

SOIL SURVEY OF
York County, Nebraska



United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Nebraska
Conservation and Survey Division

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1964-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Upper Big Blue Natural Resources District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same

limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and windbreak suitability groups.

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

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

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings and industrial buildings in the section "Engineering Uses of the Soils."

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

Scientists and others can read about soil formation and classification in the section "Formation and Classification of the Soils."

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

Cover: Area of Hastings-Fillmore association. Terraces, dams, field windbreaks, and land leveling for irrigation are important conservation practices in this association.

(Photo courtesy of Richard Hufnagle.)

Contents

	Page		Page
Index to mapping units -----	ii		
Summary of tables -----	ii		
How this survey was made -----	1		
General soil map -----	2		
1. Holder association -----	2	Windbreak suitability groups -----	32
2. Hastings-Fillmore association -----	2	Wildlife -----	33
3. Hastings association -----	4	Kinds of wildlife by soil association -----	34
4. Hord-Silty alluvial land association -----	5	Recreation -----	35
Descriptions of the soils -----	5	Engineering uses of the soils -----	35
Butler series -----	6	Engineering soil classification systems -----	36
Crete series -----	7	Soil properties significant to engineering -----	40
Fillmore series -----	7	Engineering interpretations of soils -----	42
Geary series -----	9	Engineering test data -----	44
Hall series -----	10	Formation and classification of the soils -----	45
Hastings series -----	11	Factors of soil formation -----	45
Hobbs series -----	13	Parent material -----	45
Holder series -----	14	Climate -----	46
Hord series -----	15	Plant and animal life -----	46
Marsh -----	16	Relief -----	46
Scott series -----	16	Time -----	46
Silty alluvial land -----	16	Classification of the soils -----	46
Uly series -----	17	Physical and chemical properties -----	47
Use and management of the soils -----	18	General nature of the county -----	48
Crops -----	18	Settlement and organization -----	48
Capability grouping -----	19	Geology -----	48
Dryland capability units -----	19	Relief and drainage -----	48
Irrigated capability units -----	23	Climate -----	48
Predicted yields -----	27	Water supply -----	49
Range -----	28	Natural vegetation -----	50
Range sites and condition classes -----	28	Transportation -----	50
Range plants -----	28	Cultural facilities -----	50
Descriptions of range sites -----	28	Manufacturing and industry -----	50
Windbreaks -----	30	Trends in soil use -----	50
Trees suitable for use in windbreaks -----	30	Literature cited -----	50
		Glossary -----	51
		Guide to mapping units -----	Following 52

Index to Mapping Units

	Page		Page
Bu—Butler silt loam, 0 to 1 percent slopes -----	7	HuC2—Hastings silty clay loam, 3 to 6 per-	
Ce—Crete silt loam, 0 to 1 percent slopes -----	7	cent slopes, eroded -----	12
CeB—Crete silt loam, 1 to 3 percent slopes -----	7	HuD2—Hastings silty clay loam, 6 to 11 per-	
Fm—Fillmore silt loam, 0 to 1 percent slopes -----	8	cent slopes, eroded -----	13
Fo—Fillmore silt loam, drained, 0 to 1 per-		Hv—Hobbs silt loam, 0 to 2 percent slopes -----	14
cent slopes -----	9	Hw—Holder silt loam, 0 to 1 percent slopes -----	14
GeC2—Geary silty clay loam, 3 to 6 percent		HwB—Holder silt loam, 1 to 3 percent slopes --	15
slopes, eroded -----	9	HwC—Holder silt loam, 3 to 6 percent slopes --	15
GeD2—Geary silty clay loam, 6 to 11 percent		Hx—Hord silt loam, terrace, 0 to 1 percent	
slopes, eroded -----	9	slopes -----	15
GhG—Geary-Hobbs silt loams, 11 to 30 per-		HxB—Hord silt loam, terrace, 1 to 3 percent	
cent slopes -----	9	slopes -----	15
Ha—Hall silt loam, terrace, 0 to 1 percent		HyC—Hord complex, 3 to 6 percent slopes -----	15
slopes -----	10	Ma—Marsh -----	16
Hs—Hastings silt loam, 0 to 1 percent slopes --	11	Sc—Scott silt loam, 0 to 1 percent slopes -----	16
HsB—Hastings silt loam, 1 to 3 percent		Sy—Silty alluvial land -----	16
slopes -----	11	UhG—Uly-Hobbs silt loams, 11 to 30 percent	
HsC—Hastings silt loam, 3 to 6 percent		slopes -----	18
slopes -----	12		
HsD—Hastings silt loam, 6 to 11 percent			
slopes -----	12		

Summary of Tables

	Page
Descriptions of the Soils	
Approximate acreage and proportionate extent of the soils (Table 1) -----	6
Crops	
Predicted average acre yields of principal irrigated and dryfarmed crops	
(Table 2) -----	27
Windbreaks	
Relative vigor and average height, by windbreak suitability group, of speci-	
fied trees and shrubs 20 years of age (Table 3) -----	31
Wildlife	
Potential of principal soils in soil associations for producing wildlife habi-	
tat elements and kinds of wildlife (Table 4) -----	32
Engineering Uses of the Soils	
Estimates of soil properties significant in engineering (Table 5) -----	36
Engineering interpretations (Table 6) -----	38
Engineering test data (Table 7) -----	42
Classification of the Soils	
Classification of soil series (Table 8) -----	47
Climate	
Temperature and precipitation data (Table 9) -----	49
Probability of last freezing temperatures in spring and first in fall	
(Table 10) -----	49

SOIL SURVEY OF YORK COUNTY, NEBRASKA

BY VERNON C. SEEVERS, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF NEBRASKA, CONSERVATION AND SURVEY DIVISION

YORK COUNTY is in the south-central part of Nebraska (fig. 1). It has a land area of 369,280 acres, or about 577 square miles. York, the largest town, is the county seat.

York County is mainly on an upland plain that has been covered with loess. This plain is dissected by three large streams—West Fork Big Blue River, Beaver Creek, and Lincoln Creek. All of these streams flow in a generally easterly direction. After rains, water is ponded in many shallow basins and depressions on the tablelands.

Nearly all of the land is used for farms. These farms generally combine cash-grain and livestock operations. Much of the land is used for crops, and a large acreage is irrigated mainly from deep wells. Since 1955, irrigation has been important to the economy of York County. The nearly level soils on uplands and stream terraces are well suited to furrow irrigation. Much of the land has been leveled to help to control the irrigation water. Nearly all the soils in York County have a silty surface layer. The subsoil ranges from silty to clayey.

Native vegetation covers a small part of York County. It is mainly in areas of soils that are steeply sloping, in areas that are frequently flooded, and in marshy areas in upland basins. Trees are near the main streams.

The first soil survey of York County, Nebraska, was published in 1928 (6)¹.

How This Survey Was Made

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

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

¹ Italic numbers in parenthesis refer to Literature Cited, page 50. The present survey updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

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

Soils of one series can differ in texture of the surface layer and in slope or some other characteristic that affects use of the soils by man. On the basis of such differences a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Hastings silt loam, 0 to 1 percent slopes, is one of several phases within the Hastings series.

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such

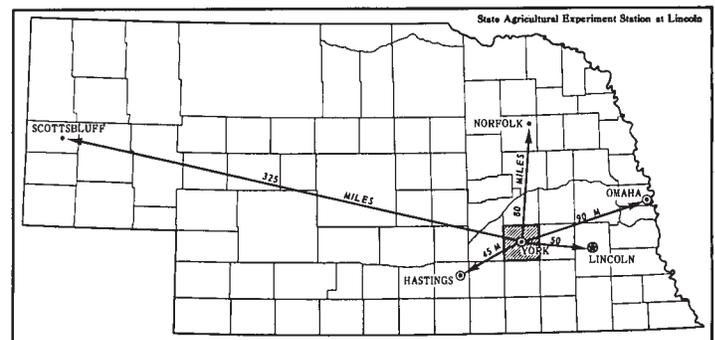


Figure 1.—Location of York County in Nebraska.

kind of mapping unit, the soil complex, is shown on the soil map of York County.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils joined by a hyphen. Geary-Hobbs silt loams, 11 to 30 percent slopes, is an example.

In most areas surveyed there are places where the soil material is flooded so often, so severely eroded, or so variable that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Silty alluvial land is a land type in this survey.

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

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their study and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning on a watershed, a wooded tract, or a wild-

life area or for broad planning of recreational facilities, community developments, and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Soil associations and delineations on the general soil map in this soil survey do not always agree fully with general soil maps of adjacent counties published at a different date. Differences are brought about by better knowledge of soils and modifications or refinements in soil series concepts. In addition, the uses of the general soil map have expanded in recent years, thus requiring a more precise and detailed map to accommodate the need.

The soil associations in this survey area are described on the pages that follow.

1. Holder association

Deep, nearly level to gently sloping, silty soils; formed in loess on uplands

This association is in the northwest corner of York County. It is nearly level or gently sloping in most areas, but is gently sloping in areas adjacent to drainageways. There are many depressions and a few marshy areas.

The association makes up about 4 percent of the county. It is about 71 percent Holder soils and 29 percent less extensive soils and land types.

Holder soils are on tablelands and on the side slopes of drainageways. These soils are deep, friable, and well drained. The surface layer is silt loam. The subsoil is silty clay loam. The underlying material is silt loam.

Less extensive in this association are Fillmore, Hord, Hastings, and Hobbs soils. The Fillmore soils are in upland depressions. The Hord soils are on stream terraces and foot slopes, mainly in the Big Blue River Valley. The Hastings soils are on side slopes of intermittent drainageways. The Hobbs soils are on narrow bottom lands of the drainageways.

Farms are mainly of the cash grain-livestock type and average about 480 acres in size. Nearly all the acreage is cultivated. The main crops are irrigated corn, grain sorghum, and a small acreage of soybeans. About 20 percent of the acreage is dryfarmed and is mainly in wheat and alfalfa. Most crops are sold for cash, but on many small farms crops are used in feedlots to fatten beef cattle and swine. Cash crops are marketed at local elevators. Livestock is sold at local auctions or to local packers, or it is trucked to terminals in Omaha.

Water erosion is the main hazard on the sloping soils. Maintaining fertility is an important management practice. Yields of dryfarmed crops are reduced in some years because of lack of sufficient moisture. The extent of irrigated land and the number of deep wells are increasing.

Gravel roads run along nearly all section lines.

2. Hastings-Fillmore association

Deep, nearly level to gently sloping, silty soils and deep, nearly level, silty soils that have a claypan subsoil, formed in loess on uplands.

This association is mainly on a broad tableland (fig. 2). There are a few shallowly entrenched intermittent drain-

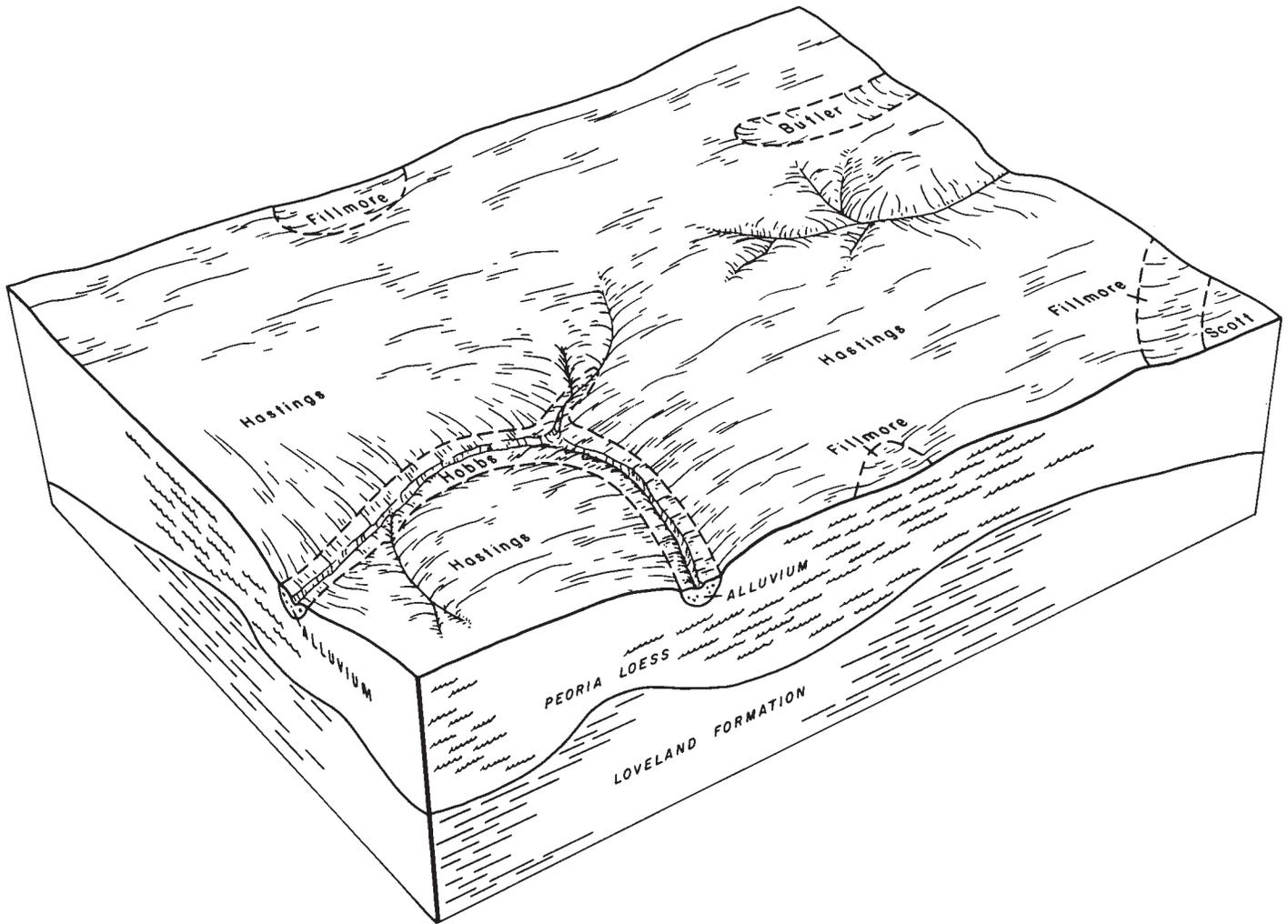


Figure 2.—Typical pattern of soils and underlying material in the Hastings-Fillmore association.

ageways. Shallow depressions and basins that hold water after rains are common.

