959). They are several feet thick and are very slowly permeable. Clarinda soils are examples. They are extensive throughout Taylor County. Bucknell and Lamoni soils formed in the truncated Yarmouth-Sangamon paleosol. They have a thinner layer of clay than the Clarinda soils. Lamoni soils also are extensive throughout Taylor County.

During the Late-Sangamon time, geologic erosion cut through the Yarmouth-Sangamon paleosol and into the Pre-Illinoian (Kansan) till. At the depth to which this erosion has cut, there is generally a stone line or subjacent till marker that is overlain by pedisediments (Kuehl; Ruhe, 1959). A paleosol formed in this material. Geologic erosion removed the loess from many slopes and exposed the paleosols on the surface. The Late-Sangamon paleosol generally is reddish and is thinner than the Yarmouth-Sangamon paleosol. Adair and Armstrong soils formed in the Late-Sangamon paleosol.

Mystic soils formed in pre-Sangamon sediments of valley fill. This pedisediment material is sometimes called "ancient alluvium." These sediments are of glacial origin and vary in texture (Ruhe, 1956). The material appears to have been angularly truncated in many places. In many areas it also occurs as an irregular mixture of material of contrasting textures on the lower foot slopes in the uplands and on escarpments of high stream benches above the present valley floor. The landscape is partly a result of valley fill, but the surface of the pedisediments merges with the present erosional uplands. Mystic soils are above the flood plain, but they are lower than the Gara and Shelby soils, which formed in Kansan till on dissected slopes of late Wisconsin age. Gara and Shelby soils are extensive throughout Taylor County.

The soils on flood plains and terraces and in drainageways formed in alluvial sediments. As the streams overflow their channels, alluvium is deposited. The coarser or larger particles are deposited closer to the stream channel or in and along the main path of the floodwater. The finer particles are deposited in the areas farther away from the stream channel, where the floodwater moves slowly or is still. Ackmore, Kennebec, Nodaway, and Colo soils formed in silty alluvium, and Wabash soils formed in clayey alluvium. The alluvial soils are mainly on the bottom land along the Hundred and Two Mile, Nodaway, and Platte Rivers and Honey, Brushy, and Buchanan Creeks. Humeston soils are on the flood plains at the higher elevations. They are less subject to overflow than the soils in lower areas and have more well developed profiles.

Sediment deposited on or at the base of steep slopes by mass wasting and local unconcentrated runoff is called colluvium. This colluvium retains many of the characteristics of the soils on the slopes from which it eroded. Olmitz soils formed in colluvium at the foot slopes of till-derived soils.

Climate

The soils in Taylor County have been forming under the influence of a midcontinental, subhumid climate for at least 5,000 years. Between 8,000 and 16,000 years ago, the climate favored the growth of forest vegetation (Ruhe, 1956). The influence of the general climate of the region is modified by local conditions. For example, soils on south-facing slopes formed under a microclimate that is warmer and drier than the average climate in nearby areas. The climate under which poorly drained soils on flood plains have formed is wetter and colder than that in most of the surrounding areas. These local conditions account for some of the differences among soils in the same climate region.

Plant and Animal Life

Plant and animal life, including human activities, are important factors in soil formation. Plant life is especially significant. Soil formation begins with the growth of vegetation. As plants grow and die, they add organic matter to the upper layers of soil material. The soils in Taylor County appear to have been influenced in recent times by two main kinds of plant life—prairie grasses and deciduous trees. The main prairie grasses were big bluestem, little bluestem, and switchgrass. The trees were mainly oak, hickory, locust, elm, maple, and other deciduous trees. The native grasses have many fibrous roots that penetrate the soil to a depth of 10 to 20 inches and add large amounts of organic matter to the surface layer. Trees commonly feed on plant nutrients deep in the subsoil; consequently, they add little organic matter to the surface layer other than that gained from falling leaves and dead trees. Much of the organic matter from dead trees remains on the surface or is lost through decomposition.

Sharpsburg, Nira, and Shelby soils are typical of soils that formed under prairie grasses. Wabash and Colo soils are examples of soils that formed in alluvium eroded from areas under prairie grasses and water-tolerant plants. Armstrong, Gara, and Ladoga soils have properties intermediate between those of soils that formed entirely under prairie vegetation and soils that formed entirely under forest vegetation.

Soils that formed under trees have a thin, dark surface layer that is generally 5 to 10 inches thick. They have a lighter colored E horizon immediately below the surface layer. In contrast, soils that formed under prairie vegetation contain a large amount of organic matter derived from roots and have a thick, dark surface layer.

Sharpsburg and Ladoga soils are members of a biosequence, or a group of soils that formed in the same parent material and under a comparable environment, except for native vegetation. The native vegetation has caused the main differences in morphology among the soils in this group.

Burrowing animals and insects have some effect in loosening and aerating the upper few feet of the soils. The removal of trees and subsequent cultivation of crops result in some soils having a somewhat thicker dark surface layer. In some sloping areas, however, cultivation followed by erosion has removed much of the dark surface layer.

Important changes took place when settlement began in the survey area. Some had little effect on soil productivity, but others had drastic effects. Breaking the prairie sod and clearing the timber removed the protective cover of vegetation and thus increased the hazard of water erosion.

Cultivation changes the soil by making the sloping areas more susceptible to erosion. Erosion in turn removes the topsoil, organic matter, and plant nutrients. Sheet erosion, which is the most prevalent type of erosion in Taylor County, removes a small amount of topsoil at a time; but cultivation generally destroys all evidence of this loss. In some places, shallow and deep gullies have formed and the eroded materials have been deposited on the lower slopes.

As the land was cultivated, surface runoff increased and the rate at which water moved into the soil decreased. As a result, accelerated erosion has removed part or all of the original surface layer from much of the sloping soils under cultivation.

Erosion has not only changed the thickness of the surface layer but also its structure and consistence. In severely eroded areas, the plow layer commonly consists partly of the upper part of the subsoil, which is less friable and finer textured than the surface layer.

Erosion and cultivation also affect the soil by reducing the content of organic matter and lowering fertility. Even in areas not subject to erosion, compaction by heavy machinery reduces the thickness of the surface layer and changes soil structure. The granular structure typical of soils in areas of natural grassland breaks down under intensive cropping.

The surface soil tends to bake and become hard when dry. The fine textured soils that have been plowed continuously when wet tend to puddle and are less permeable than similar soils in undisturbed areas.

In many low places, dark soils have received lighter colored deposition. Ackmore and Nodaway soils formed in recent alluvium. These soils show the influence of human activities. They have strata of light and dark materials that were washed from the hillsides and deposited by floods. This erosion has taken place since cultivation of the hillsides began.

Human activities have also done much to increase productivity, to decrease soil loss, and to reclaim areas previously not useful for crops or pasture. For example, terraces, erosion-control structures, and other management practices are being used in some places to control runoff and erosion. Establishing diversions at the base of slopes and installing drainage ditches and other practices have helped to minimize the effects of flooding and the subsequent deposition of alluvium. As a result, large areas on flood plains are now suitable for cultivation. Also, the application of commercial fertilizers and lime has helped to correct deficiencies in plant nutrients, and many soils are more productive now than they were in their natural state.

Erosion is a major cause of decreases in the content of organic matter, but as much as one-third of the organic matter can be lost from causes other than erosion (Smith and others, 1950). In some cases it is not economically feasible to maintain as high a reserve of organic matter as was originally present under native grasses, but maintaining a safe and economical level of organic matter is necessary for crops.

Relief

Relief, or topography, is an important cause of differences among soils. Indirectly, it influences soil development through its effect on drainage. The relief in Taylor County ranges from a few feet to more than 100 feet. Many nearly level areas are frequently flooded and have a periodically high water table. Water soaks into the nearly level areas that are not flooded. Much of the rainfall runs off the surface of the more sloping areas, and thus less water penetrates the soil.

Winterset soils formed under a high or periodically high water table and generally have a subsoil that is dominantly olive gray. Soils that formed in areas where the water table was below the subsoil have a yellowish brown subsoil. Gara, Ladoga, Sharpsburg, and Shelby soils are examples. Macksburg and Nevin soils formed in areas where natural drainage was intermediate. These soils have a mottled, grayish brown subsoil. Of the soils that formed under prairie vegetation, those that have a higher water table generally have more organic matter in the surface layer than those that have good natural drainage.

The Gara and Shelby soils that have wide slope ranges have some properties that change as slope increases. Two of these properties are the depth to carbonates and the thickness of the surface layer. The depth to carbonates is more shallow where slopes are steepest. The surface layer is thin in the more strongly sloping soils. Other properties that change as slope increases are the maximum percent of clay in the B horizon and the depth to the maximum clay content. The maximum percent of clay in the B horizon decreases as slope gradient increases. Depth to the maximum clay content also decreases as slope gradient increases (Collins; Kuehl).

Slope aspect also has a significant influence on soil formation. South-facing slopes generally are warmer and drier than north-facing slopes, and consequently they support different kinds and amounts of vegetation.

The nearly level Macksburg and Winterset soils are examples of soils that formed in the same kind of parent material and under similar vegetation but that differ because of slight differences in topographic position. Their micro-relief affects runoff and depth to the water table. Winterset soils are in nearly level or slightly depressional areas on broad upland divides. They have a seasonal high water table and tend to impound water for short periods of time. Macksburg soils are in the more sloping areas on upland divides and are somewhat poorly drained. Ely soils are on foot slopes and in some upland waterways. They have properties related to the soils upslope from which they receive sediments.

Time

Time is necessary for the various processes of soil formation to take place. The amount of time necessary ranges from a few days for the formation of fresh alluvial deposits, such as those that make up Nodaway silt loam, channeled, to a thousand years or more for many of the older upland soils. Older or more strongly developed soils have well defined genetic horizons and have a higher content of clay in the subsoil than younger soils that formed in similar kinds of parent material. As a soil forms, clay is moved from the surface layer to the subsoil. This transfer increases the content of clay in the subsoil. The increased content of clay in the subsoil is more evident in a nearly level soil than in a more sloping soil. Ladoga and Sharpsburg soils are examples of soils in which this process has taken place. A less well developed soil has only weakly developed horizons. Some of the soils that formed in alluvium have little or no profile development because fresh material is deposited periodically.

If other factors are favorable, the texture of the subsoil generally becomes finer and a greater amount of soluble materials is leached out as the soils continue to weather. On the steeper soils, material is generally removed before there has been time for the development of a thick profile that has strong horizons. Even where the material has been in place a long time, the soil exhibits little development because much of the water runs off the surface instead of through the soil material. Gara and Shelby soils formed on recently dissected slopes of late Wisconsin age.