The association makes up about 63 percent of the county. It is about 91 percent Hastings soils, about 7 percent Fillmore soils, and 2 percent less extensive soils and land types.

Hastings soils are mainly on the tableland. A few areas border the intermittent drainageways. These soils are deep, well drained, and nearly level to gently sloping. The surface layer is silt loam in the upper part and silty clay loam in the lower part. The subsoil is silty clay loam. The underlying material is silt loam.

Fillmore soils are in shallow depressions. These soils are nearly level and poorly drained. Land leveling has improved surface drainage in many places. The surface layer is silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam.

Less extensive in this association are Scott, Hobbs, Butler, and Crete soils and a few areas of Marsh. The Scott soils are in shallow depressions. The Butler soils are in large, shallow basins at slightly higher elevations than the Scott and Fillmore soils. Crete soils are on flats at higher

elevations than the Butler soils but lower than the Hastings soils.

Farms are of the cash grain-livestock type and average about 480 acres in size. Nearly all the acreage is cultivated. About 80 percent of the cultivated land is irrigated and is mainly in corn and grain sorghum. The main dryfarmed crops are wheat and alfalfa. Most crops are sold for cash, but on many small farms crops are used in feedlots to fatten beef cattle and hogs. Cash crops are marketed at local elevators. Livestock is sold at local auctions or to local packers, or it is trucked to terminals in Omaha.

Water erosion is the main hazard on the gently sloping soils. Maintaining fertility, particularly in irrigated areas, and draining excess water from depressional areas are important management practices. Land leveling is needed to prepare the soils for efficient irrigation. The extent of irrigated land and the number of deep wells are increasing.

Interstate Highway 80 and U.S. Highways 34 and 81 cross the association. Gravel roads run along nearly all section lines. The towns of Benedict, Waco, Bradshaw, and Henderson and most of York are in areas of this association.

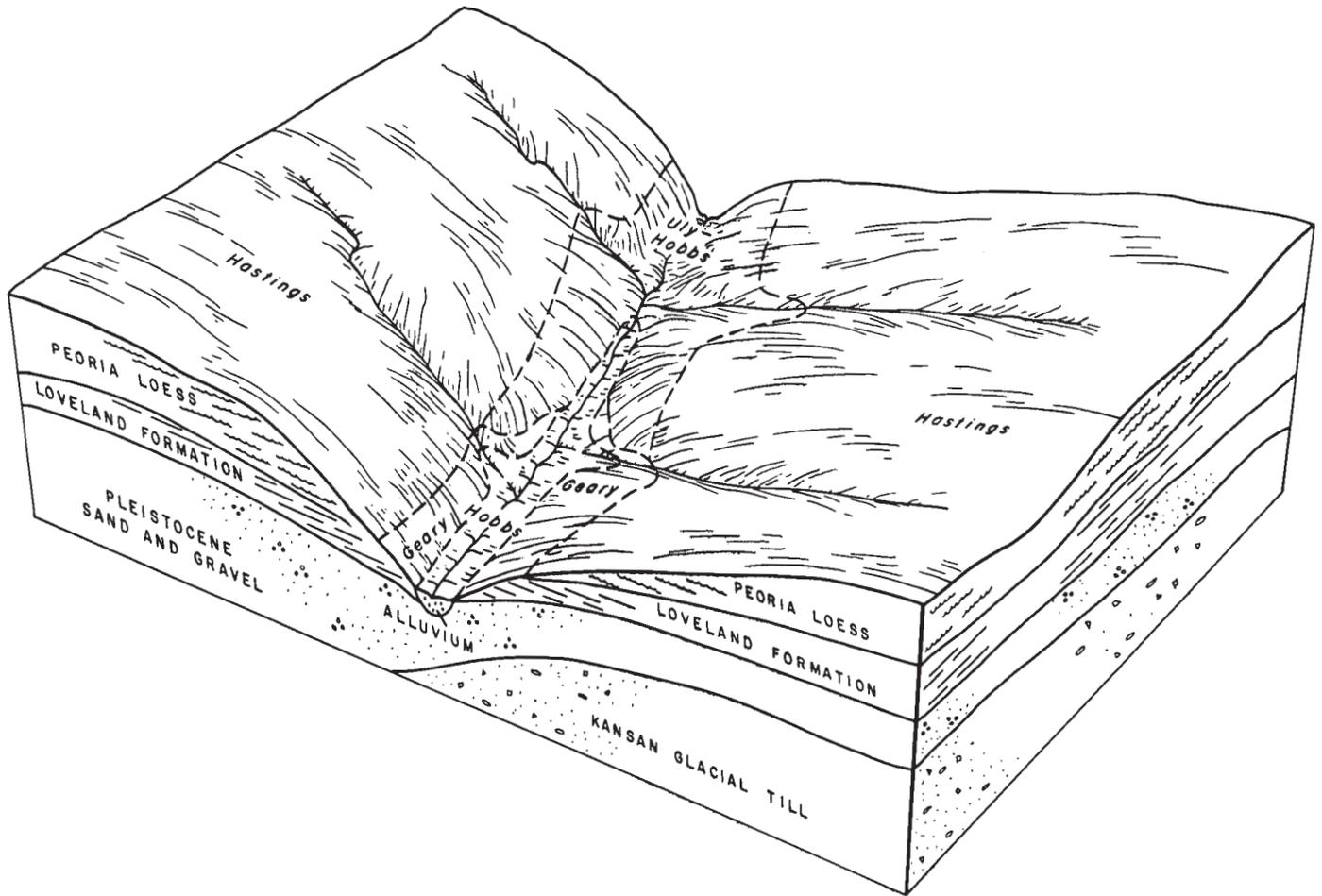


Figure 3.—Typical pattern of soils and underlying material in the Hastings association.

3. Hastings association

Deep, gently sloping to strongly sloping, silty soils; formed in loess on uplands

This association borders the valleys of Lincoln Creek, Beaver Creek, West Fork Big Blue River, Indian Creek, and a few small creeks where valleys are narrow. It is on loess uplands (fig. 3).

The association makes up about 22 percent of the county. It is about 75 percent Hastings soils and 25 percent less extensive soils and land types.

Hastings soils generally are on the upper parts of the side slopes. These soils are well drained and gently sloping to strongly sloping. The surface layer is silt loam or silty clay loam. The subsoil is silty clay loam. The underlying material is silt loam.

Less extensive in this association are Uly, Hobbs, and Geary soils and Silty alluvial land. Uly soils are in the lower parts of side slopes. The Hobbs soils are on narrow bottom lands of drainageways. Geary soils are on the lowest sides of some drainageways where material of the Loveland Formation crops out at the surface. Silty alluvial land is on frequently flooded bottom lands along some of

the large drainageways that have meandering stream channels.

Farms are diversified and average about 480 acres in size. The main crops are dryfarmed wheat, grain sorghum, and corn. About 10 percent of the cultivated land is irrigated and is mainly in corn, alfalfa, grain sorghum, and a small acreage of soybeans. The moderately steep and steep slopes are mainly in native grass and are used to sustain small cow-calf herds. Most crops are sold for cash, but on many small farms crops are used in feedlots to fatten beef cattle and hogs. Cash crops are marketed at local elevators. Livestock is sold at local auctions or to local packers, or it is trucked to terminals in Omaha.

Water erosion and lack of adequate rainfall are the main hazards on the dryfarmed cropland. Soil blowing occurs on unprotected land in some years. Maintaining fertility and improving organic-matter content and tilth are important management practices. Efficient irrigation management is difficult on these sloping soils. Farming practices are becoming more intensified, especially on irrigated land where sprinkler systems are used.

Gravel roads run along nearly all section lines, but a few roads are of dirt construction. Parts of the towns of York,

Thayer, and McCool Junction are in areas of this association.

4. *Hord-Silty alluvial land association*

Deep, nearly level and very gently sloping, silty soils and deep, silty and loamy, frequently flooded soil material; formed in alluvium on stream terraces and bottom land

This association is on stream terraces and bottom land (fig. 4). It is in the valleys of Lincoln Creek, Beaver Creek, and the West Fork Big Blue River.

This association makes up about 11 percent of the county. It is about 50 percent Hord soils, about 21 percent Silty alluvial land, and 29 percent less extensive soils.

Hord soils are on stream terraces. These soils are well drained. The surface layer, subsoil, and underlying material are silt loam.

Silty alluvial land is on the lowest elevations adjacent to stream channels. It is silty and loamy soil material that floods frequently.

Less extensive in this association are Crete, Butler, Hastings, Hobbs, and Halls soils. Generally, Crete and Hastings soils are at slightly higher elevations than the major Hord soil, and Butler and Hall soils are at slightly lower elevations. The Hobbs soils are on occasionally flooded bottom lands and at higher elevations than areas of Silty alluvial land.

Farms are of the cash grain-livestock type and average

about 480 acres in size. The main crops are irrigated corn, grain sorghum, and a small acreage of soybeans. The frequently flooded areas are used for range and wildlife habitat. A small acreage is dryfarmed in wheat and alfalfa. Most crops are sold for cash, but on many small farms crops are used in feedlots to fatten beef cattle and hogs. Cash crops are marketed at local elevators. Livestock is sold at local auctions or to local packers, or it is trucked to terminals in Omaha.

Water erosion is a hazard on the gently sloping soils. Water erosion, flooding, and siltation are hazards in areas of Silty alluvial land. Maintaining fertility is an important management practice, particularly in irrigated areas. The extent of irrigated land and the number of deep wells are increasing.

Gravel roads run along nearly all section lines, but a few roads are of dirt construction. Paved highways cross the association in many places. Parts of the towns of York, McCool Junction, and Thayer are in areas of this association.

Descriptions of the Soils

This section describes the soil series and mapping units in York County. Each soil series is described in detail, and then briefly, each mapping unit in that series is described. Unless it is specifically mentioned otherwise, it is to be

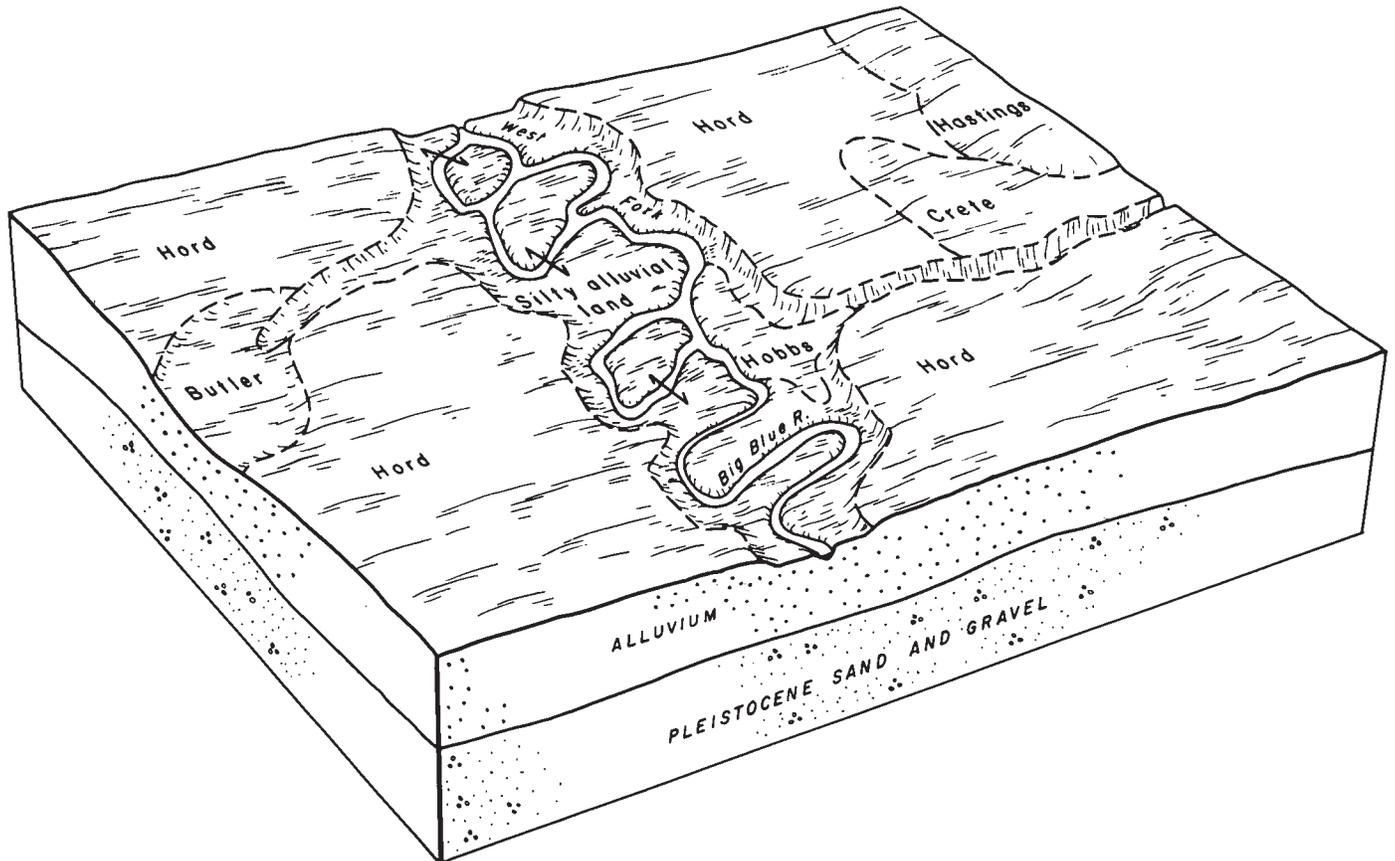


Figure 4.—Typical pattern of soils in the Hord-Silty alluvial land association.

assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to the underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, the differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Silty alluvial land, for example, does not belong to a soil series, but is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit, the range site, and the wind-break suitability group in which the mapping unit has been placed. The page for the description of each of these inter-

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

Soil	Acres	Percent
Butler silt loam, 0 to 1 percent slopes -----	5,600	1.5
Crete silt loam, 0 to 1 percent slopes -----	2,900	.8
Crete silt loam, 1 to 3 percent slopes -----	1,100	.3
Fillmore silt loam, 0 to 1 percent slopes -----	8,100	2.2
Fillmore silt loam, drained, 0 to 1 percent slopes --	9,500	2.6
Geary silty clay loam, 3 to 6 percent slopes, eroded -----	1,100	.3
Geary silty clay loam, 6 to 11 percent slopes, eroded -----	1,350	.4
Geary-Hobbs silt loams, 11 to 30 percent slopes ---	1,700	.5
Hall silt loam, terrace, 0 to 1 percent slopes -----	690	.2
Hastings silt loam, 0 to 1 percent slopes -----	173,500	46.7
Hastings silt loam, 1 to 3 percent slopes -----	36,000	9.7
Hastings silt loam, 3 to 6 percent slopes -----	16,900	4.5
Hastings silt loam, 6 to 11 percent slopes -----	1,150	.3
Hastings silty clay loam, 3 to 6 percent slopes, eroded -----	30,250	8.2
Hastings silty clay loam, 6 to 11 percent slopes, eroded -----	16,800	4.5
Hobbs silt loam, 0 to 2 percent slopes -----	3,700	1.0
Holder silt loam, 0 to 1 percent slopes -----	6,300	2.0
Holder silt loam, 1 to 3 percent slopes -----	3,800	1.0
Holder silt loam, 3 to 6 percent slopes -----	760	.2
Hord silt loam, terrace, 0 to 1 percent slopes -----	12,900	3.5
Hord silt loam, terrace, 1 to 3 percent slopes -----	9,400	2.6
Hord complex, 3 to 6 percent slopes -----	300	.1
Marsh -----	930	.2
Scott silt loam, 0 to 1 percent slopes -----	1,150	.3
Silty alluvial land -----	10,700	2.9
Uly-Hobbs silt loams, 11 to 30 percent slopes -----	11,500	3.1
Gravel pits -----	260	.1
Water areas less than 40 acres -----	940	.3
Total -----	369,280	100.0

pretative groups can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (7).

Butler Series

The Butler series consists of deep, somewhat poorly drained, nearly level soils in shallow basins in the uplands and on stream terraces. These soils formed in loess. They have a claypan subsoil that restricts root development and water movement.

In a representative profile the surface layer is gray, friable silt loam 14 inches thick. The subsurface layer is light-gray silt loam 3 inches thick. The subsoil is 21 inches thick. The upper part is dark-gray, very firm silty clay and the lower part is grayish-brown, firm silty clay loam. The underlying material is light-gray silt loam to a depth of 60 inches.

Permeability is slow, and available water capacity is high. The soils absorb moisture easily, but only until the surface layer is saturated. Subsoil moisture is released slowly to plants, because it is held under too much tension to be easily extracted by plant roots. Natural fertility is high, and organic-matter content is moderate. Short periods of flooding are common after heavy rains.

Butler soils are suited to both dryfarmed and irrigated crops. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Butler silt loam, 0 to 1 percent slopes, in a cultivated field, 375 feet north and 50 feet east of the southwest corner of sec. 30, T. 10 N., R. 3 W.:

- Ap—0 to 7 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak, medium, granular structure; slightly hard, friable; medium acid; abrupt, smooth boundary.
- A12—7 to 14 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate, fine, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable; medium acid; abrupt, smooth boundary.
- A2—14 to 17 inches, light-gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak, very thick, platy structure; slightly hard, friable; medium acid; abrupt, smooth boundary.
- B2t—17 to 33 inches, dark-gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong, medium, prismatic structure parting to strong, fine, blocky; very hard, very firm; thin films and dark coatings on faces of peds; neutral; gradual, smooth boundary.
- B3—33 to 38 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, firm; soft white lime in cracks; moderately alkaline, clear, smooth boundary.
- C—38 to 60 inches, light-gray (2.5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) moist; few, fine, distinct, yellowish-brown (10YR 5/8, moist) and black (10YR 2/1, moist) mottles; weak, coarse, prismatic structure; soft, very friable; soft whitish segregations of lime; moderately alkaline.

The A horizon ranges from 9 to 17 inches in thickness. The B horizon ranges from 18 to 36 inches in thickness. Depth to segregations of lime ranges from about 26 to 54 inches.

Butler soils are near Fillmore, Crete, and Hastings soils. Butler soils are better drained and have a less prominent and thinner A2 horizon than Fillmore soils. They are more poorly drained and have a darker colored B horizon than Crete soils. They are more poorly drained and have a darker colored, finer textured B2t horizon than

Hastings soils. They have an A2 horizon that Crete and Hastings soils lack.

Bu—Butler silt loam, 0 to 1 percent slopes. This soil is in shallow basins on the uplands and on stream terraces. Areas are roughly oval in shape and range from about 10 to 40 acres in size.

Included with this soil in mapping were areas of Butler soils that have a thicker than normal surface layer. Also included were small areas of Crete soils at higher elevations and small areas of Fillmore soils in depressions at lower elevations.

Soil wetness and the hazard of flooding are the main limitations to the use of this soil. Under dryland management, however, this soil is droughty in midsummer, because the claypan subsoil has slow permeability and absorbs and releases moisture slowly. The surface layer is more effective for the storage and release of moisture.

Nearly all the acreage is irrigated. Corn, grain sorghum, alfalfa, and wheat are the main crops. Capability units IIw-2, dryland, and IIw-2, irrigated; Clayey range site; windbreak suitability group 2.

Crete Series

The Crete series consists of deep, moderately well drained, nearly level and very gently sloping soils on uplands and stream terraces. These soils formed in loess. They have a compact subsoil that somewhat restricts water movement and root development.

In a representative profile the surface layer is 18 inches thick. The upper part is gray, friable silt loam, and the lower part is dark grayish-brown, firm silty clay loam. The subsoil is 20 inches thick. The upper part is dark grayish-brown, very firm silty clay, the middle part is grayish-brown, very firm silty clay, and the lower part is light-gray, friable silty clay loam. The underlying material is light-gray light silty clay loam to a depth of 60 inches.

Permeability is slow, and available water capacity is high. The claypan subsoil absorbs and releases moisture slowly. Natural fertility is high, and organic-matter content is moderate.

Crete soils are suited to cultivated crops. They are well suited to common crops under both dryfarm and irrigation management. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Crete silt loam, 0 to 1 percent slopes, in a cultivated field, 50 feet east and 300 feet south of the northwest corner of sec. 13, T. 11 N., R. 1 W.:

- Ap—0 to 7 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate, medium, subangular blocky structure parting to weak, fine granular; hard, friable; medium acid; abrupt, smooth boundary.
- A12—7 to 14 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate, fine, subangular blocky structure parting to moderate, fine, granular; hard, friable; medium acid; clear, smooth boundary.
- A3—14 to 18 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine and fine, subangular blocky structure; hard, firm; slightly acid; clear, smooth boundary.
- B21t—18 to 26 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to strong, medium, blocky; very hard, very firm; dark-colored coatings on faces of peds; neutral; gradual, smooth boundary.

B22t—26 to 32 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to strong, medium, blocky; very hard, very firm; dark-colored coatings on faces of peds; neutral; gradual, smooth boundary.

B3—32 to 38 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few, fine, distinct, yellowish-brown (10YR 5/8, moist) mottles; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; mildly alkaline; clear, smooth boundary.

C—38 to 60 inches, light-gray (2.5Y 7/2) light silty clay loam, light brownish gray (2.5Y 6/2) moist; few, medium, distinct, yellowish-brown (10YR 5/8, moist) mottles and few, fine, faint, very dark brown (10YR 2/2, moist) mottles; weak, coarse, prismatic structure; hard, friable; mildly alkaline.

The A horizon ranges from 11 to 20 inches in thickness. The B horizon ranges from 19 to 38 inches in thickness. The B2t horizon is 45 to 52 percent clay.

Crete soils are near Butler, Fillmore, and Hastings soils. They are better drained and have a lighter colored B horizon than Butler and Fillmore soils, and they lack the A2 horizon of those soils. Crete soils are not so well drained and have more clay in the B2 horizon than Hastings soils.

Ce—Crete silt loam, 0 to 1 percent slopes. This silty soil is in basins on the uplands and on stream terraces. It has the profile described as representative of the series. Areas are variable in shape and range from about 10 to 40 acres in size.

Included with this soil in mapping were small areas of Butler and Fillmore soils at lower elevations and small areas of Hastings soils at slightly higher elevations.

The claypan subsoil absorbs moisture slowly and releases it slowly to plants. Crops on this soil commonly lack sufficient moisture in hot, dry summers.

Nearly all the acreage is cultivated. Grain sorghum and corn are the main irrigated crops, and grain sorghum and wheat are the main dryfarmed crops. Capability units IIs-2, dryland, and IIs-2, irrigated; Clayey range site; windbreak suitability group 4.

CeB—Crete silt loam, 1 to 3 percent slopes. This silty soil is on uplands and stream terraces. It has a profile similar to the one described as representative of the series, but its surface layer is thinner. Areas are variable in shape and range from about 10 to 40 acres in size.

Included with this soil in mapping were small areas of nearly level Crete soils and very gently sloping Hastings soils. Also included were small areas of Fillmore and Butler soils at lower elevations.

The hazard of erosion is moderate. The subsoil absorbs moisture slowly and releases it slowly to plants. This soil is droughty in hot, dry summers, because only the surface layer is effective for the storage of moisture.

Nearly all the acreage is cultivated. Wheat and grain sorghum are the main crops. Capability units Iie-2, dryland, and Iie-2, irrigated; Clayey range site; windbreak suitability group 4.

Fillmore Series

The Fillmore series consists of deep, poorly drained and somewhat poorly drained, nearly level soils in basins on the uplands (fig. 5). These soils formed in loess. The subsoil restricts root development and water movement.

In a representative profile, the surface layer is gray, very friable silt loam 7 inches thick. The subsurface layer is light-gray silt loam 6 inches thick. The subsoil is 27 inches thick. The upper part is gray, very firm silty clay, and the



Figure 5.—Area of Fillmore soils. Temporary flooding is a hazard unless these soils are drained.

lower part is grayish-brown, firm silty clay loam. The underlying material is light-gray silt loam to a depth of 60 inches.

Permeability is very slow, and available water capacity is high. The soils absorb moisture easily but only until the surface layer is saturated. Moisture is slowly released to plants. Natural fertility is high, and organic-matter content is moderate.

Fillmore soils are well suited to both dryfarmed and irrigated crops. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Fillmore silt loam, 0 to 1 percent slopes, in a cultivated field, 1,700 feet south and 500 feet east of the northwest corner of sec. 28, T. 12 N., R. 4 W.:

- Ap—0 to 7 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; soft, very friable; slightly acid; abrupt, smooth boundary.
- A2—7 to 13 inches, light-gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak, very thick, platy structure; soft, very friable; few, dark-colored, shot-like iron or manganese pellets; slightly acid; abrupt, smooth boundary.
- B2t—13 to 34 inches, gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; strong, medium and fine, angular blocky structure; very hard, very firm; dark-colored coatings on faces of peds; few, dark-colored, shot-like iron or manganese pellets; mildly alkaline; clear, smooth boundary.
- B3—34 to 40 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; common, moderate, distinct, yellowish-brown (10YR 5/8, moist) mottles; moderate,

medium and fine, subangular blocky structure; hard, firm; soft white segregations of lime; mildly alkaline; gradual, smooth boundary.

- C—40 to 60 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; common, fine, distinct, yellowish-brown (10YR 5/8, moist) and black (10YR 2/1, moist) mottles at depth of 46 to 60 inches; weak, coarse, prismatic structure; soft, friable; soft white segregations of lime; moderately alkaline.

The Ap horizon ranges from 6 to 12 inches in thickness. The A2 horizon ranges from 4 to 8 inches in thickness. The B horizon ranges from 26 to 45 inches in thickness. Depth to lime ranges from 36 inches to more than 60 inches.

Fillmore soils are near Hastings, Butler, and Scott soils. Fillmore soils have more clay in the B2 horizon, are more poorly drained, and are at lower elevations than Hastings soils. They are more poorly drained, have a thicker A2 horizon, and are at lower elevations than Butler soils. They have a thicker A horizon and are at slightly higher elevations than Scott soils.

Fm—Fillmore silt loam, 0 to 1 percent slopes. This soil is in basins on the uplands. It has the profile described as representative of the series. Areas generally are rounded or oval in shape and range from about 5 to 160 acres in size.

Included with this soil in mapping were small areas of Scott soils at lower elevations and small areas of Butler and Crete soils at higher elevations. Also included were a few areas of soils that are partly drained by dugouts and ditches.

This soil is subject to flooding after heavy rains. Water remains on the surface until it evaporates or slowly seeps into the soil. This soil is droughty during dry periods in

summer, because the subsoil has slow permeability and absorbs and releases moisture slowly. The surface layer is more effective for the storage of moisture. Root development is restricted by the fine-textured subsoil.

Nearly all the acreage is cultivated. Wheat and grain sorghum are the main crops. A few areas are in native grass. Capability unit IIIw-2, dryland, IIIw-2 irrigated; Clayey Overflow range site; windbreak suitability group 2.

Fo—Fillmore silt loam, drained, 0 to 1 percent slopes. This soil is in drained shallow basins on the uplands. Areas are oval in shape and range from 5 to about 160 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer has been altered by land-leveling operations in most areas. The areas generally have been filled to facilitate surface drainage. This practice has thickened the surface layer near the center of the areas, but along the edges the surface layer has been cut and thinned.

Included with this soil in mapping were small areas of Crete, Scott, and Butler soils that have been leveled for irrigation and in which surface drainage has been established.

Wetness after rains is the main hazard in areas of this soil. Surface drainage is adequate, but downward movement of moisture is restricted by the claypan.

Nearly all the acreage is cultivated and irrigated. Corn or grain sorghum are the main crops. Capability units IIw-2, dryland, and IIw-2, irrigated; Clayey range site; windbreak suitability group 4.

Geary Series

The Geary series consists of deep, well-drained, gently sloping to steep, silty soils that are adjacent to intermittent drainageways on the uplands. These soils formed in material of the Loveland Formation.

In a representative profile the surface layer is grayish-brown, friable silty clay loam about 7 inches thick. The subsoil is silty clay loam about 53 inches thick. The upper and middle parts are light brown and firm, and the lower part is pink and friable.

Permeability is moderately slow, and available water capacity is high. The soils release moisture readily to plant roots. Fertility is medium where the soils are not eroded and low where they are eroded. Organic matter content is moderately low or low, depending on the extent of erosion.