In places where organic materials, such as trees, have been buried by later deposition through the action of ice, water, or wind, the age of a landscape can be determined by a process known as radiocarbonation. The loess in which the Sharpsburg and Ladoga soils of this region formed is probably about 14,000 to 20,000 years old. Time is needed for soil development, but the age of the parent material does not necessarily reflect the true age of the soil profile that formed in that material.

Processes of Horizon Differentiation

Horizon differentiation is a result of four major processes. These are additions, removals, transfers, and transformations in the soil system (Simonson, 1959). Each of these four kinds of change affects many substances that compose soils. For example, there may be additions, removals, transfers, or transformations of organic matter, soluble salts, carbonates, sesquioxides, or silicate clay minerals.

These processes tend to promote horizon differentiation, but some tend to offset or retard it. These processes and the changes brought about proceed simultaneously in soils, and the ultimate nature of the profile is governed by the balance of the changes within the profile.

An accumulation of organic matter is an early step in the process of horizon differentiation in most soils. The content of organic matter in the surface layer of the soils in Taylor County ranges from very high to very low. Nodaway soils, for example, have a thin surface layer that has a low content of organic matter. Wabash and Colo soils are among those that have a thick surface layer in which the content of organic matter is high. Erosion has reduced the content of organic matter in some soils. The accumulation of organic matter has been an important process in the differentiation of soil horizons in Taylor County.

The process through which substances are removed from parts of the soil profile is important in the differentiation of soil horizons. The movement of calcium carbonates and bases downward through the soil profile is an example. All of the soils in the county have been leached free of calcium carbonates in the upper part of the profile.

Several kinds of transfers of substances from one horizon to another are evident in the soils in the survey area. Phosphorus is removed from the subsoil by plant roots and transferred to parts of the plant growing above the ground. It is then added to the surface layer in the plant residue. These processes affect the forms and distribution of phosphorus in the profile.

The translocation of silicate clay minerals is an important process in horizon differentiation. The clay minerals are carried downward in suspension in percolating water from the A horizon. They accumulate in the B horizon in pores and root channels and as clay films on faces of peds. Sharpsburg and Macksburg soils are examples of soils in which this process has taken place.

Shrinking and swelling can result in another kind of transfer. This process has a minimal effect in most soils but occurs to some extent in very clayey soils. It causes cracks to form and results in the incorporation of some materials from the surface layer into lower parts of the profile. Wabash soils are examples of soils that have potential for this kind of physical transfer.

Transformations are physical and chemical. For example, soil particles are weathered to smaller sizes. The reduction of iron is another example of a transformation. This process, which is called gleying, involves the saturation of the soil with water for long periods in the presence of organic matter. It is characterized by the presence of ferrous iron and gray colors. Gleying is associated with poorly drained soils, such as Colo soils. The content of reductive extractable iron, or free iron, is normally lower in somewhat poorly drained soils, such as Nevin soils, than in more well drained soils.

The weathering of the primary apatite mineral present in parent materials to secondary phosphorus compounds is another kind of transformation. At a pH level near 7, for example, the primary mineral apatite is weathered to secondary phosphorus compounds. Thus, soils that have a pH near 7, such as Colo soils, have more available phosphorus than soils that have a pH of more than 7, such as calcareous soils.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material left by a stream where its gradient lessens abruptly.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

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

Benches (geologic). Higher, older terraces (old alluvial plains) that are now a part of the erosional surface of the valley. In Iowa, the benches are of pre-Wisconsin age and are covered with loess.

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

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

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles 2 millimeters to 38 centimeters (15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

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

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

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

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

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

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

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

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

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

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of the more gently sloping land surfaces and produced by erosion.

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

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material that can be used as feed by domestic animals. It may be grazed or cut for hay.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Interfluve. The landform that divides water into two different drainage areas of any size that flow in the same general direction.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Meander. One of a series of sinuous loops in the course of a stream channel.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

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

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. Water-sorted erosional sediment that covers a paleosol.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

Phosphorus. The amount of phosphorus available to plants at a depth of 30 to 42 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available phosphorus are:

Very low	less than 7.5 ppm
Low	7.5 to 13.0 ppm
Medium	13.0 to 22.5 ppm
High	more than 22.5 ppm

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Potassium. The amount of potassium available to plants at a depth of 12 to 24 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available potassium are:

Very low	less than 50 ppm
Low	50 to 79 ppm
Medium	79 to 125 ppm
High	more than 125 ppm

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Puddled soil. A soil that is dense and massive because it has been artificially compacted when wet. Commonly, a puddled soil is a clayey soil that has been tilled when wet.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Ridgetop. A long, narrow summit of a hillslope in the uplands.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

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

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. A short, convex part of a hillslope immediately below the ridgetop.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river and approximately 2 to 5 feet above a second bottom.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration. The description of tilth is based on the content of clay, organic matter, and sand; the drainage class; and the size of the sand grains.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-87 at Bedford, Iowa)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	32.0	12.0	22.0	57	-20	0	1.00	0.27	1.59	3	6.4
February----	39.0	18.0	28.5	65	-15	11	1.06	.34	1.63	3	5.2
March-------	49.7	27.7	38.7	79	1	44	2.22	.83	3.38	5	4.6
April-------	64.5	40.1	52.3	88	17	148	3.50	2.02	4.80	7	1.0
May---------	74.7	50.8	62.8	90	30	403	4.80	3.00	6.42	8	.0
June--------	83.2	59.6	71.4	97	43	642	5.09	2.76	7.14	7	.0
July--------	88.1	64.4	76.3	101	48	815	4.32	1.21	6.82	6	.0
August------	85.9	61.8	73.9	99	46	741	4.72	2.14	6.92	6	.0
September---	78.3	53.2	65.8	95	32	474	3.85	1.74	5.66	6	.0
October-----	67.4	41.9	54.7	88	20	202	3.08	.84	4.89	5	.2
November----	50.7	29.5	40.1	74	4	17	1.97	.51	3.13	4	1.8
December----	37.1	18.5	27.8	63	-11	9	1.08	.41	1.64	3	5.2
Yearly:											
Average---	62.6	39.8	51.2	---	---	---	---	---	---	---	---
Extreme---	---	---	---	102	-23	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,506	36.69	29.70	41.95	63	24.4

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-87 at Bedford, Iowa)

Probability	Temperature 24 °F or lower	Temperature 28 °F or lower	Temperature 32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 18	Apr. 27	May 9
2 years in 10 later than--	Apr. 13	Apr. 22	May 4
5 years in 10 later than--	Apr. 3	Apr. 13	Apr. 26
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 14	Oct. 2	Sept. 23
2 years in 10 earlier than--	Oct. 19	Oct. 7	Sept. 28
5 years in 10 earlier than--	Oct. 31	Oct. 18	Oct. 7

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-87 at Bedford, Iowa)

Probability	Daily minimum temperature during growing season: Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	187	167	144
8 years in 10	195	174	150
5 years in 10	209	187	163
2 years in 10	224	200	176
1 year in 10	232	207	183

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

Map symbol	Soil name	Acres	Percent
5B	Colo-Ackmore complex, 0 to 5 percent slopes	9,340	2.7
8B	Judson silty clay loam, 2 to 5 percent slopes	470	0.1
8C	Judson silty clay loam, 5 to 9 percent slopes	210	0.1
24D	Shelby clay loam, 9 to 14 percent slopes	2,315	0.7
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded	14,855	4.3
24E	Shelby clay loam, 14 to 18 percent slopes	305	0.1
24E2	Shelby clay loam, 14 to 18 percent slopes, moderately eroded	1,880	0.5
51	Vesser silt loam, 0 to 2 percent slopes	900	0.3
51+	Vesser silt loam, overwash, 0 to 2 percent slopes	345	0.1
51B	Vesser silt loam, 2 to 5 percent slopes	2,795	0.8
51B+	Vesser silt loam, overwash, 2 to 5 percent slopes	1,025	0.3
69C	Clearfield silty clay loam, 5 to 9 percent slopes	8,505	2.5
69C2	Clearfield silty clay loam, 5 to 9 percent slopes, moderately eroded	1,200	0.3
76C	Ladoga silt loam, 5 to 9 percent slopes	1,720	0.5
76C2	Ladoga silty clay loam, 5 to 9 percent slopes, moderately eroded	3,770	1.1
76D	Ladoga silt loam, 9 to 14 percent slopes	200	0.1
76D2	Ladoga silty clay loam, 9 to 14 percent slopes, moderately eroded	625	0.2
88	Nevin silty clay loam, 0 to 2 percent slopes	550	0.2
93D	Shelby-Adair complex, 9 to 14 percent slopes	685	0.2
93D2	Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded	6,950	2.0
133	Colo silty clay loam, 0 to 2 percent slopes	1,550	0.5
133+	Colo silt loam, overwash, 0 to 2 percent slopes	1,770	0.5
133B	Colo silty clay loam, 2 to 5 percent slopes	935	0.3
133B+	Colo silt loam, overwash, 2 to 5 percent slopes	475	0.1
172	Wabash silty clay, 0 to 1 percent slopes	1,180	0.3
179D	Gara loam, 9 to 14 percent slopes	1,080	0.3
179D2	Gara clay loam, 9 to 14 percent slopes, moderately eroded	8,355	2.4
179E	Gara loam, 14 to 18 percent slopes	1,015	0.3
179E2	Gara clay loam, 14 to 18 percent slopes, moderately eroded	3,780	1.1
179F	Gara loam, 18 to 25 percent slopes	480	0.1
179F2	Gara clay loam, 18 to 25 percent slopes, moderately eroded	520	0.2
192C	Adair clay loam, 5 to 9 percent slopes	3,100	0.9
192C2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	9,050	2.6
192D	Adair clay loam, 9 to 14 percent slopes	265	0.1
192D2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	1,330	0.4
212	Kennebec silt loam, 0 to 2 percent slopes	220	0.1
220	Nodaway silt loam, 0 to 2 percent slopes	13,330	3.9
222C	Clarinda silty clay loam, 5 to 9 percent slopes	3,330	1.0
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded	5,360	1.6
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded	315	0.1
248	Wabash silty clay loam, 0 to 1 percent slopes	3,085	0.9
248+	Wabash silt loam, overwash, 0 to 1 percent slopes	1,105	0.3
269	Humeston silty clay loam, 0 to 2 percent slopes	4,125	1.2
269+	Humeston silt loam, overwash, 0 to 2 percent slopes	1,275	0.4
273B	Olmitz loam, 2 to 5 percent slopes	935	0.3
273C	Olmitz loam, 5 to 9 percent slopes	815	0.2
286B	Colo-Judson-Nodaway complex, 0 to 5 percent slopes	34,590	10.0
368	Macksburg silty clay loam, 0 to 2 percent slopes	1,095	0.3
368B	Macksburg silty clay loam, 2 to 5 percent slopes	3,025	0.9
369	Winterset silty clay loam, 0 to 2 percent slopes	1,065	0.3
370B	Sharpsburg silty clay loam, 2 to 5 percent slopes	20,770	6.0
370C	Sharpsburg silty clay loam, 5 to 9 percent slopes	11,125	3.2
370C2	Sharpsburg silty clay loam, 5 to 9 percent slopes, moderately eroded	6,365	1.9
370D	Sharpsburg silty clay loam, 9 to 14 percent slopes	630	0.2
370D2	Sharpsburg silty clay loam, 9 to 14 percent slopes, moderately eroded	540	0.2
423C2	Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded	965	0.3
423D2	Bucknell silty clay loam, 9 to 14 percent slopes, moderately eroded	1,140	0.3
428B	Ely silty clay loam, 2 to 5 percent slopes	265	0.1
430	Ackmore silt loam, 0 to 2 percent slopes	750	0.2
452C	Lineville silt loam, 5 to 9 percent slopes	200	0.1
452C2	Lineville silty clay loam, 5 to 9 percent slopes, moderately eroded	225	0.1
470D	Lamoni-Shelby complex, 9 to 14 percent slopes	910	0.3
470D2	Lamoni-Shelby complex, 9 to 14 percent slopes, moderately eroded	12,380	3.6
570C	Nira silty clay loam, 5 to 9 percent slopes	35,690	10.1
570C2	Nira silty clay loam, 5 to 9 percent slopes, moderately eroded	16,670	4.8