Geary soils are suited to cultivated crops where slopes are less than 11 percent. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Geary silty clay loam, 3 to 6 percent slopes, eroded, in a cultivated field, 2,240 feet north and 350 feet west of the southeast corner of sec. 1, T. 9 N., R. 2 W.:

AP—0 to 7 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure parting to weak, fine, granular; slightly hard, friable; medium acid; abrupt, smooth boundary.

B21t—7 to 30 inches, light-brown (7.5YR 6/3) silty clay loam, brown (7.5YR 4/3) moist; weak, fine, subangular blocky structure; hard, firm; dark-colored coatings on faces of peds; slightly acid; gradual, smooth boundary.

B22t—30 to 45 inches, light-brown (7.5YR 6/3) silty clay loam, brown

(7.5YR 4/3) moist; moderate, medium and fine, subangular blocky structure; hard, firm; few small accumulations of lime; dark-colored coating on faces of peds; slightly acid; gradual, smooth boundary.

B3—45 to 60 inches, pink (7.5YR 7/3) light silty clay loam, light brown (7.5YR 6/3) moist; weak, fine, prismatic structure parting to moderate, fine, subangular blocky; slightly hard, friable; few small accumulations of lime; neutral.

The A horizon ranges from 6 to 13 inches in thickness. It is silty clay loam or silt loam. The B horizon ranges from 36 to 56 inches in thickness. The B2t horizon is 27 to 35 percent clay. Pebbles are common in some profiles.

Geary soils in York County have a thinner A horizon than is defined in the range for the series.

Geary soils are near Hobbs and Hastings soils. Geary soils have more clay between depths of 10 and 40 inches than Hobbs soils, and they formed in loess instead of in alluvium. They have less clay in the B2t horizon than Hastings soils, and they formed in loess that is redder.

GeC2—Geary silty clay loam, 3 to 6 percent slopes, eroded. This deep, silty soil is on side slopes along intermittent drainageways on the uplands. It has the profile described as representative of the series. Areas range from about 10 to 80 acres.

Included with this soil in mapping were areas of Hobbs soils in narrow drainageways, areas of steep Geary soils, and a few areas of Hastings and uneroded Geary soils. A few included gravelly and sandy areas are shown by spot symbols on the soil map.

Runoff is medium. The hazard of water erosion is severe. In some years rainfall is insufficient for dryfarmed crops. Organic-matter content is low.

Nearly all the acreage is dryfarmed. Grain sorghum, wheat, alfalfa, and corn are the main crops. Areas not cultivated are seeded to grass and are used for pasture or hay. Capability units IIIe-8, dryland, and IIIe-3, irrigated; Silty range site; windbreak suitability group 4.

GeD2—Geary silty clay loam, 6 to 11 percent slopes, eroded. This deep, silty soil is on side slopes on uplands. It has a profile similar to the one described as representative of the series, but its subsoil is slightly thinner. Areas range from about 10 to 40 acres.

Included with this soil in mapping were small areas of Hastings soils and uneroded Geary soils. Also included were areas of Hobbs soils on narrow bottom lands, areas of soils that have a sandy loam profile, and small, severely eroded areas of soils that have a light-colored surface layer. Small included areas of very sandy or gravelly soils are shown by spot symbols on the soil map.

Runoff is rapid. The hazard of erosion is severe. Insufficient rainfall limits crop production in some years. Organic-matter content is low.

Nearly all the acreage is dryfarmed. Grain sorghum, wheat, alfalfa, and corn are the main crops. Areas not cultivated have been seeded to grass and are used for pasture or hay. Capability units IVE-8, dryland, and IVE-3, irrigated; Silty range site; windbreak suitability group 4.

GhG—Geary-Hobbs silt loams, 11 to 30 percent slopes. This mapping unit is on side slopes and on bottom lands of narrow drainageways on the uplands. The Geary soils are on the side slopes, and the Hobbs soils are on the bottom lands. Areas range from about 10 to 40 acres.

This mapping unit is about 30 to 50 percent Geary silt loam, 25 to 40 percent Hobbs silt loam, and 20 to 30 percent other soils.

The Geary soil has a profile similar to the one described as representative of its series, but the surface layer is silt loam and is slightly thicker and the subsoil is thinner and not so well developed. The Hobbs soil has a profile similar to the one described as representative of its series.

Included with this complex in mapping were areas of Uly silt loam and Hastings silt loam on the highest parts of mapped areas and areas of very steep Geary silt loam. Also included were a few areas that have sand or mixed sand and gravel at a depth of 10 to 40 inches.

Runoff is very rapid. The hazard of water erosion is very severe where the Geary soil is steep. Small gullies are common in some areas. The moderately steep and steep slope of the Geary soil is the main limitation to its use. Occasional flooding is a hazard on the Hobbs soil.

Nearly all the acreage is in grass and is used for range. Capability unit VIe-1, dryland; Geary soil in Silty range site and Hobbs soil in Silty Overflow range site; Geary soil in windbreak suitability group 10 and Hobbs soil in windbreak suitability group 1.

Hall Series

The Hall series consists of deep, well-drained, nearly level soils on stream terraces (fig. 6). These soils formed in alluvium derived mainly from loess.

In a representative profile the surface layer is gray, friable silt loam 13 inches thick. The subsoil is silty clay loam 28 inches thick. The upper part is grayish brown and friable, the middle part is grayish brown and light brownish gray and firm, and the lower part is light brownish gray and friable. The underlying material is light-gray silt loam to a depth of 60 inches.

Permeability is moderately slow, and available water capacity is high. These soils absorb water easily and release it readily to plant roots. Natural fertility is high, and organic-matter content is moderate.

Hall soils are suited to both dryfarmed and irrigated crops. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Hall silt loam, terrace, 0 to 1 percent slopes, in a cultivated field, 600 feet west and 2,200 feet south of the northeast corner of sec. 1, T. 9 N., R. 1 W.:

- Ap—0 to 6 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; slightly hard, friable; slightly acid; abrupt, smooth boundary.
- A12—6 to 13 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; slightly hard, friable; slightly acid; abrupt, smooth boundary.
- B1—13 to 18 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; slightly acid, friable, slightly acid; clear, smooth boundary.
- B2t—18 to 23 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, subangular blocky structure; hard, firm; dark-colored coatings on faces of peds; slightly acid; clear, smooth boundary.
- B22t—23 to 31 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; hard, firm; dark-colored coatings on faces of peds; slightly acid; clear, smooth boundary.
- B3—31 to 41 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few, fine, faint, black (10YR 2/1, moist) mottles; weak, medium and coarse, subangular blocky structure; slightly hard, friable; neutral; abrupt, smooth boundary.

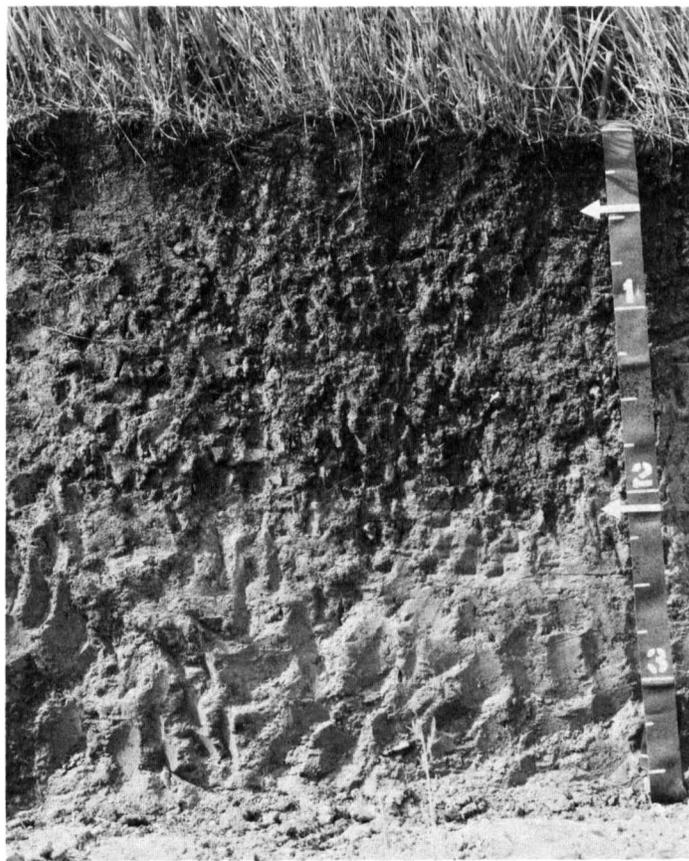


Figure 6.—Profile of Hall silt loam. This deep soil has a granular surface layer and a subangular blocky subsoil.

C—41 to 60 inches, light-gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; few, fine, faint, black (10YR 2/1, moist) and brownish-yellow (10YR 6/6, moist) mottles; weak, coarse, prismatic structure; soft, very friable; soft white segregations of lime; mildly alkaline.

The A horizon ranges from 10 to 18 inches in thickness. The B horizon ranges from 24 to 42 inches in thickness. The B2t horizon is 28 to 35 percent clay. Reaction in the C horizon is neutral or mildly alkaline. Depth to lime ranges from 36 inches to more than 60 inches.

Hall soils are near Hord, Butler, and Crete soils. Hall soils have more clay in the B2 horizon than Hord soils. They have less clay in the B2t horizon than Butler and Crete soils, and they lack the A2 horizon of Butler soils.

Ha—Hall silt loam, terrace, 0 to 1 percent slopes. This silty soil is on stream terraces. Areas range from about 10 to 60 acres.

Included with this soil in mapping were a few small areas of Hord soils and a few areas of soils that have a surface layer of silty clay loam. Also included were small areas of soils that are subject to occasional flooding.

This Hall soil is an excellent soil for cultivated crops, but in some years rainfall is insufficient for dryfarmed crops.

Nearly all the acreage is cultivated, and much of it is irrigated. Corn, grain sorghum, and alfalfa are the main irrigated crops, and winter wheat is the main dryfarmed crop. Capability units I-1, dryland, and I-4, irrigated; Silty Lowland range site; windbreak suitability group 1.

Hastings Series

The Hastings series consists of deep, well-drained, nearly level to strongly sloping soils on uplands (fig. 7). These soils formed in loess.

In a representative profile the surface layer is dark grayish-brown and friable. It is 14 inches thick. The upper part is silt loam, and the lower part is silty clay loam. The subsoil is silty clay loam 34 inches thick. The upper part is grayish brown and firm, the middle part is brown and firm, and the lower part is pale brown and friable. The underlying material is pale-brown heavy silt loam to a depth of 60 inches.

Permeability is moderately slow, and available water capacity is high. Moisture is readily released to plant roots. Natural fertility is high or medium, and organic-matter content is moderate or moderately low, depending on the extent of erosion.

Hastings soils are suited to both dryfarmed and irrigated crops. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Hastings silt loam, 0 to 1 percent slopes, in a cultivated field, 150 feet south and 80 feet west of the northeast corner of sec. 4, T. 10 N., R. 2 W.:

- Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; medium acid; abrupt, smooth boundary.
- A12—6 to 14 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, blocky structure parting to moderate or strong, fine, granular; slightly hard, friable; medium acid; gradual, smooth boundary.
- B1—14 to 20 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to strong, fine and very fine, blocky; hard, firm; medium acid; gradual, smooth boundary.
- B21t—20 to 29 inches, grayish-brown (10YR 5/2) heavy silty clay loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to strong, medium and coarse, blocky; hard, firm; dark-colored coatings on faces of peds; slightly acid; gradual, smooth boundary.
- B22t—29 to 37 inches, brown (10YR 5/3) heavy silty clay loam, light olive brown (2.5Y 5/3) moist; strong, medium and coarse, blocky structure; hard, firm; dark-colored coatings on faces of peds; slightly acid; gradual, smooth boundary.
- B3—37 to 48 inches, pale-brown (10YR 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; moderate, medium, blocky structure; slightly hard, friable; dark-colored coatings on faces of peds; slightly acid; gradual, smooth boundary.
- C—48 to 60 inches, pale-brown (10YR 6/3) heavy silt loam, light olive brown (2.5Y 5/4) moist; massive; soft, friable; neutral.

The A horizon ranges from 8 to 14 inches in thickness. It is silt loam or silty clay loam. The B horizon ranges from 22 to 38 inches in thickness. Depth to lime ranges from 36 inches to more than 60 inches.

Hastings soils in York County in mapping units HuC2 and HuD2 have a thinner and lighter colored surface layer than is defined in the range for the series.

Hastings soils are near Crete, Fillmore, and Geary soils. Hastings soils have less clay in the B horizon and are better drained than Fillmore and Crete soils. They have more clay in the B2t horizon than Geary soils, and they formed in Peoria loess instead of in Loveland loess.

Hs—Hastings silt loam, 0 to 1 percent slopes. This silty soil is on loess uplands. It has the profile described as representative of the series. Areas range from 10 to more than 1,000 acres.

Included with this soil in mapping were some leveled areas of this soil that have a surface layer only 5 to 8 inches thick. Also included were few areas of Holder soils, small



Figure 7.—Profile of Hastings silt loam, a deep soil that has a friable surface layer.

areas of Fillmore soils in depressions, and small, adjacent, flat areas of Butler and Crete soils at lower elevations. Small included depressions are shown by spot symbols on the soil map.

Runoff is slow. Insufficient rainfall limits production of dryfarmed crops in some years.

Nearly all the acreage is cultivated, and much of it is irrigated from deep wells. This Hastings soil is one of the better soils in the county for irrigated crops. Corn and grain sorghum are the main irrigated crops. Corn, grain sorghum, alfalfa, and wheat are the main dryfarmed crops. Capability units I-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 4.

HsB—Hastings silt loam, 1 to 3 percent slopes. This silty soil is on loess uplands. Areas range from 10 to 300 acres.

Included with this soil in mapping were a few areas of nearly level soils and a few areas of gently sloping soils. Also included were small areas of Fillmore soils in depressions, areas of Butler and Crete soils at slightly lower elevations, and areas of Holder soils at slightly higher elevations.

Runoff is slow. The hazard of erosion is moderate. Insufficient rainfall limits crop production in some years.

Nearly all the acreage is cultivated, and much of it is irrigated from deep wells. Corn and grain sorghum are the main irrigated crops. Corn, grain sorghum, wheat, and

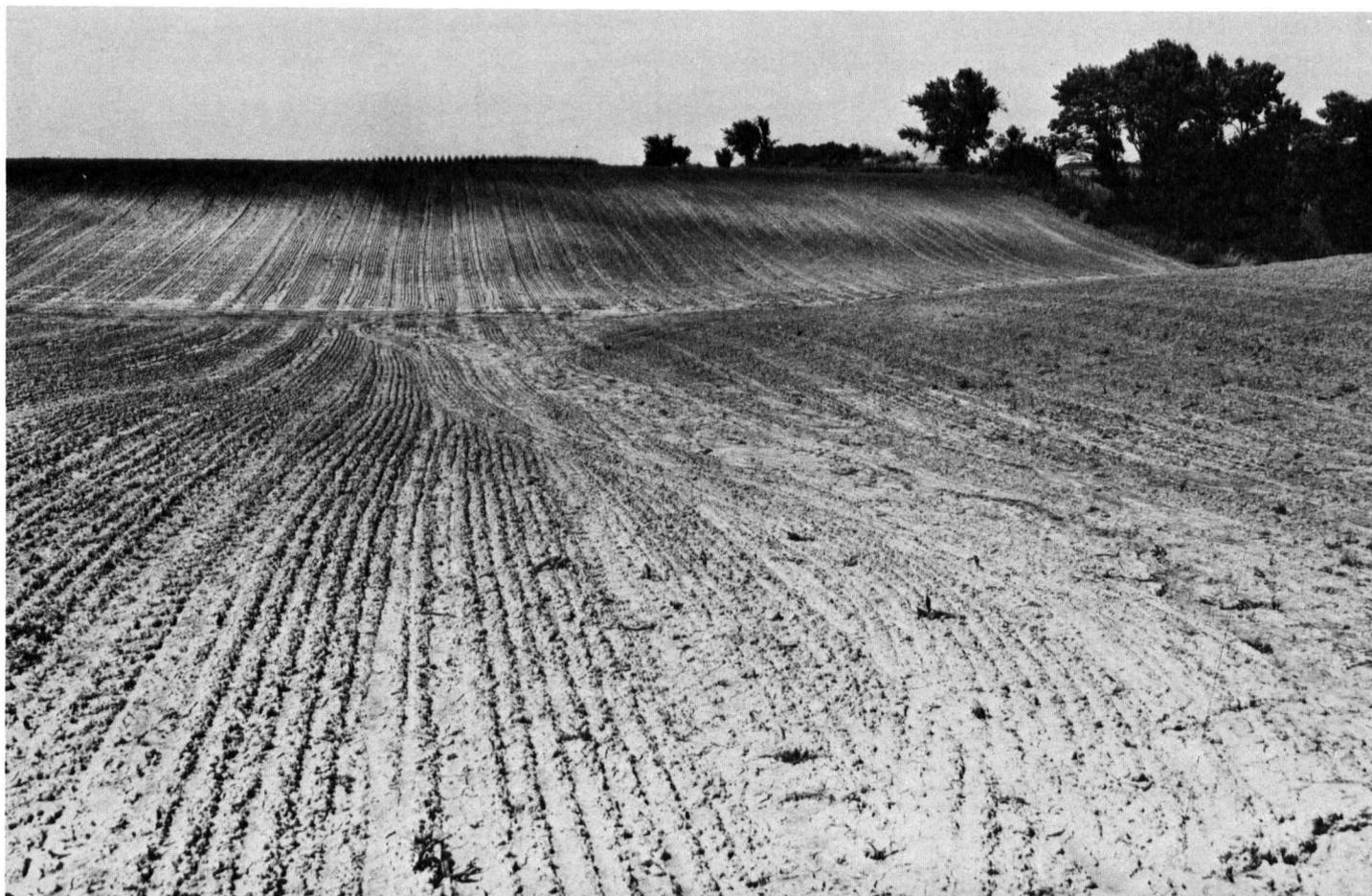


Figure 8.—Area of Hastings silty clay loam, 6 to 11 percent slopes, eroded, in which alfalfa has recently been planted.

alfalfa are the main dryfarmed crops. Capability units IIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 4.

HsC—Hastings silt loam, 3 to 6 percent slopes. This silty soil is on ridgetops and hillsides on uplands. Areas range from about 10 to 120 acres.

This soil has a profile similar to the one described as representative of the series, but its subsoil is thinner. Erosion has removed a part of the original surface layer in cultivated areas.

Included with this soil in mapping were areas of strongly sloping Hastings and Holder soils. Also included were small areas of Hobbs soils on bottom lands of narrow drainageways.

Runoff is medium. The hazard of erosion is severe. Insufficient rainfall limits crop production in some years. Maintaining fertility is a concern of management.

Nearly all the acreage is dryfarmed. Corn, grain sorghum, wheat, and alfalfa are the main crops. Areas not cultivated have been seeded to grass and are used for range. Capability units IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 4.

HsD—Hastings silt loam, 6 to 11 percent slopes. This soil is on side slopes on loess uplands and commonly is in

areas that slope to drainageways. Areas range from about 10 to 40 acres.

This soil has a profile similar to the one described as representative of the series, but its surface layer and subsoil are thinner. Erosion has removed a part of the original surface layer in cultivated areas.

Included with this soil in mapping were areas of Hastings silt loam that are gently sloping and small areas that are severely eroded. Also included were small areas of Holder and Geary soils and areas of Hobbs soils on bottom lands of narrow drainageways.

Runoff is rapid. The hazard of erosion is very severe. Insufficient rainfall is a limitation in some years. Conserving available moisture is an important concern of management.

Nearly all the acreage is dryfarmed. Wheat, alfalfa, grain sorghum, and corn are the main crops. A smaller acreage is in grass and is used for grazing. Capability units IVe-1, dryland, and IVe-4, irrigated; Silty range site; windbreak suitability group 4.

HuC2—Hastings silty clay loam, 3 to 6 percent slopes, eroded. This silty soil is on ridgetops and hillsides and in areas that slope to intermittent drainageways. Areas are long and narrow in shape and range from about 10 to 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner and lighter colored, and its subsoil is thinner. Erosion has removed a part of the original surface layer in cultivated areas. In places, the remaining part of the original surface layer has been mixed with the upper part of the subsoil during tillage. The present surface layer generally is 5 to 8 inches thick, about the thickness of the plow layer. It is light brownish gray or pale brown.

Included with this soil in mapping were small areas of Hastings soils that are not eroded and areas of Hobbs soils in the narrow drainageways.

Runoff is medium. The hazard of erosion is very severe. Insufficient rainfall limits crop production in some years. Nitrogen content generally is low, and as a result, improving fertility is an important concern of management. Organic-matter content is moderately low.

Nearly all the acreage is dryfarmed. Wheat, grain sorghum, alfalfa, and corn are the main crops. Many areas

have been reseeded to grass. A small acreage is irrigated. Capability units IIIe-8, dryland, and IIIe-3, irrigated; Silty range site; windbreak suitability group 4.

HuD2—Hastings silty clay loam, 6 to 11 percent slopes, eroded. This silty soil is on side slopes along intermittent drainageways (fig. 8). Areas are long and narrow in shape and range from about 10 to 60 acres in size.

This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner and lighter colored and its subsoil is thinner and not so well developed. Erosion has removed a part of the original surface layer in cultivated areas. The remaining part has been mixed with the upper part of the subsoil. The present surface layer is 5 to 8 inches thick, about the thickness of the plow layer. It is light brownish gray or pale brown.

Included with this soil in mapping were small areas of Hastings soils that are not eroded and areas of Uly soils. Also included were areas of Hobbs soils on bottom lands of narrow drainageways.

Runoff is rapid. The hazard of erosion is very severe. Insufficient rainfall limits crop production in some years. Nitrogen content generally is low, and organic-matter content is moderately low. Maintaining fertility is an important management concern.

Nearly all the acreage is dryfarmed. Grain sorghum, wheat, alfalfa, and corn are the main crops. A few areas have been reseeded to grass. A small acreage is irrigated. Capability units IVE-8, dryland, and IVE-3, irrigated; Silty range site; windbreak suitability group 4.

Hobbs Series

The Hobbs series consists of deep, well-drained, nearly level soils in valleys of flowing streams and in intermittent drainageways. These soils formed in recent alluvium. They occasionally are flooded (fig. 9).

In a representative profile the surface layer is grayish-brown, very friable silt loam about 8 inches thick. The underlying material is finely stratified silt loam to a depth of 60 inches. The upper part is grayish brown, and the lower part is dark gray.

Permeability is moderate, and available water capacity is high. Moisture is readily absorbed and released to plants. Natural fertility is high, and organic-matter content is moderate.

Hobbs soils are suited to dryfarmed and irrigated crops. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Hobbs silt loam, 0 to 2 percent slopes, in a cultivated field, 2,000 feet south and 90 feet west of the northeast corner of sec. 6, T. 11 N., R. 4 W.:

- Ap—0 to 8 inches, after mixing, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium to coarse, granular structure; soft, very friable; slightly acid; abrupt, smooth boundary.
- C1—8 to 18 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, subangular blocky structure parting to weak, medium, granular; soft, very friable; fine strata of lighter colored and darker colored lenses; slightly acid; gradual, smooth boundary.
- C2—18 to 43 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak, coarse, subangular blocky structure parting to weak, medium, granular; soft, very friable; fine strata of lighter colored and darker colored lenses; neutral; gradual, smooth boundary.

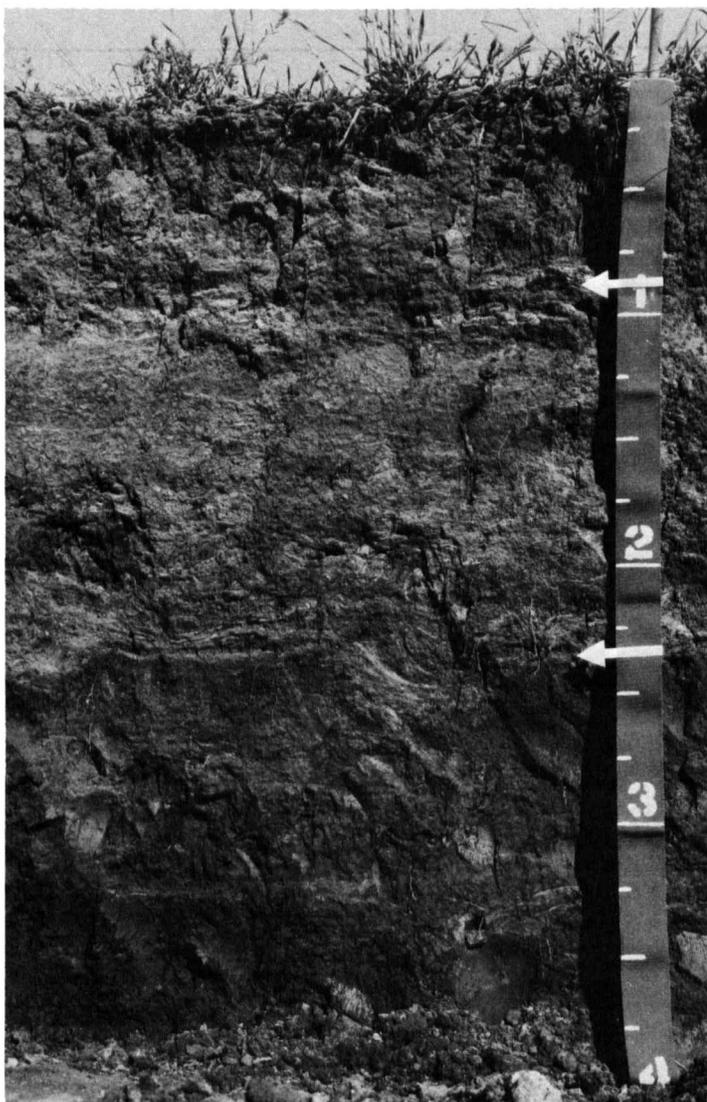


Figure 9.—Profile of Hobbs silt loam showing stratification caused by deposition of soil material during periods of flooding.

C3—43 to 60 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak, medium, granular structure; soft, very friable; fine strata of lighter colored and darker colored lenses; neutral.

The A horizon ranges from 7 to 10 inches in thickness. The solum is 10 inches or less in thickness. Reaction in the C horizon is slightly acid or neutral.

Hobbs soils are near Hord, Geary, Hall, and Uly soils. Hobbs soils are more stratified than Hord soils. They contain less clay between depths of 10 to 40 inches than Geary soils. They have a thinner A horizon and have less clay between depths of 10 to 40 inches than Hall soils. Hobbs soils lack the B horizon of Hord, Geary, Hall, and Uly soils.

Hv—Hobbs silt loam, 0 to 2 percent slopes. This silty soil formed in recent alluvium on bottom lands. It has the profile described as representative of the series. Areas are long and narrow in shape and range from about 5 to 40 acres in size.

Included with this soil in mapping were a few areas of soils that have a thin surface layer. Also included were small areas of Hastings, Geary, and Hord soils, all at higher elevations.

Runoff is slow. Flooding is the main hazard on this soil. The soil commonly is too wet for tillage at normal planting time. Floodwaters damage young plants in places.

Nearly all the acreage is cultivated. A few areas are irrigated. Corn, grain sorghum, and alfalfa are the main crops. Capability units IIw-3, dryland, and IIw-6, irrigated; Silty Overflow range site; windbreak suitability group 1.

Holder Series

The Holder series consists of deep, well-drained, nearly level to gently sloping soils on uplands (fig. 10). These soils formed in loess.

In a representative profile the surface layer is dark grayish-brown, very friable silt loam 14 inches thick. The subsoil is silty clay loam 27 inches thick. The upper part is grayish brown and friable, the middle part is pale brown and firm, and the lower part is pale brown and friable. The underlying material is very pale brown silt loam to a depth of 60 inches.

Permeability is moderate, and available water capacity is high. Moisture is readily absorbed and released to plant roots. Natural fertility is high, and organic-matter content is moderate.

Holder soils are well suited to both dryfarmed and irrigated crops. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Holder silt loam, 0 to 1 percent slopes, in a cultivated field, 1,300 feet north and 70 feet east of the southwest corner of sec. 7, T. 12 N., R. 4 W.:

- Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, fine to medium, granular structure; soft, very friable; medium acid; abrupt, smooth boundary.
- A12—7 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate, medium to fine, granular structure; soft, very friable; medium acid; clear, smooth boundary.
- B1—14 to 20 inches, grayish-brown (10YR 5/2) light silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable; slightly acid; clear, smooth boundary.
- B2t—20 to 32 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; weak, medium, prismatic structure parting to moderate, fine, subangular blocky; slightly hard, firm; neutral; clear, smooth boundary.