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

Map symbol	Soil name	Acres	Percent
570D	Nira silty clay loam, 9 to 14 percent slopes	425	0.1
570D2	Nira silty clay loam, 9 to 14 percent slopes, moderately eroded	950	0.3
592C	Mystic silt loam, 5 to 9 percent slopes	635	0.2
592C2	Mystic silty clay loam, 5 to 9 percent slopes, moderately eroded	1,480	0.4
592D	Mystic silt loam, 9 to 14 percent slopes	885	0.3
592D2	Mystic silty clay loam, 9 to 14 percent slopes, moderately eroded	9,045	2.6
792C	Armstrong loam, 5 to 9 percent slopes	1,950	0.6
792C2	Armstrong clay loam, 5 to 9 percent slopes, moderately eroded	3,880	1.1
792D	Armstrong loam, 9 to 14 percent slopes	365	0.1
792D2	Armstrong clay loam, 9 to 14 percent slopes, moderately eroded	2,405	0.7
822C	Lamoni silty clay loam, 5 to 9 percent slopes	9,230	2.7
822C2	Lamoni silty clay loam, 5 to 9 percent slopes, moderately eroded	21,550	6.3
822D	Lamoni silty clay loam, 9 to 14 percent slopes	2,095	0.6
822D2	Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded	7,615	2.2
870B	Sharpsburg silty clay loam, bench, 2 to 5 percent slopes	250	0.1
870C2	Sharpsburg silty clay loam, bench, 5 to 9 percent slopes, moderately eroded	420	0.1
993D	Gara-Armstrong complex, 9 to 14 percent slopes	200	0.1
993D2	Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded	3,065	0.9
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes	610	0.2
1368B	Macksburg silty clay loam, bench, 0 to 4 percent slopes	300	0.1
5030	Pits, limestone quarry	330	0.1
5040	Orthents, loamy	290	0.1
	Water	100	*
	Total	343,900	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
5B	Colo-Ackmore complex, 0 to 5 percent slopes (where drained)
8B	Judson silty clay loam, 2 to 5 percent slopes
51	Vesser silt loam, 0 to 2 percent slopes (where drained)
51+	Vesser silt loam, overwash, 0 to 2 percent slopes (where drained)
51B	Vesser silt loam, 2 to 5 percent slopes (where drained)
51B+	Vesser silt loam, overwash, 2 to 5 percent slopes (where drained)
88	Nevin silty clay loam, 0 to 2 percent slopes
133	Colo silty clay loam, 0 to 2 percent slopes (where drained)
133+	Colo silt loam, overwash, 0 to 2 percent slopes (where drained)
133B	Colo silty clay loam, 2 to 5 percent slopes (where drained)
133B+	Colo silt loam, overwash, 2 to 5 percent slopes (where drained)
212	Kennebec silt loam, 0 to 2 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
269	Humeston silty clay loam, 0 to 2 percent slopes (where drained)
269+	Humeston silt loam, overwash, 0 to 2 percent slopes (where drained)
273B	Olmitz loam, 2 to 5 percent slopes
286B	Colo-Judson-Nodaway complex, 0 to 5 percent slopes (where drained)
368	Macksburg silty clay loam, 0 to 2 percent slopes
368B	Macksburg silty clay loam, 2 to 5 percent slopes
369	Winterset silty clay loam, 0 to 2 percent slopes (where drained)
370B	Sharpsburg silty clay loam, 2 to 5 percent slopes
428B	Ely silty clay loam, 2 to 5 percent slopes
430	Ackmore silt loam, 0 to 2 percent slopes (where drained)
870B	Sharpsburg silty clay loam, bench, 2 to 5 percent slopes
1368B	Macksburg silty clay loam, bench, 0 to 4 percent slopes

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Wheat	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
5B----------------- Colo-Ackmore	IIw	63	136	46	68	54	4.7	3.3	5.6	7.8
8B----------------- Judson	IIe	82	149	50	75	59	6.3	3.7	6.1	10.5
8C----------------- Judson	IIIe	67	144	48	72	57	6.0	3.5	5.9	10.0
24D---------------- Shelby	IIIe	50	119	40	60	47	5.0	2.9	4.9	8.4
24D2--------------- Shelby	IIIe	48	115	39	58	46	4.8	2.8	4.7	8.1
24E---------------- Shelby	IVe	40	102	34	51	41	4.3	2.5	4.2	7.2
24E2--------------- Shelby	IVe	38	98	33	49	39	4.1	2.4	4.0	6.9
51----------------- Vesser	IIw	70	130	44	65	52	5.2	3.2	5.3	8.7
51+---------------- Vesser	IIw	71	132	44	66	52	5.3	3.2	5.4	8.9
51B---------------- Vesser	IIw	65	127	43	64	51	5.1	3.1	5.2	8.5
51B+--------------- Vesser	IIw	66	129	43	65	52	5.2	3.2	5.3	8.7
69C---------------- Clearfield	IIIw	50	112	38	56	45	3.4	2.8	4.6	5.6
69C2--------------- Clearfield	IIIw	45	108	36	54	43	3.2	2.7	4.4	5.4
76C---------------- Ladoga	IIIe	67	139	47	70	55	5.8	3.4	5.7	10.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Wheat	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
76C2 Ladoga	IIIe	62	135	45	68	54	5.7	3.3	5.5	9.5
76D Ladoga	IIIe	57	130	44	65	52	5.5	3.2	5.3	9.2
76D2 Ladoga	IIIe	52	126	42	63	50	5.3	3.1	5.2	8.9
88 Nevin	I	90	153	51	77	61	6.1	3.8	6.3	10.2
93D Shelby-Adair	IVe	36	105	35	52	42	4.4	2.6	4.2	7.3
93D2 Shelby-Adair	IVe	33	98	33	49	39	4.1	2.4	4.0	6.7
133 Colo	IIw	80	136	46	82	54	4.1	3.3	5.6	6.8
133+ Colo	IIw	85	140	47	84	56	4.2	3.4	5.7	7.0
133B Colo	IIw	75	133	45	80	53	4.0	3.3	5.5	6.7
133B+ Colo	IIw	81	137	46	82	55	4.1	3.4	5.6	6.8
172 Wabash	IIIw	45	86	29	43	34	2.6	2.1	3.5	4.3
179D Gara	IVe	45	110	37	55	44	4.6	2.7	4.5	7.7
179D2 Gara	IVe	43	106	36	53	42	4.5	2.6	4.3	7.4
179E Gara	VIe	35	---	---	---	---	3.9	2.3	3.8	6.5
179E2 Gara	VIe	33	---	---	---	---	3.7	2.2	3.6	6.2
179F Gara	VIe	15	---	---	---	---	2.4	2.0	3.4	5.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Wheat	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
179F2---------------- Gara	VIIe	13	---	---	---	---	---	1.9	---	---
192C---------------- Adair	IIIe	35	92	31	46	37	3.7	2.3	3.8	6.2
192C2---------------- Adair	IIIe	30	82	27	41	33	3.3	2.0	3.4	5.5
192D---------------- Adair	IVe	20	83	28	42	33	3.3	2.0	3.4	5.5
192D2---------------- Adair	IVe	15	73	24	37	29	2.9	1.8	3.0	4.6
212---------------- Kennebec	IIw	86	155	52	85	62	6.5	3.8	6.4	10.9
220---------------- Nodaway	IIw	85	145	49	80	58	6.1	3.6	5.9	10.2
222C---------------- Clarinda	IVw	30	82	27	41	33	2.5	2.0	3.4	4.1
222C2---------------- Clarinda	IVw	25	72	24	36	29	2.2	1.8	3.0	3.6
222D2---------------- Clarinda	IVe	10	63	21	32	25	1.9	1.5	2.6	3.2
248---------------- Wabash	IIIw	60	107	36	54	43	3.2	2.6	4.4	5.3
248+---------------- Wabash	IIIw	64	122	41	61	49	3.7	3.0	5.0	6.2
269---------------- Humeston	IIIw	58	110	37	55	44	3.3	2.7	4.5	5.5
269+---------------- Humeston	IIIw	62	118	40	59	47	3.5	3.5	4.8	5.8
273B---------------- Olmitz	IIe	72	137	46	69	55	5.8	3.4	5.6	9.6
273C---------------- Olmitz	IIIe	57	132	44	66	53	5.5	3.2	5.4	9.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Wheat	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
286B--------------- Colo-Judson- Nodaway	IIw	65	124	42	62	50	5.2	3.1	5.1	8.7
368---------------- Macksburg	I	95	164	55	82	66	6.6	4.0	6.7	11.0
368B--------------- Macksburg	IIe	90	161	54	81	64	6.4	4.0	6.6	10.8
369---------------- Winterset	IIw	87	159	53	80	64	4.8	3.9	6.5	8.0
370B--------------- Sharpsburg	IIe	87	153	51	77	61	6.4	3.8	6.3	10.7
370C--------------- Sharpsburg	IIIe	72	148	50	74	59	6.2	3.6	6.1	10.4
370C2-------------- Sharpsburg	IIIe	67	144	48	72	58	6.0	3.5	5.9	10.0
370D--------------- Sharpsburg	IIIe	62	139	47	70	56	5.8	3.4	5.7	9.8
370D2-------------- Sharpsburg	IIIe	57	135	45	68	54	5.7	3.3	5.5	9.5
423C2-------------- Bucknell	IIIe	27	73	24	37	29	2.9	1.8	3.0	4.9
423D2-------------- Bucknell	IVe	13	64	21	32	26	2.6	1.6	2.6	4.3
428B--------------- Ely	IIe	84	149	50	75	60	6.0	3.7	6.1	10.0
430---------------- Ackmore	IIw	83	141	47	71	56	4.2	3.5	5.8	7.1
452C--------------- Lineville	IIIe	36	92	31	46	37	3.7	2.3	3.8	6.2
452C2-------------- Lineville	IIIe	31	85	28	43	34	3.4	2.1	3.5	5.7