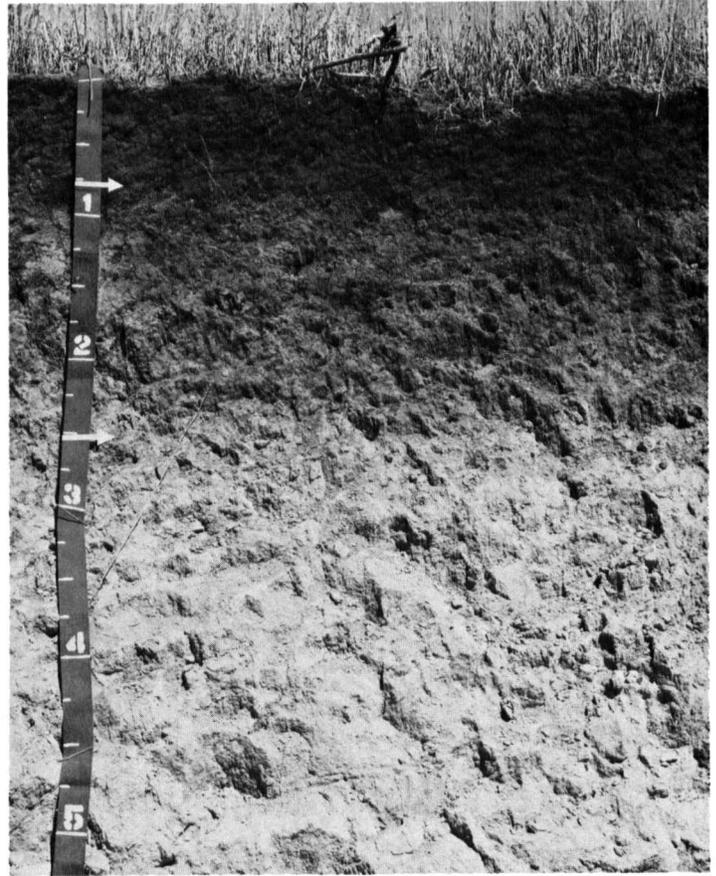


Figure 10.—Profile of Holder silt loam.

B3—32 to 41 inches, pale-brown (10YR 6/3) light silty clay loam, brown (10YR 5/3) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; slightly hard, friable; mildly alkaline; gradual, smooth boundary.

C—41 to 60 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; few, fine, faint, brownish-yellow (10YR 6/8, moist) mottles; weak, coarse, prismatic structure; soft, very friable; moderately alkaline.

The A horizon ranges from 7 to 15 inches in thickness. The B horizon ranges from 18 to 33 inches in thickness. The B2 horizon is 28 to 35 percent clay. Depth to lime ranges from 40 inches to more than 60 inches.

Holder soils are near Hobbs, Fillmore, and Butler soils. Holder soils have more clay between depths of 10 and 40 inches than Hobbs soils, and they have a B horizon that Hobbs soils lack. Holder soils have less clay in the B2 horizon than Fillmore and Butler soils, and they lack the A2 horizon of those soils.

Hw—Holder silt loam, 0 to 1 percent slopes. This silty soil is on tablelands in the loess uplands. It has the profile described as representative of the series. Areas range from about 20 to more than 600 acres.

Included with this soil in mapping were areas that have a surface layer more than 15 inches thick. Also included were a few areas of gently sloping Holder silt loams, a few areas of Hastings, Butler, and Crete soils at lower elevations, and a few areas of Fillmore soils in depressions.

This Holder soil is an excellent soil for cultivated crops, but insufficient rainfall is a limitation in some years. Maintaining fertility is a concern of management, especially where the soil is irrigated.

Nearly all the acreage is cultivated, and much of it is irrigated. Corn, grain sorghum, alfalfa, and wheat are the main crops. Capability units I-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 4.

HwB—Holder silt loam, 1 to 3 percent slopes. This silty soil is on tablelands in the loess uplands. Areas range from about 10 to 200 acres.

Included with this soil in mapping were a few areas that have a surface layer 15 to 25 inches thick. Also included were small areas of gently sloping Holder soils, a few areas of Hastings, Butler, and Crete soils at slightly lower elevations, and a few small areas of Fillmore soils in depressions.

Runoff is slow. The hazard of erosion is moderate. Insufficient rainfall limits production of dryfarmed crops in some years. Maintaining fertility is a concern of management, especially where the soil is irrigated.

Nearly all the acreage is cultivated, and much of it is irrigated. Corn, grain sorghum, wheat, and alfalfa are the main crops. Capability units IIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 4.

HwC—Holder silt loam, 3 to 6 percent slopes. This silty soil is on ridgetops and hillsides in the loess uplands. It has a profile similar to the one described as representative of the series, but its surface layer and subsoil are slightly thinner. Areas range from about 10 to 80 acres.

Included with this soil in mapping were a few areas that have a surface layer only 5 to 10 inches thick. Also included were small areas of Holder silt loam that are very gently sloping and small areas that are severely eroded.

Runoff is medium. The hazard of erosion is severe. In some years, rainfall is insufficient for dryfarmed crops. Maintaining fertility is an important concern of management, especially where crops are irrigated.

Nearly all the acreage is cultivated. Corn, grain sorghum, alfalfa, and wheat are the main crops. Capability units IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 4.

Hord Series

The Hord series consists of deep, well-drained, nearly level to gently sloping soils. These soils formed in alluvium on stream terraces and in colluvium on foot slopes.

In a representative profile the surface layer is friable, silt loam 16 inches thick. The upper part is dark gray, and the lower part is dark grayish brown. The subsoil is silt loam 34 inches thick. The upper part is grayish brown and friable, and the lower part is light brownish gray and very friable. The underlying material is light-gray silt loam to a depth of 60 inches.

Permeability is moderate, and available water capacity is high. Moisture is readily absorbed and released to plant roots. Natural fertility is high, and organic-matter content is moderate.

Hord soils are suited to both irrigated and dryfarmed cultivated crops. They are also suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Representative profile of Hord silt loam, terrace, 0 to 1 percent slopes, in a cultivated field, 30 feet north and 2,620 feet west of the southeast corner of sec. 25, T. 9 N., R. 3 W.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak, medium, granular structure; slightly hard, friable;

slightly acid; abrupt, smooth boundary.

A12—8 to 16 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B2—16 to 32 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; slightly hard, friable; neutral; clear, smooth boundary.

B3—32 to 50 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, subangular blocky structure; soft, very friable; neutral; clear, smooth boundary.

C—50 to 60 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; neutral.

The A horizon ranges from 12 to 24 inches in thickness. The B horizon ranges from 25 to 39 inches in thickness and is 20 to 35 percent clay.

Hord soils are near Hobbs, Butler, Crete, and Hastings soils. Hord soils are not so stratified as Hobbs soils, and they have a B horizon that Hobbs soils lack. They are better drained and have less clay in the B horizon than Butler and Crete soils, and they lack the A2 horizon of those soils. Hord soils have less clay in the B horizon than Hastings soils.

Hx—Hord silt loam, terrace, 0 to 1 percent slopes. This silty soil formed in alluvium on stream terraces. It has the profile described as representative of the series. Areas range from about 10 to 200 acres.

Included with this soil in mapping were areas in which the subsoil and underlying material are stratified and areas in which the subsoil is light silty clay loam. Also included were small areas of Hobbs, Butler, and Crete soils at slightly lower elevations.

This Hord soil is one of the better soils in the county for cultivated crops. Insufficient rainfall is a limitation for dryfarmed crops in some years.

Nearly all the acreage is cultivated, and much of it is irrigated. Corn, grain sorghum, alfalfa, and wheat are the main crops. Capability units I-1, dryland, and I-6, irrigated; Silty Lowland range site; windbreak suitability group 1.

HxB—Hord silt loam, terrace, 1 to 3 percent slopes. This silty soil formed in recent alluvium on foot slopes. Areas range from about 10 to 120 acres.

Included with this soil in mapping were areas of very gently sloping Hastings silt loam, Hobbs silt loam, and Crete silt loam. Also included were areas that have a thin layer of sandy material on the surface.

Runoff is medium. The hazard of erosion is moderate. Insufficient rainfall limits production of dryfarmed crops in some years.

Nearly all the acreage is cultivated, and much of it is irrigated. Corn, grain sorghum, wheat, and alfalfa are the main crops. Capability units IIe-1, dryland, and IIe-6, irrigated; Silty Lowland range site; windbreak suitability group 1.

HyC—Hord complex, 3 to 6 percent slopes. This mapping unit is in areas that border drainageways that cross stream terraces. Areas range from about 5 to 15 acres.

This mapping unit is about 45 percent Hord silt loam, 20 percent Hastings silt loam, 10 percent Hastings silty clay loam, eroded, and 25 percent minor soils. The proportions of the major soils vary from one area to another.

Hord silt loam and Hastings silt loam have a profile similar to the one described as representative of their respective series, but have a surface layer that is slightly thinner. Hastings silty clay loam has a finer textured and

thinner surface layer than is described for the representative profile.

Included with this complex in mapping were small areas of Hobbs silt loam and Silty alluvial land at lower elevations and areas of sandy soils.

Runoff is medium. The hazard of water erosion is severe. Insufficient rainfall limits production of dryfarmed crops in dry years. Fertility is medium in eroded areas; nitrogen, mainly, is needed.

Nearly all the acreage is cultivated. Wheat, grain sorghum, alfalfa, and corn are the main crops. Areas not cultivated are seeded to grass and are used for pasture or range. A small acreage is irrigated. Capability units IIIe-1, dryland, and IIIe-6, irrigated; Silty range site; windbreak suitability group 4.

Marsh

Ma—Marsh (0 to 1 percent slopes). Marsh areas are in shallow basins on the uplands where water is on the surface during most of the growing season. Areas are common throughout loess tablelands and range from about 40 to 140 acres.

Marsh areas are 25 percent or less open waters; the largest percentage occurs late in spring. Water accumulates as runoff after heavy rains in the watershed. Excess irrigation water contributes to the water supply in summer. Most of the water in Marsh areas evaporates, but some water is slowly absorbed by the soil. Marsh areas commonly are dry after prolonged dry periods, usually in late summer.

The soil material in Marsh areas is deep and ranges from silty to clayey. Included in mapping are small areas of Scott soils.

Nearly all the acreage is used as wetland habitat and for recreation. Vegetation consists mainly of reeds, rushes, tall sedges, cattails, smartweeds, and other aquatic vegetation. Marsh areas are not important for grazing, because the vegetation is too coarse and unpalatable. Capability unit VIIIw-7, dryland; no assigned range site; windbreak suitability group 10.

Scott Series

The Scott series consists of deep, poorly drained, nearly level soils in shallow depressions on the uplands. These soils formed in loess.

In a representative profile the surface layer is gray, friable silt loam 5 inches thick. The subsurface layer is light-gray, very friable silt loam 3 inches thick. The subsoil is 52 inches thick. The upper part is gray, very firm silty clay, the middle part is light brownish-gray, very firm silty clay, and the lower part is light brownish-gray, firm silty clay loam.

Permeability is very slow, and available water capacity is high. The claypan subsoil absorbs moisture slowly and releases it slowly to plants. Natural fertility is medium, and organic-matter content is moderate.

Scott soils are suited to dryfarmed cultivated crops, but need protection from flooding in wet years. They are more suited to grass or trees than to cultivated crops because of the hazard of flooding. They provide excellent

habitat for some species of wildlife and are useful for recreation.

Representative profile of Scott silt loam, 0 to 1 percent slopes, in native vegetation, 2,500 feet south and 800 feet east of the northwest corner of sec. 28, T. 12 N., R. 4 W.:

A1—0 to 5 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate, medium and coarse, granular structure; slightly hard, friable; slightly acid; abrupt, smooth boundary.

A2—5 to 8 inches, light-gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak, thick, platy structure parting to moderate, fine, granular; soft, very friable; slightly acid; abrupt, smooth boundary.

B21t—8 to 31 inches, gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; strong, medium, prismatic structure parting to strong, fine, blocky; very hard, very firm; few, dark-colored, shot-like iron or manganese pellets; shiny surfaces on faces of peds; neutral; clear, smooth boundary.

B22t—31 to 45 inches, light brownish-gray (10YR 6/2) silty clay, grayish brown (2.5Y 5/2) moist; strong, medium, prismatic structure parting to strong, medium, blocky; very hard, very firm; shiny surfaces on faces of peds; neutral; clear, smooth boundary.

B3—45 to 60 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common, medium, distinct, brownish-yellow (10YR 6/6, moist) mottles and few, fine, faint, black (10YR 2/1, moist) mottles; moderate, fine, subangular blocky structure; hard, firm; shiny surfaces on faces of peds; neutral; gradual, smooth boundary.

The A horizon ranges from 3 to 11 inches in thickness. The B horizon ranges from 27 to 54 inches in thickness. The B2t horizon is 40 to 55 percent clay. Depth to lime ranges from 35 inches to more than 60 inches.

Scott soils are near Hastings, Fillmore, Butler, and Crete soils. Scott soils are more poorly drained and have more clay in the B2t horizon than Hastings soils. They have a thinner combined A1 and A2 horizon than Fillmore soils. They have a thinner combined A horizon and are more poorly drained than Butler soils. They are more poorly drained than Crete soils. Scott soils have an A2 horizon that Crete and Hastings soils lack.

Sc—Scott silt loam, 0 to 1 percent slopes. This soil is in frequently flooded depressions on uplands. Areas range from 20 to 80 acres.

Included with this soil in mapping were small areas of Fillmore, Butler, and Crete soils at higher elevations and areas of Marsh at lower elevations. Some areas are poorly drained by V-shaped ditches. Dugouts concentrate surface water in the lowest areas. In areas where this soil has been plowed, the subsurface layer generally is mixed with the surface layer.

Wetness caused by flooding is a serious hazard. Wetness at planting time commonly delays planting, and crop growth is slowed by excessive water. In wet years water ponds on this soil and crop production is not possible. The very slow permeability of the subsoil restricts drying, and the high clay content of the subsoil restricts water movement and root development.

Scott soils are used mainly for winter wheat, but a crop is raised in only about half the years. Grain sorghum is also grown. Grasses that tolerate flooding are planted in some areas, and these areas are used for pasture. A few areas are used for recreation, such as waterfowl hunting. Dryland capability unit IVw-2; no assigned range site; windbreak suitability group 10.

Silty Alluvial Land

Sy—Silty alluvial land (0 to 2 percent slopes). This land type consists of deep, silty and loamy soils on frequently



Figure 11.—Flooding after heavy rains is common in areas of Silty alluvial land.

flooded bottom lands along flowing streams and the longer intermittent drainageways. Areas range from 300 to 1,800 acres. The soil is highly stratified because material is deposited by successive flooding (fig. 11).

Included with this land type in mapping are a few areas of sandy material. These areas are dissected in many places by deep channels that limit their usefulness. Also included are a few areas of Hobbs soils at higher elevations.

Permeability is moderate, and available water capacity is high. Moisture is readily absorbed and released. Natural fertility is medium or high.

Frequent flooding is the main hazard to use of this land type. Stream channels dissect the areas and make intensive use difficult. Siltation after large floods covers the vegetation in places, and trash and branches are sometimes deposited by floodwaters.

Silty alluvial land is suited to range and wildlife habitat. It is not suited to planting of trees or shrubs because of frequent flooding. Capability unit VIw-7; Silty Overflow range site; windbreak suitability group 10.

Uly Series

The Uly series consists of deep, somewhat excessively drained, moderately steep and steep soils on side slopes on uplands. These soils formed in loess.

In a representative profile the surface layer is grayish-

brown, friable silt loam 10 inches thick. The subsoil is friable silt loam 16 inches thick. The upper part is light brownish gray, and the lower part is light gray. The underlying material is light-gray silt loam to a depth of 60 inches.

Permeability is moderate, and available water capacity is high. Organic-matter content is moderately low, and natural fertility is medium. Moisture is readily released to plants.

Uly soils are suited to grass, trees, and shrubs; to wildlife habitat; and to recreational uses.

Uly soils in York County are mapped only in a complex with Hobbs soils.

Representative profile of Uly silt loam in an area of Uly-Hobbs silt loams, 11 to 30 percent slopes, in native grass range, 250 feet east and 2,500 feet north of the southwest corner of sec. 22, T. 11 N., R. 4 W.:

- A—0 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) moist; moderate, weak, subangular blocky structure parting to weak, fine, granular; slightly hard, friable; slightly acid; clear, smooth boundary.
- B2—10 to 18 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few, fine, faint, yellowish-brown (10YR 5/6, moist) mottles; weak, coarse, subangular blocky structure parting to weak, fine, subangular blocky; slightly hard, friable; neutral; gradual, wavy boundary.
- B3—18 to 26 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; few, fine, faint, yellowish-brown (10YR 5/6,

moist) mottles; weak, coarse, subangular blocky structure parting to weak, fine, subangular blocky; slightly hard, friable; neutral; gradual, wavy boundary.

- C—26 to 60 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; common, fine, distinct, yellowish-brown (10YR 5/8, moist) mottles; weak, coarse, prismatic structure; slightly hard, friable; neutral.

The A horizon ranges from 6 to 12 inches in thickness. It is slightly acid or neutral in reaction. The B horizon ranges from 6 to 24 inches in thickness. It is neutral or mildly alkaline in reaction.

Uly soils in York County have lime at a greater depth than is defined in the range for the series.

Uly soils are near Hobbs, Hastings, and Geary soils. Uly soils have a thinner A horizon than Hobbs soils, and they have a B horizon that Hobbs soils lack. They have less clay in the B horizon than Hastings soils. They have less clay in the B horizon than Geary soils, and they formed in Peoria loess instead of in Loveland loess.

UhG—Uly-Hobbs silt loams, 11 to 30 percent slopes.

This mapping unit is on side slopes and on bottom lands of narrow intermittent drainageways on the uplands. The Uly soils are on the side slopes, and the Hobbs soils are on the bottom lands. Areas range from 5 to 400 acres.

This mapping unit is about 40 to 50 percent Uly soils, 30 to 40 percent Hobbs soils, and 15 to 25 percent minor soils and land types. The proportions of the soils vary from one area to another.

Included with this complex in mapping were small areas of Hastings silt loam, generally on the highest parts of mapped areas. Also included were areas in which the surface layer of the Uly soil has been removed by erosion, and a few places in which the subsoil has also been washed away and the calcareous silt loam of the underlying material is at the surface. Also included are areas of Silty alluvial land in some of the lowest parts of the mapped areas.

Runoff is very rapid in areas of Uly soils and slow in areas of Hobbs soils. Water erosion is the main hazard on this unit. Eroded areas are low in fertility. Small gullies are common. Flooding is common in areas of Hobbs soils after heavy rains.

Nearly all the acreage is in native grass and is used for range or pasture. A small acreage is cultivated. A few areas have been reseeded to tame grasses. Capability units VIe-1, dryland; Uly soil in Silty range site and Hobbs soil in Silty Overflow range site; Uly soil in windbreak suitability group 10 and Hobbs soil in windbreak suitability group 1.

Use and Management of the Soils

This section explains how the soils in York County can be used. It begins with a general discussion of management practices on dryland and irrigated soils. This is followed by an explanation of the capability classification used by the Soil Conservation Service and a grouping of the soils into capability units according to that classification. Information on the yields of dryfarmed and irrigated crops under a high level of management is given for each arable soil. Next, management of rangeland is discussed and soils are grouped into range sites, each of which is a distinctive type of rangeland. Then, the suitability of the soils for growing trees in windbreaks is discussed and the soils are grouped according to their suitability. Information is also presented on the capacity of the soil association areas to produce food and cover for wildlife. This section concludes with a discus-

sion of the engineering properties of soils, a description of the systems used in classifying soils for engineering purposes, estimates of engineering properties, and engineering interpretations for each of the soil series.

Crops ²

Most soils of York County are suited to cultivated crops, pasture, or range if they are well managed and their limitations can be overcome. Some soils, because of their properties and the hazard of erosion, are poorly suited to cultivated crops. They are better suited to range or to wildlife and recreational uses.

According to the 1969 Census of Agriculture, more than 300,000 acres was cultivated in York County in 1969. More than 118,600 acres, or about 39 percent of the total cultivated area, was irrigated. According to the 1973 preliminary Nebraska Agricultural Statistics, corn, sorghum, wheat, soybeans, and alfalfa hay were the most important crops in 1973. Wild hay, oats, rye, tame hay, barley, and alfalfa for seed were also grown.

Corn is the main irrigated crop. Winter wheat and grain sorghum are the main dryfarmed crops. Each year parts of cultivated areas are summer fallowed, used for temporary pasture, or planted to grasses or legumes.

Conserving moisture, controlling erosion, and maintaining high fertility, good tilth, and the organic-matter content are important in managing cultivated soils in York County.

Terracing, contour farming, contour bench leveling, and the use of grassed waterways help to control water erosion. These practices are suited to such soils as Hastings silt loam, 3 to 6 percent slopes. They are most effectively used in connection with good conservation tillage practices. Leaving crop residue on the surface or growing a protective cover for plants helps to prevent crusting of the soil after heavy rains. Tall stubble left standing throughout winter can catch drifting snow and help to replenish moisture in soils under dryland management.

Managing an adequate cropping system helps to reduce soil loss. A suitable system for row crops uses productive soils that have very little hazard of erosion and uses the steeper, more erodible soils for hay and pasture.

Soil blowing can be reduced on such soils as Hastings, Hobbs, and Holder soils by protecting them from the wind. Such conservation tillage practices as stubble mulch tillage on small grain, mulch planting for row crops, and rotating narrow fields of row crops and small grain help to reduce wind velocity on the surface and, thus, reduce the hazard of soil blowing.

Managing tillage during preparation of seedbeds is important. Minimum tillage and leaving maximum crop residue on the surface help to improve the physical condition of the soil, reduce loss of soil and water, and reduce compaction of the soil.

All soils that are used for cultivated crops and pasture in York County should be tested for plant nutrients to determine the need for commercial fertilizer to sustain high crop production. Applications of fertilizer should be based on the results of these tests. The supply of soil moisture in

² By JOHN I. BRUBACHER, soil scientist, Soil Conservation Service.

dryfarmed areas should be considered. A dry subsoil in an area of limited rainfall needs a slightly lower application of fertilizer than a subsoil in an area of adequate rainfall. Nitrogen fertilizer increases vegetative growth. Phosphorus and zinc commonly are needed on the eroded Geary and Hastings soils on uplands. Because of the chance of more crop growth, soils in irrigated areas need larger amounts of fertilizer.

Proper land leveling generally is needed for efficient use of irrigation water where a gravity system is used. Leveling allows for uniform water distribution and better control of irrigation runoff. Sprinklers can be used on most arable soils, and furrows and borders can be used on the deep, level to gently sloping soils. An irrigation system that allows for control and good management of runoff from sloping fields helps to prevent loss of water as runoff and to provide for reuse of the water.

Capability grouping

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

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

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

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

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat. (None in York County.)

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

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat. (None in York County.)

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is the hazard 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 too cold or too dry.

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

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Both dryland farming and irrigated farming are practiced in York County, and each capability unit is designated as either dryland or irrigated. Soils that are farmed partly as dryland and partly under irrigation are in two capability units. Butler silt loam, 0 to 1 percent slopes, for example, is in capability unit IIw-2, dryland, and in IIw-2, irrigated.

Dryland capability units

In the following pages the capability units for dryland soils in York County are described and suggestions for use and management are discussed.

To find the capability classification of any given mapping unit, refer to the "Guide to Mapping Units."

CAPABILITY UNIT I-I, DRYLAND

This unit consists of deep, nearly level, well-drained soils on uplands and stream terraces. The surface layer is slightly acid to medium acid silt loam. The subsoil is silty clay loam or silt loam. The underlying material is silt loam.

Permeability is moderate or moderately slow, and available water capacity is high. Runoff is slow. The soils absorb moisture easily and release it readily to plants. Organic-matter content is moderate, and natural fertility is high.

Tilth is good and is easy to maintain.

The soils are some of the best and most extensive soils in York County for dryfarmed crops. They have only slight limitations. Fertility needs to be maintained. Soil blowing is a slight hazard where the surface is not protected.

Corn, sorghum, soybeans, small grain, and alfalfa are the main crops. Crop residue on the surface and adequate fertilization are needed to maintain these soils for sustained crop production. A cropping system that rotates row crops with small grain or hay and pasture helps to control crop diseases and insects.

CAPABILITY UNIT II-1, DRYLAND

This unit consists of deep, very gently sloping, well-drained soils on uplands and stream terraces. The surface layer is medium acid or slightly acid silt loam. The subsoil is silty clay loam or silt loam. The underlying material is silt loam.

Permeability is moderately slow or moderate, and available water capacity is high. Runoff is slow. The soils absorb moisture easily and release it readily to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good and is easy to maintain.

Water erosion is the main hazard on the soils. Preventing runoff helps to conserve moisture. Soil blowing is a slight hazard.

The soils are suited to corn, sorghum, small grain, alfalfa, and hay. Corn and sorghum are the main crops. Terracing, wind stripcropping, contour farming, conservation tillage, and grassed waterways are needed to help control erosion. A cropping system that keeps the soil covered with vegetation most of the time helps to reduce the loss of soil moisture.

CAPABILITY UNIT II-2, DRYLAND

Crete silt loam, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, very gently sloping, moderately well drained soil on uplands and stream terraces. The surface layer is medium acid silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silty clay loam.

Permeability is slow, and available water capacity is high. Runoff is medium. This soil absorbs water slowly and releases it slowly to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is easy to maintain, and workability is fair.

Water erosion is a moderate hazard on this soil. Conserving moisture by slowing runoff is a concern in management. During extended dry periods, this soil is droughty, because moisture is not readily released from the clayey subsoil. Organic-matter content needs to be increased in eroded areas.

Corn, wheat, sorghum, soybeans, and alfalfa are the main crops. Because this droughty soil releases moisture slowly, it is best suited to crops that mature early in spring, such as wheat and alfalfa. Contour farming, terracing, and grassed waterways are needed to control runoff. Minimum tillage allows a maximum amount of crop residue to remain on the surface as a mulch. A cropping system that rotates row crops with small grains and legumes is desirable.

CAPABILITY UNIT II-2, DRYLAND

This unit consists of deep, nearly level, somewhat poorly

drained soils on side slopes and in drained basins of uplands. The surface layer is medium acid or slightly acid silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam.

Permeability is slow or very slow, and available water capacity is high. Runoff is slow. The soils absorb moisture slowly and release it slowly to plants. Organic-matter content is moderate, and natural fertility is high.

Tilth is difficult to maintain because of slow drainage and wetness. Wetness is most common in spring, when rainfall is highest, because the clayey subsoil absorbs water slowly and the surface layer stays wet for extended periods. Wetness delays tillage and can retard crop growth, but seldom does it result in a complete crop loss. During some hot periods in summer, the soils are droughty.

The soils are suited to corn, small grain, sorghum, and alfalfa. A cropping system that rotates small grain and alfalfa with row crops is desirable. This system helps to conserve crop residue and to open the subsoil for easier moisture penetration. Terraces and diversions on adjacent soils that drain into these areas help to reduce the excessive wetness that is common in spring.

CAPABILITY UNIT II-3, DRYLAND

Hobbs silt loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, well-drained soil on bottom lands. The surface layer is slightly acid silt loam. The subsoil and underlying material are silt loam.

Permeability is moderate, and available water capacity is high. Runoff is slow or medium. This soil absorbs moisture easily and releases it readily to plants. Organic-matter content is moderate, and natural fertility is high. The soil is easy to work when not too wet.

Occasional flooding and wetness, mainly in spring, are hazards on this soil. Flooding generally is of short duration, but crops can be damaged by standing water, sedimentation, and scouring. Tillage is sometimes delayed by wetness.

This soil is suited to corn, sorghum, small grain, and alfalfa. Occasional flooding in spring limits growth of small grain and alfalfa in places. During dry periods, however, flooding is beneficial to crops, because it adds to the supply of moisture. Flooding generally is of short duration, and damage is seldom severe. Divisions and drainage ditches are needed in most areas to intercept and drain the floodwaters.

CAPABILITY UNIT II-2, DRYLAND

Crete silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, nearly level, moderately well drained soil on uplands and stream terraces. The surface layer is medium acid silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam.

Permeability is slow, and available water capacity is high. Runoff is slow. This soil absorbs moisture slowly and releases it slowly to plants. The subsoil releases moisture slowly to plants. Organic-matter content is moderate, and natural fertility is high. The soil is easy to work when not too wet.