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Wheat	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
470D--------------- Lamoni-Shelby	IVe	29	94	31	47	38	3.8	2.3	3.9	6.4
470D2-------------- Lamoni-Shelby	IVe	25	86	29	43	34	3.5	2.1	3.5	5.9
570C--------------- Nira	IIIe	69	143	48	72	57	6.0	3.5	5.9	10.0
570C2-------------- Nira	IIIe	64	139	47	70	56	5.8	3.4	5.7	9.7
570D--------------- Nira	IIIe	59	134	45	67	54	5.6	3.3	5.5	9.4
570D2-------------- Nira	IIIe	54	130	44	65	52	5.5	3.2	5.3	9.2
592C--------------- Mystic	IIIe	25	75	25	38	30	3.0	1.8	3.1	5.0
592C2-------------- Mystic	IIIe	20	65	22	33	26	2.6	1.6	2.7	4.3
592D--------------- Mystic	IVe	12	66	22	33	26	2.6	1.6	2.6	4.4
592D2-------------- Mystic	IVe	5	56	19	28	22	2.2	1.4	2.3	3.7
792C--------------- Armstrong	IIIe	31	83	28	42	33	3.3	2.0	3.4	5.5
792C2-------------- Armstrong	IIIe	27	73	24	37	29	2.9	1.8	3.0	4.9
792D--------------- Armstrong	IVe	18	74	25	37	30	3.0	1.8	3.0	4.9
792D2-------------- Armstrong	IVe	13	64	21	32	26	2.6	1.6	2.6	4.3
822C--------------- Lamoni	IIIe	35	92	31	46	37	3.7	2.3	3.8	6.2
822C2-------------- Lamoni	IIIe	30	82	28	41	33	3.3	2.0	3.4	5.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Wheat	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
822D--------------- Lamoni	IVe	20	83	28	42	33	3.3	2.0	3.4	5.5
822D2-------------- Lamoni	IVe	15	73	24	37	29	2.9	1.8	3.0	4.9
870B--------------- Sharpsburg	IIe	87	153	51	77	61	6.4	3.8	6.3	10.7
870C2-------------- Sharpsburg	IIIe	67	144	48	72	58	6.1	3.5	5.9	10.1
993D--------------- Gara-Armstrong	IVe	34	96	36	53	38	4.0	2.3	3.9	6.6
993D2-------------- Gara-Armstrong	IVe	31	89	30	49	36	3.7	2.2	3.6	6.1
1220--------------- Nodaway	Vw	25	---	---	---	---	---	3.0	---	---
1368B-------------- Macksburg	IIe	90	161	54	81	64	6.4	4.0	6.6	10.8
5030. Pits										
5040. Orthents										

* Relative value: The value for corn suitability rating (CSR).

** Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
5B:										
Colo.										
Ackmore	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Eastern white pine, red pine, cottonwood, sugar maple, black walnut.
76C, 76C2, 76D, 76D2	4A	Slight	Slight	Slight	Slight	Moderate	White oak	75	4	Eastern white pine, red pine, white oak, sugar maple, northern red oak, European larch, black walnut.
Ladoga							Northern red oak	75	4	
172	4W	Slight	Severe	Severe	Moderate	Severe	Pin oak	75	4	Pin oak, pecan, eastern cottonwood.
Wabash										
179D	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	White oak, northern red oak, eastern white pine, red pine.
Gara							Northern red oak	55	3	
179D2	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Eastern white pine, red pine, white oak, northern red oak.
Gara							Northern red oak	55	3	
179E	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	White oak, northern red oak, eastern white pine, red pine.
Gara							Northern red oak	55	3	
179E2	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Eastern white pine, red pine, white oak, northern red oak.
Gara							Northern red oak	55	3	
179F	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	White oak, northern red oak, eastern white pine, red pine.
Gara							Northern red oak	55	3	
179F2	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Eastern white pine, red pine, white oak, northern red oak.
Gara							Northern red oak	55	3	

See footnote at end of table.

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

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
212 Kennebec	3A	Slight	Slight	Slight	Slight	Moderate	Bur oak	63	3	Bur oak, black walnut, hackberry, green ash, eastern cottonwood, American sycamore.
							Black walnut	79	---	
							Hackberry	---	---	
							Green ash	---	---	
							Eastern cottonwood	---	---	
220 Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Eastern white pine, red pine, black walnut, sugar maple, European larch.
248, 248+ Wabash	4W	Slight	Severe	Moderate	Moderate	Severe	Pin oak	75	4	Pin oak, pecan, eastern cottonwood.
286B: Colo.										
Judson.										
Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Eastern white pine, red pine, black walnut, sugar maple, European larch.
423C2, 423D2 Bucknell	2C	Slight	Slight	Slight	Moderate	Slight	White oak	50	2	Silver maple, American sycamore, green ash, hackberry, eastern redcedar.
							Northern red oak	50	2	
430 Ackmore	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Eastern white pine, red pine, cottonwood, sugar maple, black walnut.
452C, 452C2 Lineville	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Eastern white pine, red pine, Norway spruce, white spruce, sugar maple.
592C Mystic	3A	Slight	Slight	Slight	Slight	Moderate	White oak	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak	55	3	
592C2 Mystic	3A	Slight	Slight	Slight	Slight	Moderate	White oak	55	3	Eastern white pine, red pine, black walnut, sugar maple.

See footnote at end of table.

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

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
592D---------------- Mystic	3A	Slight	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	55 55	3 3	Eastern white pine, red pine, black walnut, sugar maple.
592D2--------------- Mystic	3A	Slight	Slight	Slight	Slight	Moderate	White oak-----------	55	3	Eastern white pine, red pine, black walnut, sugar maple.
792C, 792C2, 792D, 792D2-------------- Armstrong	3C	Slight	Slight	Moderate	Severe	Slight	White oak----------- Northern red oak----	55 55	3 3	Eastern white pine, red pine, European larch, sugar maple.
993D:										
Gara----------------	3A	Slight	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	3 3	White oak, northern red oak, eastern white pine, red pine.
Armstrong-----------	3C	Slight	Slight	Moderate	Severe	Slight	White oak----------- Northern red oak----	55 55	3 3	Eastern white pine, red pine, European larch, sugar maple.
993D2:										
Gara----------------	3A	Slight	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	3 3	Eastern white pine, red pine, white oak, northern red oak.
Armstrong-----------	3C	Slight	Slight	Moderate	Severe	Slight	White oak----------- Northern red oak----	55 55	3 3	Eastern white pine, red pine, European larch, sugar maple.
1220---------------- Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak-----------	65	3	Eastern white pine, red pine, black walnut, sugar maple, European larch.

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
5B:					
Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, white fir, blue spruce, Washington hawthorn, northern whitecedar.	Eastern white pine	Pin oak.
Ackmore	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
8B, 8C Judson	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Hackberry, bur oak, green ash, Russian-olive, eastern redcedar.	Honeylocust, eastern white pine.	---
24D, 24D2, 24E, 24E2 Shelby	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Norway spruce	Pin oak, eastern white pine.
51, 51+, 51B, 51B+ Vesser	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
69C, 69C2 Clearfield	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Blue spruce, white fir, northern whitecedar, Washington hawthorn, Norway spruce.	Eastern white pine	Pin oak.
76C, 76C2, 76D, 76D2 Ladoga	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
88 Nevin	---	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
93D, 93D2:					
Shelby	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Adair	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---
133, 133+ Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, blue spruce, white fir, northern whitecedar, Washington hawthorn.	Eastern white pine	Pin oak.
133B Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, white fir, blue spruce, Washington hawthorn, northern whitecedar.	Eastern white pine	Pin oak.
133B+ Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, blue spruce, white fir, northern whitecedar, Washington hawthorn.	Eastern white pine	Pin oak.
172 Wabash	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Hackberry, eastern redcedar, northern whitecedar, Norway spruce, white fir.	Pin oak, eastern white pine.	Eastern cottonwood, pin oak.
179D, 179D2, 179E, 179E2, 179F, 179F2 Gara	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Northern whitecedar, white fir, Washington hawthorn, blue spruce.	Norway spruce	Eastern white pine, pin oak.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
192C, 192C2, 192D, 192D2 Adair	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---
212 Kennebec	---	Amur maple, Amur honeysuckle, lilac, autumn-olive.	Eastern redcedar	Hackberry, pin oak, green ash, honeylocust.	Eastern white pine, eastern cottonwood.
220 Nodaway	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
222C, 222C2, 222D2 Clarinda	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---
248, 248+ Wabash	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Hackberry, eastern redcedar, northern whitecedar, Norway spruce, white fir.	Pin oak, eastern white pine.	Eastern cottonwood, pin oak.
269, 269+ Humeston	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
273B, 273C Olmitz	---	Amur honeysuckle, Amur privet, silky dogwood, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
286B:					
Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, white fir, blue spruce, Washington hawthorn, northern whitecedar.	Eastern white pine	Pin oak.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
286B:					
Judson	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Hackberry, bur oak, green ash, Russian-olive, eastern redcedar.	Honeylocust, eastern white pine.	---
Nodaway	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
368, 368B Macksburg	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Northern whitecedar, blue spruce, Washington hawthorn, white fir, Austrian pine.	Norway spruce	Eastern white pine, pin oak.
369 Winterset	---	American cranberrybush, Amur privet, silky dogwood, Amur honeysuckle.	Washington hawthorn, blue spruce, northern whitecedar, white fir, Norway spruce.	Eastern white pine	Pin oak.
370B, 370C, 370C2, 370D, 370D2 Sharpsburg	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
423C2, 423D2 Bucknell	---	American cranberrybush, eastern redcedar, arrowwood, Washington hawthorn, Amur privet, Amur honeysuckle.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---
428B Ely	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
430 Ackmore	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
452C, 452C2------- Lineville	---	Eastern redcedar, American cranberrybush, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle.	Osage-orange, green ash.	Eastern white pine, pin oak.	---
470D, 470D2:					
Lamoni-----------	---	Eastern redcedar, Washington hawthorn, arrowwood, Amur honeysuckle, Amur privet, American cranberrybush.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---
Shelby-----------	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
570C, 570C2, 570D, 570D2------------ Nira	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	White fir, blue spruce, Washington hawthorn, northern whitecedar.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
592C, 592C2, 592D, 592D2------------ Mystic	---	American cranberrybush, Amur honeysuckle, eastern redcedar, arrowwood, Amur privet, Washington hawthorn.	Osage-orange, green ash, Austrian pine.	Eastern white pine, pin oak.	---
792C, 792C2, 792D, 792D2------------ Armstrong	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, American cranberrybush, Amur honeysuckle.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---
822C, 822C2, 822D, 822D2------------ Lamoni	---	Eastern redcedar, Washington hawthorn, arrowwood, Amur honeysuckle, Amur privet, American cranberrybush.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
870B, 870C2------- Sharpsburg	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
993D, 993D2:					
Gara-------------	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Northern whitecedar, white fir, Washington hawthorn, blue spruce.	Norway spruce-----	Eastern white pine, pin oak.
Armstrong--------	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, American cranberrybush, Amur honeysuckle.	Green ash, Osage-orange.	Eastern white pine, pin oak.	---
1220-------------- Nodaway	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
1368B------------- Macksburg	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Northern whitecedar, blue spruce, Washington hawthorn, white fir, Austrian pine.	Norway spruce-----	Eastern white pine, pin oak.
5030. Pits					
5040. Orthents					

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
5B:					
Colo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
8B Judson	Slight	Slight	Moderate: slope.	Slight	Slight.
8C Judson	Slight	Slight	Severe: slope.	Slight	Slight.
24D, 24D2 Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
24E, 24E2 Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
51, 51+ Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
51B Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
51B+ Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
69C Clearfield	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
69C2 Clearfield	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
76C, 76C2 Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
76D, 76D2 Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
88 Nevin	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
93D, 93D2:					
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
93D, 93D2:					
Adair	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
133, 133+ Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
133B Colo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
133B+ Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
172 Wabash	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
179D, 179D2 Gara	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
179E, 179E2, 179F, 179F2 Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
192C, 192C2 Adair	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
192D, 192D2 Adair	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
212 Kennebec	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
220 Nodaway	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
222C, 222C2 Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
222D2 Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
248, 248+ Wabash	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
269, 269+ Humeston	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
273B Olmitz	Slight	Slight	Moderate: slope.	Slight	Slight.
273C Olmitz	Slight	Slight	Severe: slope.	Slight	Slight.
286B:					
Colo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Judson	Slight	Slight	Moderate: slope.	Slight	Slight.
Nodaway	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
368 Macksburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
368B Macksburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
369 Winterset	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
370B Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
370C, 370C2 Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
370D, 370D2 Sharpsburg	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
423C2 Bucknell	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
423D2 Bucknell	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
428B Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
430 Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
452C, 452C2 Lineville	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
470D, 470D2:					
Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
570C, 570C2 Nira	Slight	Slight	Severe: slope.	Slight	Slight.
570D, 570D2 Nira	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
592C Mystic	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
592C2 Mystic	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
592D Mystic	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
592D2 Mystic	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
792C, 792C2 Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
792D, 792D2 Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
822C, 822C2 Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
822D, 822D2 Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
870B------------------ Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
870C2----------------- Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
993D, 993D2:					
Gara-----------------	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
Armstrong------------	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
1220------------------ Nodaway	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
1368B----------------- Macksburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight----------	Slight.
5030------------------ Pits	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
5040------------------ Orthents	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope.	Slight----------	Slight.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
5B:										
Colo	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Good.
Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
8B Judson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
8C Judson	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
24D, 24D2 Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
24E, 24E2 Shelby	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
51, 51+, 51B, 51B+ Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
69C, 69C2 Clearfield	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
76C, 76C2, 76D, 76D2 Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
88 Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
93D, 93D2:										
Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
133, 133+ Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
133B Colo	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Good.
133B+ Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
172 Wabash	Poor	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
179D, 179D2 Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
179E, 179E2, 179F, 179F2 Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
192C, 192C2, 192D, 192D2------------- Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
212---------------- Kennebec	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
220---------------- Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
222C, 222C2, 222D2- Clarinda	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
248, 248+---------- Wabash	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
269, 269+---------- Humeston	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
273B--------------- Olmitz	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
273C--------------- Olmitz	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
286B:										
Colo--------------	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Good.
Judson------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Nodaway-----------	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
368, 368B---------- Macksburg	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
369---------------- Winterset	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
370B--------------- Sharpsburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
370C, 370C2, 370D, 370D2------------- Sharpsburg	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
423C2, 423D2------- Bucknell	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Very poor.
428B--------------- Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
430---------------- Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
452C, 452C2-------- Lineville	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
470D, 470D2:										
Lamoni------------	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
470D, 470D2:										
Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
570C, 570C2, 570D, 570D2 Nira	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
592C, 592C2, 592D, 592D2 Mystic	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
792C, 792C2, 792D, 792D2 Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
822C, 822C2, 822D, 822D2 Lamoni	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
870B Sharpsburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
870C2 Sharpsburg	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
993D, 993D2:										
Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
1220 Nodaway	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
1368B Macksburg	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
5030 Pits	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
5040. Orthents										

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
5B:						
Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
8B Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
8C Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
24D, 24D2 Shelby	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
24E, 24E2 Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
51, 51+ Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
51B Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
51B+ Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
69C, 69C2 Clearfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
76C, 76C2 Ladoga	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
76D, 76D2 Ladoga	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
88----------------- Nevin	Severe: excess humus, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
93D, 93D2:						
Shelby------------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Adair-------------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
133, 133+--------- Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
133B-------------- Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
133B+------------- Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
172---------------- Wabash	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
179D, 179D2------- Gara	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
179E, 179E2, 179F, 179F2------------ Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
192C, 192C2------- Adair	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
192D, 192D2------- Adair	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
212---------------- Kennebec	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
220---------------- Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
222C Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
222C2 Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
222D2 Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
248, 248+ Wabash	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
269, 269+ Humeston	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
273B Olmitz	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
273C Olmitz	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
286B:						
Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
368, 368B Macksburg	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
369 Winterset	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
370B Sharpsburg	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
370C, 370C2: Sharpsburg	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
370D, 370D2: Sharpsburg	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
423C2: Bucknell	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
423D2: Bucknell	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
428B: Ely	Severe: excess humus, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
430: Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
452C, 452C2: Lineville	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
470D, 470D2:						
Lamoni	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
Shelby	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
570C, 570C2: Nira	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
570D, 570D2: Nira	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
592C, 592C2: Mystic	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
592D, 592D2: Mystic	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
792C, 792C2: Armstrong	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
792D, 792D2: Armstrong	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
822C, 822C2: Lamoni	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
822D, 822D2: Lamoni	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
870B: Sharpsburg	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
870C2: Sharpsburg	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
993D, 993D2:						
Gara	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Armstrong	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
1220: Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
1368B: Macksburg	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
5030: Pits	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
5040: Orthents	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Slight.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
5B:					
Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
8B Judson	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
8C Judson	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
24D, 24D2 Shelby	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
24E, 24E2 Shelby	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
51, 51+ Vesser	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
51B Vesser	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
51B+ Vesser	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
69C, 69C2 Clearfield	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
76C, 76C2 Ladoga	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
76D, 76D2 Ladoga	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
88 Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
93D:					
Shelby	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
93D:					
Adair	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
93D2:					
Shelby	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Adair	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
133, 133+ Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
133B Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
133B+ Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
172 Wabash	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
179D, 179D2 Gara	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
179E, 179E2, 179F, 179F2 Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
192C Adair	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
192C2 Adair	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
192D Adair	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
192D2 Adair	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
212 Kennebec	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
220 Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
222C Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
222C2, 222D2 Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
248, 248+ Wabash	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
269, 269+ Humeston	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
273B Olmitz	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
273C Olmitz	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
286B:					
Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Judson	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
368, 368B Macksburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
369 Winterset	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
370B Sharpsburg	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
370C, 370C2 Sharpsburg	Severe: percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
370D, 370D2--------- Sharpsburg	Severe: percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: too clayey, slope.
423C2, 423D2-------- Bucknell	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
428B---------------- Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
430----------------- Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
452C, 452C2--------- Lineville	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
470D, 470D2:					
Lamoni--------------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Shelby-------------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
570C, 570C2--------- Nira	Moderate: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Poor: hard to pack.
570D, 570D2--------- Nira	Moderate: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Poor: hard to pack.
592C, 592C2, 592D, 592D2-------------- Mystic	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
792C, 792C2, 792D, 792D2-------------- Armstrong	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
822C, 822C2, 822D, 822D2-------------- Lamoni	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
870B---------------- Sharpsburg	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
870C2--------------- Sharpsburg	Severe: percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
993D, 993D2:					
Gara	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Armstrong	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
1220 Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
1368B Macksburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
5030 Pits	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
5040 Orthents	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
5B:				
Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ackmore	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
8B, 8C Judson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
24D Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
24D2 Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
24E, 24E2 Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
51, 51+, 51B, 51B+ Vesser	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
69C, 69C2 Clearfield	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
76C, 76C2, 76D, 76D2 Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
88 Nevin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
93D:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
93D2:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
133, 133+ Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
133B Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
133B+ Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
172 Wabash	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
179D, 179D2 Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
179E, 179E2, 179F, 179F2 Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
192C Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
192C2 Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
192D Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
192D2 Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
212 Kennebec	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
220 Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
222C, 222C2, 222D2 Clarinda	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
248, 248+ Wabash	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
269, 269+ Humeston	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
273B, 273C Olmitz	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
286B:				
Colo-----------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Judson---------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Nodaway--------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
368, 368B------------- Macksburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
369------------------- Winterset	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
370B, 370C------------ Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
370C2----------------- Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
370D------------------ Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
370D2----------------- Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
423C2, 423D2---------- Bucknell	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
428B------------------ Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
430------------------- Ackmore	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
452C, 452C2----------- Lineville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
470D:				
Lamoni---------------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Shelby---------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
470D2:				
Lamoni---------------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
470D2:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
570C, 570C2 Nira	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
570D, 570D2 Nira	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
592C, 592C2, 592D, 592D2 Mystic	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
792C, 792C2, 792D, 792D2 Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
822C, 822C2, 822D, 822D2 Lamoni	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
870B Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
870C2 Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
993D, 993D2:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
1220 Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
1368B Macksburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
5030 Pits	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
5040 Orthents	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
5B:						
Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness.
Ackmore	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
8B, 8C Judson	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
24D Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
24D2 Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
24E Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
24E2 Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
51, 51+ Vesser	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
51B Vesser	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
51B+ Vesser	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
69C, 69C2 Clearfield	Moderate: slope.	Moderate: thin layer, hard to pack, wetness.	Severe: no water.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
76C, 76C2 Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Erodes easily	Erodes easily.
76D, 76D2 Ladoga	Severe: slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
88 Nevin	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Erodes easily, wetness.	Erodes easily.
93D:						
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
93D:						
Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Wetness, slope, percs slowly.
93D2:						
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Wetness, slope, percs slowly.
133, 133+ Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
133B Colo	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Wetness	Wetness.
133B+ Colo	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action, slope.	Wetness	Wetness.
172 Wabash	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, droughty, percs slowly.
179D, 179D2, 179E, 179E2, 179F, 179F2 Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, rooting depth.
192C, 192C2 Adair	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness	Wetness, percs slowly.
192D, 192D2 Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Wetness, slope, percs slowly.
212 Kennebec	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable	Favorable.
220 Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
222C, 222C2 Clarinda	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
222D2 Clarinda	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
248, 248+ Wabash	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
269, 269+ Humeston	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
273B, 273C Olmitz	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Favorable	Favorable.
286B:						
Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness.
Judson	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
368 Macksburg	Moderate: seepage.	Moderate: wetness.	Severe: slow refill.	Frost action	Erodes easily, wetness.	Erodes easily.
368B Macksburg	Moderate: seepage, slope.	Moderate: wetness.	Severe: slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
369 Winterset	Slight	Severe: wetness.	Severe: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
370B, 370C, 370C2 Sharpsburg	Moderate: seepage, slope.	Slight	Severe: slow refill.	Deep to water	Erodes easily	Erodes easily.
370D, 370D2 Sharpsburg	Severe: slope.	Slight	Severe: slow refill.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
423C2 Bucknell	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
423D2 Bucknell	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
428B Ely	Moderate: seepage, slope.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
430 Ackmore	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
452C, 452C2 Lineville	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
470D:						
Lamoni	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
470D:						
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
470D2:						
Lamoni	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
570C, 570C2 Nira	Moderate: seepage, slope.	Moderate: hard to pack.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
570D, 570D2 Nira	Severe: slope.	Moderate: hard to pack.	Moderate: deep to water, slow refill.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
592C, 592C2 Mystic	Severe: seepage.	Moderate: thin layer, hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
592D, 592D2 Mystic	Severe: seepage, slope.	Moderate: thin layer, hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
792C, 792C2 Armstrong	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Wetness, percs slowly.
792D, 792D2 Armstrong	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
822C, 822C2 Lamoni	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
822D, 822D2 Lamoni	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
870B, 870C2 Sharpsburg	Moderate: seepage, slope.	Slight	Severe: slow refill.	Deep to water	Erodes easily	Erodes easily.
993D, 993D2:						
Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, rooting depth.
Armstrong	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
1220 Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
1368B------------- Macksburg	Moderate: seepage.	Moderate: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Erodes easily.
5030-------------- Pits	Severe: depth to rock, slope.	Slight---------	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
5040-------------- Orthents	Moderate: seepage, slope.	Slight---------	Severe: no water.	Deep to water	Favorable------	Favorable.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
5B:											
Colo	0-31	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	31-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Ackmore	0-8	Silt loam	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	8-30	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	30-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
8B, 8C Judson	0-33	Silty clay loam	CL, ML	A-6, A-7	0	100	100	100	95-100	35-50	10-25
	33-50	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-50	15-25
	50-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
24D Shelby	0-12	Clay loam	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	12-43	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	43-60	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24D2 Shelby	0-6	Clay loam	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-14	Clay loam	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	14-35	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	35-60	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24E Shelby	0-12	Clay loam	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	12-43	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	43-60	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24E2 Shelby	0-6	Clay loam	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-14	Clay loam	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	14-35	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	35-60	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
51 Vesser	0-12	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	12-30	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	30-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
51+ Vesser	0-15	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	15-27	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	27-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
51B Vesser	0-12	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	12-30	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	30-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
51B+ Vesser	0-12	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	12-27	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	27-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
69C Clearfield	0-13	Silty clay loam	CH, CL, ML	A-7	0	100	100	100	95-100	45-55	20-30
	13-41	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-60	25-35
	41-60	Silty clay, silty clay loam, clay.	CH	A-7	0	100	100	95-100	80-90	55-70	35-45

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
69C2-------------Clearfield	0-7	Silty clay loam	CH, CL, ML	A-7	0	100	100	100	95-100	45-55	20-30
	7-41	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-60	25-35
	41-60	Silty clay, silty clay loam, clay.	CH	A-7	0	100	100	95-100	80-90	55-70	35-45
76C--------------Ladoga	0-11	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	11-53	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	53-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
76C2-------------Ladoga	0-6	Silty clay loam	CL	A-6	0	100	100	100	95-100	30-40	10-20
	6-51	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	51-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
76D--------------Ladoga	0-11	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	11-53	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	53-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
76D2-------------Ladoga	0-6	Silty clay loam	CL	A-6	0	100	100	100	95-100	30-40	10-20
	6-51	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	51-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
88---------------Nevin	0-20	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
	20-51	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	51-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
93D:											
Shelby----------	0-12	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	12-43	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	43-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
Adair-----------	0-11	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	11-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
93D2:											
Shelby----------	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-12	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	12-35	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	35-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
Adair-----------	0-6	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	6-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
133--------------Colo	0-31	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	31-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
133+------------- Colo	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	12-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
133B------------- Colo	0-31	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	31-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
133B+------------ Colo	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	12-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
172-------------- Wabash	0-14	Silty clay-------	CH	A-7	0	100	100	100	95-100	50-75	30-50
	14-60	Silty clay, clay	CH	A-7	0	100	100	100	95-100	52-78	30-55
179D------------- Gara	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	13-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179D2------------ Gara	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
	6-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
179E------------- Gara	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	13-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179E2------------ Gara	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
	6-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
179F------------- Gara	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	13-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179F2------------ Gara	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
	6-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
192C------------- Adair	0-11	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	11-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
192C2------------ Adair	0-6	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	6-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
192D------------- Adair	0-11	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	11-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
192D2------------ Adair	0-6	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	6-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
212-------------- Kennebec	0-48	Silt loam--------	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	48-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	90-100	25-40	5-15
220-------------- Nodaway	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-40	5-15
222C------------- Clarinda	0-13	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	13-39	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	39-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
222C2, 222D2----- Clarinda	0-6	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	6-39	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	39-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
248-------------- Wabash	0-14	Silty clay loam	CL, CH	A-6, A-7	0	100	100	100	95-100	35-55	15-35
	14-60	Silty clay, clay	CH	A-7	0	100	100	100	95-100	52-78	30-55
248+------------- Wabash	0-15	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	15-60	Silty clay, clay	CH	A-7	0	100	100	100	95-100	52-78	30-55
269-------------- Humeston	0-10	Silty clay loam	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
	10-24	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	24-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35
269+------------- Humeston	0-15	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	15-27	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	27-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35
273B, 273C------- Olmitz	0-8	Loam-------------	CL	A-6	0	100	90-100	85-95	60-80	30-40	11-20
	8-31	Loam, clay loam	CL	A-6	0	100	90-100	85-95	60-80	30-40	11-20
	31-60	Clay loam--------	CL	A-6, A-7	0	100	90-100	85-95	60-80	35-45	15-25
286B:											
Colo------------	0-31	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	31-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Judson----------	0-33	Silty clay loam	CL, ML	A-6, A-7	0	100	100	100	95-100	35-50	10-25
	33-50	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-50	15-25
	50-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
Nodaway---------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-40	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
368, 368B-------- Macksburg	0-21	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	21-36	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	36-49	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	49-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
369-------------- Winterset	0-17	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	17-46	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-70	30-40
	46-60	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	25-35
370B, 370C------- Sharpsburg	0-17	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	18-32
	17-38	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	38-46	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	46-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
370C2------------ Sharpsburg	0-7	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	18-32
	7-38	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	85-100	35-55	18-32
	38-42	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	42-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
370D------------- Sharpsburg	0-17	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	18-32
	17-38	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	38-46	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	46-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
370D2------------ Sharpsburg	0-7	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	18-32
	7-38	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	85-100	35-55	18-32
	38-42	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	42-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
423C2, 423D2----- Bucknell	0-6	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	6-44	Clay, clay loam	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	44-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
428B------------- Ely	0-27	Silty clay loam	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	27-48	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	48-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
430-------------- Ackmore	0-8	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	8-30	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	30-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
452C------------- Lineville	0-11	Silt loam--------	CL, ML	A-6, A-7	0	100	100	95-100	95-100	35-45	10-20
	11-16	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	45-55	25-35
	16-45	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	75-95	65-90	35-50	20-35
	45-60	Clay loam, clay	CH, CL	A-7	0-5	95-100	80-100	70-90	55-80	45-60	25-35

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
452C2------------ Lineville	0-6	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	45-55	25-35
	6-16	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	45-55	25-35
	16-34	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	75-95	65-90	35-50	20-35
	34-60	Clay loam, clay	CH, CL	A-7	0-5	95-100	80-100	70-90	55-80	45-60	25-35
470D:											
Lamoni----------	0-11	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	11-42	Clay loam, clay	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
Shelby----------	0-12	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	12-43	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	43-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
470D2:											
Lamoni----------	0-6	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	6-42	Clay loam, clay	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
Shelby----------	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-14	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	14-42	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	42-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
570C------------- Nira	0-15	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	100	95-100	40-55	15-25
	15-43	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
570C2------------ Nira	0-6	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	100	95-100	40-55	15-25
	6-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	31-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
570D------------- Nira	0-15	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	100	95-100	40-55	15-25
	15-43	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
570D2------------ Nira	0-6	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	100	95-100	40-55	15-25
	6-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	31-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
592C------------- Mystic	0-11	Silt loam--------	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
	11-43	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	43-50	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
	50-60	Stratified sandy loam to clay.	SC-SM, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
592C2------------ Mystic	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
	5-43	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	43-50	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
	50-60	Stratified sandy loam to clay.	SC-SM, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
592D------------- Mystic	0-11	Silt loam--------	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
	11-43	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	43-50	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
	50-60	Stratified sandy loam to clay.	SC-SM, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
592D2------------ Mystic	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
	5-43	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	43-50	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
	50-60	Stratified sandy loam to clay.	SC-SM, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
792C------------- Armstrong	0-11	Loam-------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	11-42	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	42-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792C2------------ Armstrong	0-6	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	6-42	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	42-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792D------------- Armstrong	0-11	Loam-------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	11-42	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	42-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792D2------------ Armstrong	0-6	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	6-42	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	42-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
822C------------- Lamoni	0-11	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	11-42	Clay loam, clay	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
822C2------------ Lamoni	0-6	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	6-42	Clay loam, clay	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
822D------------- Lamoni	0-11	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	11-42	Clay loam, clay	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
822D2------------ Lamoni	0-6	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	6-42	Clay loam, clay	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
870B------------- Sharpsburg	0-17	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	18-32
	17-38	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	38-46	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	46-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
870C2------------ Sharpsburg	0-7	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	18-32
	7-38	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	85-100	35-55	18-32
	38-42	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	42-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
993D:											
Gara------------	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	13-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Armstrong-------	0-11	Loam-------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	11-42	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	42-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
993D2:											
Gara------------	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
	6-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
Armstrong-------	0-11	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	11-42	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	42-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1220------------- Nodaway	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-40	5-15
1368B------------ Macksburg	0-21	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	21-36	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	36-49	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	49-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
5030------------- Pits	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
5040------------- Orthents	0-60	Clay loam--------	---	---	---	---	---	---	---	---	15-30
	60-80	Variable---------	---	---	---	---	---	---	---	---	---

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
5B:										
Colo------------	0-31	27-36	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	31-48	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28		
	48-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.32		
Ackmore---------	0-8	18-27	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6
	8-30	18-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32		
	30-60	26-38	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.32		
8B, 8C----------- Judson	0-33	27-32	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	33-50	30-35	1.35-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.43		
	50-60	25-32	1.35-1.45	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.43		
24D------------- Shelby	0-12	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28	5	6
	12-43	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.37		
	43-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
24D2------------ Shelby	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.32	5	6
	6-14	30-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	14-35	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	35-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
24E------------- Shelby	0-12	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28	5	6
	12-43	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.37		
	43-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
24E2------------ Shelby	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.32	5	6
	6-14	30-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	14-35	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	35-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
51-------------- Vesser	0-12	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.28	5	6
	12-30	18-22	1.35-1.40	0.6-2.0	0.18-0.22	5.1-6.0	Moderate-----	0.43		
	30-60	30-35	1.40-1.45	0.6-2.0	0.17-0.21	5.1-6.5	Moderate-----	0.43		
51+------------- Vesser	0-15	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.28	5	6
	15-27	18-22	1.35-1.40	0.6-2.0	0.18-0.22	5.1-6.0	Moderate-----	0.43		
	27-60	30-35	1.40-1.45	0.6-2.0	0.17-0.21	5.1-6.5	Moderate-----	0.43		
51B------------- Vesser	0-12	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.28	5	6
	12-30	18-22	1.35-1.40	0.6-2.0	0.18-0.22	5.1-6.0	Moderate-----	0.43		
	30-60	30-35	1.40-1.45	0.6-2.0	0.17-0.21	5.6-6.5	Moderate-----	0.43		
51B+------------ Vesser	0-12	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.28	5	6
	12-27	18-22	1.35-1.40	0.6-2.0	0.18-0.22	5.1-6.0	Moderate-----	0.43		
	27-60	30-35	1.40-1.45	0.6-2.0	0.17-0.21	5.1-6.5	Moderate-----	0.43		
69C------------- Clearfield	0-13	32-38	1.30-1.40	0.2-0.6	0.21-0.23	5.6-7.3	High---------	0.32	5	4
	13-41	35-37	1.30-1.45	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.43		
	41-60	40-50	1.40-1.65	<0.06	0.10-0.12	5.6-7.3	High---------	0.43		
69C2------------ Clearfield	0-7	32-38	1.30-1.40	0.2-0.6	0.21-0.23	5.6-7.3	High---------	0.37	5	4
	7-41	35-37	1.30-1.45	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.43		
	41-60	40-50	1.40-1.65	<0.06	0.10-0.12	5.6-7.3	High---------	0.43		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
76C------------- Ladoga	0-11	18-27	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	11-53	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	53-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
76C2------------ Ladoga	0-6	27-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	7
	6-51	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	51-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
76D------------- Ladoga	0-11	18-27	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	11-53	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	53-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
76D2------------ Ladoga	0-6	27-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	7
	6-51	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	51-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
88-------------- Nevin	0-20	27-29	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	20-51	30-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43		
	51-60	25-36	1.40-1.45	0.6-2.0	0.18-0.20	6.6-7.3	Moderate-----	0.43		
93D:										
Shelby----------	0-12	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28	5	6
	12-43	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.37		
	43-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
Adair-----------	0-11	35-42	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	3	4
	11-43	38-60	1.55-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	43-60	30-38	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
93D2:										
Shelby----------	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.32	5	6
	6-12	30-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	12-35	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	35-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
Adair-----------	0-6	35-42	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	3	4
	6-43	38-60	1.55-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	43-60	30-38	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
133------------- Colo	0-31	27-36	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	31-48	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28		
	48-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.32		
133+------------ Colo	0-12	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
	12-48	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28		
	48-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.32		
133B------------ Colo	0-31	27-36	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	31-48	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28		
	48-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.32		
133B+----------- Colo	0-12	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
	12-48	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28		
	48-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.32		
172------------- Wabash	0-14	40-46	1.25-1.45	0.00-0.06	0.12-0.14	5.1-7.3	Very high----	0.28	5	4
	14-60	40-60	1.20-1.45	0.00-0.06	0.08-0.12	5.1-7.8	Very high----	0.28		
179D------------ Gara	0-13	18-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
	13-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group
	In	Pct	g/cc	In/hr	In/in	pH				
179D2------------	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.6-7.3	Moderate-----	0.32	5	6
Gara	6-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	5.6-8.4	Moderate-----	0.37		
179E-------------	0-13	18-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
Gara	13-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
179E2------------	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.6-7.3	Moderate-----	0.32	5	6
Gara	6-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	5.6-8.4	Moderate-----	0.37		
179F-------------	0-13	18-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
Gara	13-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
179F2------------	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.6-7.3	Moderate-----	0.32	5	6
Gara	6-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	5.6-8.4	Moderate-----	0.37		
192C-------------	0-11	35-42	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	3	4
Adair	11-43	38-60	1.55-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	43-60	30-38	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
192C2------------	0-6	35-42	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	3	4
Adair	6-43	38-60	1.55-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	43-60	30-38	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
192D-------------	0-11	35-42	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	3	4
Adair	11-43	38-60	1.55-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	43-60	30-38	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
192D2------------	0-6	35-42	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	3	4
Adair	6-43	38-60	1.55-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	43-60	30-38	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
212--------------	0-48	22-27	1.25-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
Kennebec	48-60	24-28	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.43		
220--------------	0-8	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Low----------	0.32	5	6
Nodaway	8-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.43		
222C-------------	0-13	27-38	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37	3	7
Clarinda	13-39	40-60	1.50-1.65	0.00-0.06	0.14-0.16	5.1-6.5	High---------	0.37		
	39-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	5.6-8.4	High---------	0.37		
222C2, 222D2-----	0-6	27-38	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37	3	7
Clarinda	6-39	40-60	1.50-1.65	0.00-0.6	0.14-0.16	5.1-6.5	High---------	0.37		
	39-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	5.6-8.4	High---------	0.37		
248--------------	0-14	27-35	1.35-1.50	0.06-0.2	0.21-0.24	5.1-7.3	High---------	0.28	5	7
Wabash	14-60	40-60	1.20-1.45	0.00-0.06	0.08-0.12	5.1-7.8	Very high----	0.28		
248+-------------	0-15	20-27	1.35-1.50	0.2-0.6	0.21-0.24	5.1-7.3	Moderate-----	0.28	5	6
Wabash	15-60	40-60	1.20-1.45	0.00-0.06	0.08-0.12	5.1-7.8	Very high----	0.28		
269--------------	0-10	27-30	1.35-1.40	0.2-0.6	0.21-0.23	5.1-7.3	Moderate-----	0.37	4	7
Humeston	10-24	20-26	1.30-1.35	0.2-2.0	0.20-0.22	4.5-6.0	Moderate-----	0.43		
	24-60	30-48	1.35-1.50	<0.06	0.13-0.15	4.5-6.5	High---------	0.32		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
269+-------------	0-15	24-27	1.35-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.43	4	6
Humeston	15-27	20-26	1.30-1.35	0.2-2.0	0.20-0.22	4.5-6.0	Moderate-----	0.43		
	27-60	30-48	1.35-1.50	<0.06	0.13-0.15	4.5-6.5	High---------	0.32		
273B, 273C-------	0-8	24-27	1.40-1.45	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.24	5	6
Olmitz	8-31	24-30	1.40-1.45	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28		
	31-60	27-34	1.45-1.55	0.6-2.0	0.15-0.17	5.1-6.5	Moderate-----	0.28		
286B:										
Colo------------	0-31	27-36	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	31-48	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28		
	48-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.32		
Judson----------	0-33	27-32	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	33-50	30-35	1.35-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.43		
	50-60	25-32	1.35-1.45	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.43		
Nodaway---------	0-8	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Low----------	0.32	5	6
	8-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.43		
368, 368B--------	0-21	27-34	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
Macksburg	21-36	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	High---------	0.43		
	36-49	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	49-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
369--------------	0-17	27-35	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
Winterset	17-46	38-42	1.35-1.40	0.2-0.6	0.14-0.18	5.6-6.5	High---------	0.43		
	46-60	27-40	1.40-1.45	0.2-0.6	0.18-0.20	6.1-7.3	Moderate-----	0.43		
370B, 370C-------	0-17	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
Sharpsburg	17-38	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	38-46	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	46-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43		
370C2------------	0-7	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
Sharpsburg	7-38	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.43		
	38-42	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	42-60	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
370D-------------	0-17	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
Sharpsburg	17-38	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	38-46	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	46-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43		
370D2------------	0-7	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
Sharpsburg	7-38	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.43		
	38-42	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	42-60	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
423C2, 423D2-----	0-6	27-38	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.37	3	7
Bucknell	6-44	38-50	1.55-1.65	<0.2	0.13-0.17	4.5-6.0	High---------	0.32		
	44-60	30-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High---------	0.32		
428B-------------	0-27	27-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
Ely	27-48	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43		
	48-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43		
430--------------	0-8	18-27	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6
Ackmore	8-30	18-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32		
	30-60	26-38	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.32		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
452C------------- Lineville	0-11	22-27	1.45-1.50	0.6-2.0	0.16-0.20	5.1-7.3	Moderate-----	0.37	3	6
	11-16	28-35	1.50-1.55	0.2-0.6	0.17-0.21	5.1-6.0	Moderate-----	0.37		
	16-45	20-35	1.65-1.75	0.06-0.2	0.17-0.21	5.6-6.0	Moderate-----	0.37		
	45-60	28-45	1.65-1.75	0.06-0.2	0.13-0.21	5.6-7.3	High---------	0.37		
452C2------------ Lineville	0-6	27-37	1.50-1.55	0.2-0.6	0.17-0.21	5.1-6.0	Moderate-----	0.37	3	6
	6-16	28-35	1.50-1.55	0.2-0.6	0.17-0.21	5.1-6.0	Moderate-----	0.37		
	16-34	20-35	1.65-1.75	0.06-0.2	0.17-0.21	5.6-6.0	Moderate-----	0.37		
	34-60	28-45	1.65-1.75	0.06-0.2	0.13-0.21	5.6-7.3	High---------	0.37		
470D:										
Lamoni----------	0-11	27-40	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.37	3	7
	11-42	38-50	1.55-1.65	<0.2	0.13-0.17	5.1-6.5	High---------	0.37		
	42-60	32-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High---------	0.37		
Shelby----------	0-12	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28	5	6
	12-43	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.37		
	43-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
470D2:										
Lamoni----------	0-6	27-40	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.37	3	7
	6-42	38-50	1.55-1.65	<0.2	0.13-0.17	5.1-6.5	High---------	0.37		
	42-60	32-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High---------	0.37		
Shelby----------	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.32	5	6
	6-14	30-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	14-42	30-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	42-60	30-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
570C------------- Nira	0-15	28-34	1.25-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	15-43	30-38	1.25-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	43-60	24-34	1.35-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
570C2------------ Nira	0-6	28-34	1.25-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	6-31	30-38	1.25-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	31-60	24-34	1.35-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
570D------------- Nira	0-15	28-34	1.25-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	15-43	30-38	1.25-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	43-60	24-34	1.35-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
570D2------------ Nira	0-6	28-34	1.25-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	6-31	30-38	1.25-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	31-60	24-34	1.35-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
592C------------- Mystic	0-11	22-29	1.40-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Moderate-----	0.37	3	6
	11-43	30-48	1.55-1.65	0.06-0.2	0.15-0.19	4.5-6.5	High---------	0.37		
	43-50	20-35	1.65-1.75	0.6-2.0	0.16-0.18	6.1-6.5	Moderate-----	0.37		
	50-60	10-30	1.65-1.75	0.6-6.0	0.11-0.13	6.1-7.3	Low----------	0.24		
592C2------------ Mystic	0-5	27-35	1.40-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Moderate-----	0.32	3	6
	5-43	30-48	1.55-1.65	0.06-0.2	0.15-0.19	4.5-6.5	High---------	0.37		
	43-50	20-35	1.65-1.75	0.6-2.0	0.16-0.18	6.1-6.5	Moderate-----	0.37		
	50-60	10-30	1.65-1.75	0.6-6.0	0.11-0.13	6.1-7.3	Low----------	0.24		
592D------------- Mystic	0-11	22-29	1.40-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Moderate-----	0.37	3	6
	11-43	30-48	1.55-1.65	0.06-0.2	0.15-0.19	4.5-6.5	High---------	0.37		
	43-50	20-35	1.65-1.75	0.6-2.0	0.16-0.18	6.1-6.5	Moderate-----	0.37		
	50-60	10-30	1.65-1.75	0.6-6.0	0.11-0.13	6.1-7.3	Low----------	0.24		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
592D2------------ Mystic	0-5	27-35	1.40-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Moderate-----	0.32	3	6
	5-43	30-48	1.55-1.65	0.06-0.2	0.15-0.19	4.5-6.5	High---------	0.37		
	43-50	20-35	1.65-1.75	0.6-2.0	0.16-0.18	6.1-6.5	Moderate-----	0.37		
	50-60	10-30	1.65-1.75	0.6-6.0	0.11-0.13	6.1-7.3	Low----------	0.24		
792C------------- Armstrong	0-11	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6
	11-42	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	42-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
792C2------------ Armstrong	0-6	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	3	4
	6-42	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	42-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
792D------------- Armstrong	0-11	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6
	11-42	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	42-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
792D2------------ Armstrong	0-6	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	3	4
	6-42	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	42-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
822C------------- Lamoni	0-11	27-40	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.37	3	7
	11-42	38-50	1.55-1.65	<0.2	0.13-0.17	5.1-6.5	High---------	0.37		
	42-60	32-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High---------	0.37		
822C2------------ Lamoni	0-6	27-40	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.37	3	7
	6-42	38-50	1.55-1.65	<0.2	0.13-0.17	5.1-6.5	High---------	0.37		
	42-60	32-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High---------	0.37		
822D------------- Lamoni	0-11	27-40	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.37	3	7
	11-42	38-50	1.55-1.65	<0.2	0.13-0.17	5.1-6.5	High---------	0.37		
	42-60	32-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High---------	0.37		
822D2------------ Lamoni	0-6	27-40	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.37	3	7
	6-42	38-50	1.55-1.65	<0.2	0.13-0.17	5.1-6.5	High---------	0.37		
	42-60	32-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High---------	0.37		
870B------------- Sharpsburg	0-17	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	17-38	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	38-46	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	46-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43		
870C2------------ Sharpsburg	0-7	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	7-38	27-36	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.43		
	38-42	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	42-60	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
993D:										
Gara------------	0-13	18-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
	13-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
Armstrong--------	0-11	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6
	11-42	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	42-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
993D2:										
Gara------------	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.6-7.3	Moderate-----	0.32	5	6
	6-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	5.6-8.4	Moderate-----	0.37		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
993D2:										
Armstrong-------	0-11	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	3	4
	11-42	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	42-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
1220------------- Nodaway	0-8	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Low----------	0.32	5	6
	8-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.43		
1368B------------ Macksburg	0-21	27-34	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	21-36	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	High---------	0.43		
	36-49	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	49-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
5030------------- Pits	0-60	---	---	0.01-20	---	---	-------------	----	---	8
5040------------- Orthents	0-60	18-35	1.45-1.65	0.06-2.0	0.12-0.18	---	Moderate-----	0.32	5	6
	60-80	---	---	0.06-2.0	---	---	-------------	----		

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
5B:												
Colo	B	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
Ackmore	B	Occasional	Very brief or brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
8B, 8C Judson	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Low.
24D, 24D2, 24E, 24E2 Shelby	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
51, 51+ Vesser	C	Occasional	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
51B Vesser	C	Rare	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
51B+ Vesser	C	Occasional	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
69C, 69C2 Clearfield	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Low.
76C, 76C2, 76D, 76D2 Ladoga	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate	Moderate.
88 Nevin	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Low.
93D, 93D2:												
Shelby	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Adair	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
133, 133+ Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
133B Colo	B	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
133B+ Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
172 Wabash	D	Occasional	Brief or long.	Nov-May	0-1.0	Apparent	Nov-Apr	>60	---	Moderate	High	Moderate.
179D, 179D2, 179E, 179E2, 179F, 179F2 Gara	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
192C, 192C2, 192D, 192D2 Adair	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
212 Kennebec	B	Occasional	Brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
220 Nodaway	B	Occasional	Very brief or brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	>80	---	High	Moderate	Low.
222C, 222C2, 222D2 Clarinda	D	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
248, 248+ Wabash	D	Occasional	Brief or long.	Nov-May	0-1.0	Apparent	Nov-Apr	>60	---	Moderate	High	Moderate.
269, 269+ Humeston	C/D	Occasional	Very brief	Feb-Nov	0-1.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
273B, 273C Olmitz	B	None	---	---	>6.0	---	---	>80	---	Moderate	Moderate	Moderate.
286B:												
Colo	B	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
Judson	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Low.
Nodaway	B	Occasional	Very brief or brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	>80	---	High	Moderate	Low.
368, 368B Macksburg	B	None	---	---	2.0-4.0	Apparent	Apr-Jul	>60	---	High	High	Moderate.
369 Winterset	C	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
370B, 370C, 370C2, 370D, 370D2: Sharpsburg	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	High	Moderate	Moderate.
423C2, 423D2: Bucknell	D	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	Moderate	High	Moderate.
428B: Ely	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
430: Ackmore	B	Occasional	Very brief or brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
452C, 452C2: Lineville	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
470D, 470D2:												
Lamoni	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	Moderate	High	Moderate.
Shelby	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
570C, 570C2, 570D, 570D2: Nira	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	High	Moderate	Moderate.
592C, 592C2, 592D, 592D2: Mystic	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate	Moderate.
792C, 792C2, 792D, 792D2: Armstrong	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
822C, 822C2, 822D, 822D2: Lamoni	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	Moderate	High	Moderate.
870B, 870C2: Sharpsburg	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	High	Moderate	Moderate.
993D, 993D2:												
Gara	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Armstrong	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
1220: Nodaway	B	Frequent	Very brief or brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	>80	---	High	Moderate	Low.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1368B------------- Macksburg	B	None--------	---	---	2.0-4.0	Apparent	Apr-Jul	>60	---	High-----	High-----	Moderate.
5030-------------- Pits	A	None--------	---	---	>6.0	---	---	0-4	Hard	---	---	---
5040-------------- Orthents	---	None--------	---	---	>6.0	---	---	>60	---	---	---	---

TABLE 18.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Adair	Fine, montmorillonitic, mesic Aquic Argiudolls
Armstrong	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Bucknell	Fine, montmorillonitic, mesic, sloping Udollic Ochraqualfs
Clarinda	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Clearfield	Fine, montmorillonitic, mesic, sloping Typic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Gara	Fine-loamy, mixed, mesic Mollic Hapludalfs
Humeston	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Judson	Fine-silty, mixed, mesic Cumulic Hapludolls
Kennebec	Fine-silty, mixed, mesic Cumulic Hapludolls
Ladoga	Fine, montmorillonitic, mesic Mollic Hapludalfs
Lamoni	Fine, montmorillonitic, mesic Aquic Argiudolls
Lineville	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Macksburg	Fine, montmorillonitic, mesic Aquic Argiudolls
Mystic	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Nira	Fine-silty, mixed, mesic Typic Hapludolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Olmitz	Fine-loamy, mixed, mesic Cumulic Hapludolls
Orthents	Loamy, mixed, mesic Udorthents
Sharpsburg	Fine, montmorillonitic, mesic Typic Argiudolls
*Shelby	Fine-loamy, mixed, mesic Typic Argiudolls
Vesser	Fine-silty, mixed, mesic Argiaquic Argialbolls
Wabash	Fine, montmorillonitic, mesic Vertic Haplaquolls
Winterset	Fine, montmorillonitic, mesic Typic Argiaquolls

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