During periods of dry weather, this soil is droughty, because the subsoil is clayey and restricts movement of moisture, and because most of the effective moisture is

stored above the subsoil. Soil blowing can be a hazard where the surface is bare. In early spring, when rainfall is highest, this soil stays moist longer than better drained soils. Tillage commonly is delayed.

This soil is suited to corn, wheat, sorghum, and alfalfa. It is best suited to early maturing crops because it is droughty in summer. A cropping system that rotates row crops with small grains and legumes and includes minimum tillage, good management, return of crop residue, and stubble mulch is desirable. This system helps to maintain good tilth, prevent erosion, and increase moisture intake.

CAPABILITY UNIT IIIc-1, DRYLAND

This unit consists of deep, gently sloping, well-drained soils on uplands and stream terraces. The surface layer is slightly acid to medium acid silt loam or silty clay loam. The subsoil is silty clay loam or silt loam. The underlying material is silt loam. Included are a few small, eroded areas.

Permeability is moderate or moderately slow, and available water capacity is high. Runoff is medium. The soils absorb moisture easily and release it readily to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good.

Water erosion is a hazard where the soils are cultivated and not protected (fig. 12). Conserving available moisture by slowing runoff is an important concern of management.

The soils are well suited to corn, sorghum, small grain, and alfalfa. In hot, dry periods in summer, the lack of moisture damages crops. Terracing, grassed waterways, contour farming, and the use of crop residue as mulch help to reduce runoff and the hazards of water erosion and soil blowing. A cropping system that rotates row crops with small grain, hay, or alfalfa is desirable. This system helps to reduce erosion by keeping the soil covered most of the time. All of these practices help to conserve available soil moisture.

CAPABILITY UNIT IIIc-8, DRYLAND

This unit consists of deep, gently sloping, well-drained, eroded soils on uplands. The surface layer is medium acid or slightly acid silty clay loam. The subsoil and underlying material are silt loam.

Permeability is moderately slow, and available water capacity is high. Runoff is medium. The soils absorb moisture slowly but release it readily to plants. Organic-matter content is low or moderately low, and fertility is low or medium. Tilth is fair and is more difficult to maintain than on soils that are not eroded. The soils tend to puddle if worked when too wet.

Water erosion is a severe hazard on the soils. Conserving moisture by slowing runoff is an important concern of management. Fertility and organic-matter content need to be increased.

Corn, sorghum, small grain, and alfalfa are the main crops. Terracing, grassed waterways, and contour farming help to control runoff and the hazard of water erosion. A cropping system that keeps the soil covered with crops, mulch, or crop residue most of the time is an effective supplement to mechanical water-control practices. Consecutive years of row crops should be limited, a close-growing

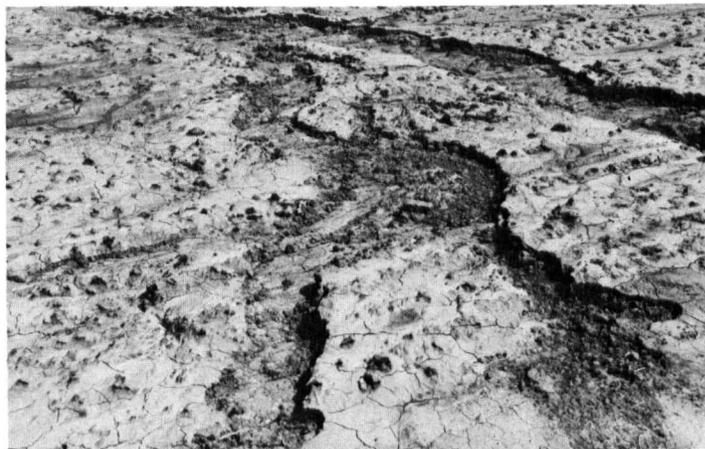


Figure 12.—Rill erosion on Hastings silt loam, 3 to 6 percent slopes. This soil needs protection from further damage by water erosion.

small grain, hay, or similar crop should be added to the cropping sequence, and mulch tillage should be used during seedbed preparation. Small gullies can be shaped and seeded to grass. Grassed field borders help to control runoff and can be used as turn rows, roadways, or wildlife habitat. Barnyard manure can be applied to severely eroded areas to reduce further erosion and provide additional plant nutrients.

CAPABILITY UNIT IIIw-2, DRYLAND

Fillmore silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, nearly level, poorly drained soil in basins on uplands. The surface layer is slightly acid silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam.

Permeability is very slow, and available water capacity is high. Runoff is ponded. This soil absorbs moisture slowly and releases it slowly to plants. Organic-matter content is moderate, and natural fertility is high.

Flooding after heavy rains is a hazard on this soil, particularly in spring. Slow permeability of the subsoil restricts water movement. This soil can be droughty in summer, when precipitation is lowest.

This soil is suited to corn, sorghum, small grain, and tame grass. It is better suited to sorghum and small grain than to corn. Alfalfa generally is not grown because it is susceptible to drowning. Terraces and diversions constructed on the surrounding higher soils help to divert runoff from these basin areas. If outlets are available, open ditches help to remove most of the excess water.

CAPABILITY UNIT IVc-1, DRYLAND

Hastings silt loam, 6 to 11 percent slopes, is the only soil in this unit. It is a deep, well-drained soil on uplands. The surface layer is slightly acid silt loam and silty clay loam. The subsoil is silty clay loam. The underlying material is silt loam.

Permeability is moderately slow, and available water capacity is high. Runoff is rapid. This soil releases moisture readily to plants. Organic-matter content is medium, and natural fertility is high. Tilth is easy to maintain under good management.

Water erosion is the main hazard on this soil. Conserving moisture and controlling runoff are important concerns of management. Rainfall is insufficient in some years for economical production of common crops.

This soil is suited to alfalfa, grasses, and wheat. It is less well suited to grain sorghum and corn. A cropping system that severely limits the use of row crops helps to reduce runoff and erosion. Terracing, contour farming, grassed waterways, and the use of crop residue and mulch tillage are among the cropping practices needed to help prevent erosion and conserve moisture.

CAPABILITY UNIT IV-8, DRYLAND

This unit consists of deep, strongly sloping, well-drained, eroded soils on uplands. The surface layer is medium acid or slightly acid silty clay loam. The subsoil is silty clay loam. The underlying material is silt loam.

Permeability is moderately slow, and available water capacity is high. Runoff is rapid. The soils absorb moisture slowly but release it readily to plants. Organic-matter content is low or moderately low, and fertility is low or medium. Tilth generally is poor to fair.

Water erosion is the main hazard in areas of the soils. Gullies and rills are common. Most of the original surface layer has been eroded away. Controlling runoff helps to prevent further erosion. Some areas are difficult to cultivate because of steepness and poor tilth. The soils puddle if worked when too wet. Organic-matter content and fertility need to be increased. Rainfall is insufficient in some years for profitable crop production.

The soils are best suited to small grain, grass, alfalfa, and similar close-growing crops. They are not well suited to row crops because of the hazard of erosion. A good management practice is seeding the areas to native grasses and using them for range. Terracing, grassed waterways, contour farming, and the use of crop residue as mulch all help to control runoff and erosion. Mulching and the addition of barnyard manure and fertilizer help to maintain the fertility level and to keep the soils porous for easier moisture penetration.

CAPABILITY UNIT IV-2, DRYLAND

Scott silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, poorly drained soil in basins on uplands. The surface layer is slightly acid silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam.

Permeability is very slow, and available water capacity is high. Runoff is ponded. This soil absorbs water very slowly and releases it slowly to plants. Organic-matter content is moderate, and natural fertility is medium. Tilth generally is poor, and the soil is difficult to work.

Flooding is the main hazard on this soil. The very slow permeability of the subsoil limits movement of moisture and growth of crop roots. This soil is ponded after rains, but it is droughty in midsummer. It is difficult to drain, because suitable outlets are scarce. Tillage commonly incorporates a part of the clayey subsoil into the surface layer.

Corn, sorghum, wheat, and tame grasses can be grown successfully where this soil is drained. Alfalfa generally is not grown because it is sensitive to flooding. If satisfactory drainage cannot be established, this soil should be left in

native grass and used for pasture or range or as wildlife habitat. Terraces and diversions on adjacent higher land help to protect these basin areas from floodwaters. The basins can be drained, in many cases, with a V-shaped ditch. When the basins are drained, the use of crop residue and barnyard manure can help to make the soil more friable and tillage less difficult. Application of nitrogen fertilizer is necessary for sustained production of cultivated crops.

CAPABILITY UNIT VI-1, DRYLAND

This unit consists of deep, moderately steep and steep, well drained and moderately well drained soils on uplands and on adjacent bottom lands of narrow drainageways. The surface layer is slightly acid silt loam. The subsoil is silt loam or silty clay loam. The underlying material is silt loam. Included are a few moderately eroded areas.

Permeability is moderate or moderately slow, and available water capacity is high. Because runoff is very rapid, these soils do not absorb moisture so easily as soils that are not so steep. They do release moisture readily to plants. Organic-matter content is moderate and moderately low, and natural fertility is medium and high.

Water erosion is a very severe hazard on the soils because of their slope. The soils are not suited to crop production because they are too steep, the hazard of erosion is too severe, and runoff is too rapid. Conserving moisture is the important concern of management.

Because of slope and susceptibility to erosion, the soils are best suited to grass. Areas already cultivated should be reseeded to native grasses. This is best done by first planting sorghum or sudangrass and then sowing a mixture of native grasses in the stubble. Good grazing practices are needed to control gulley erosion and to give the grass a chance to get started. Seeding waterways to grass, shaping gullies, and building structures to control gullies generally are also needed. The areas offer good sites for dams that impound water for livestock, recreation, and wildlife.

CAPABILITY UNIT VI-7, DRYLAND

Silty alluvial land is the only mapping unit in this capability unit. It is on bottom lands. The soil material is deep, and it is silty or loamy.

Slope is nearly level in most areas, but banks of the stream channels are very steep. Most areas are dissected by a stream channel. Most of the streams are intermittent, but a few flow constantly.

Permeability is moderate, and available water capacity is high. Runoff is slow. This soil material absorbs moisture easily and releases it readily to plants. Organic-matter content is moderate, and natural fertility is medium or high.

Flooding and siltation are very severe hazards. Debris and trash commonly are deposited by floodwaters. Erosion occurs in places along streambanks where moving water deepens and widens the channel.

This land type is well suited to grass. Areas already cultivated should be reseeded to native grasses where the land is protected from flooding. Good range management, including proper grazing, deferred grazing, and a planned grazing system, is needed for maximum grass production. Structures that help to control gulley and streambank ero-

sion are needed in some places. Excess debris and trash should be cleaned out periodically to avoid debris dams and to prevent further erosion.

CAPABILITY UNIT VIII^w-7, DRYLAND

Marsh is the only mapping unit in this capability unit. It is in the deepest basins on uplands. The soil material ranges from silty to clayey.

Runoff from higher surrounding areas collects in Marsh areas and remains there until it evaporates or seeps slowly into the soil. In wet periods, the water is 6 to 18 inches deep, but in the driest periods, the areas are dry. Cattails, rushes, reedgrass, and other aquatic plants cover most of the areas. Where plants are not present, shallow open water covers the areas.

The main concern in management of Marsh areas is the excess water. If the areas are managed for wildlife, however, the excess water is beneficial. The areas are difficult to drain, because they generally lack suitable outlets.

This land type is best suited to wetland wildlife. It provides good areas for the feeding of waterfowl. Hunters use the wettest areas for recreation during open season.

Irrigated capability units

In the following pages the capability units for irrigated soils in York County are described and suggestions for use and management are discussed.

To find the capability classification of any given mapping unit, refer to the "Guide to Mapping Units."

CAPABILITY UNIT I-4, IRRIGATED

This unit consists of deep, nearly level, well-drained soils on uplands and stream terraces. The surface layer is slightly acid or medium acid silt loam. The subsoil is silty clay loam. The underlying material is silt loam.

Permeability is moderate or moderately slow, and available water capacity is high. Runoff is slow. The soils absorb moisture easily and release it readily to plants. The intake rate is moderately slow. Organic-matter content is moderate, and natural fertility is high. Tilth is good and is easy to maintain.

The soils are some of the best in York County for irrigated crops. Maintaining high fertility and organic-matter content is the main concern of management. Soil blowing can be a hazard where the surface is not adequately protected.

Corn, sorghum, alfalfa, soybeans, and tame grasses are suitable irrigated crops. Leaving crop residue on the surface in winter helps to control soil blowing. Incorporating crop residue, commercial fertilizer, and barnyard manure into the soil helps to maintain organic-matter content and high fertility and to increase the intake rate.

Most methods of irrigation are suitable. Only minor land leveling is needed to ensure uniform distribution of irrigation water. Irrigation water needs to be applied in an amount sufficient for the needs of the crop and at a rate that permits maximum absorption and minimum runoff. Irrigation runoff at the ends of fields can be collected in pits and recycled into the irrigation system.

CAPABILITY UNIT I-6, IRRIGATED

Hord silt loam, terrace, 0 to 1 percent slopes, is the only

soil in this unit. It is a deep, nearly level, well-drained soil on stream terraces. The surface layer is slightly acid silt loam. The subsoil and underlying material are also silt loam.

Available water capacity is high, and permeability is moderate. Runoff is slow. This soil absorbs moisture easily and releases it readily to plants. The intake rate is moderate. Organic-matter content is moderate, and natural fertility is high. Tilth is good, and the soil is easy to work.

This is one of the best soils in York County for irrigated crops. It has only a few slight limitations. Soil blowing can occur, particularly in spring, after the soil has been worked, or in late fall, after the crop has been harvested. The main concern of management is maintaining high fertility and organic-matter content.

Corn, sorghum, alfalfa, soybeans, and tame grasses are suitable irrigated crops. Leaving crop residue on the surface in winter helps to control soil blowing. Incorporating crop residue and barnyard manure into the soil helps to increase the intake rate, and with the addition of commercial fertilizers, helps to maintain organic-matter content and high fertility.

Most methods of irrigation are suitable. Only minor land leveling is needed to ensure uniform distribution of irrigation water. Irrigation water needs to be applied in an amount sufficient for the needs of the crop and at a rate that permits maximum absorption and minimum runoff. Irrigation runoff at the ends of fields can be collected in pits and recycled into the irrigation system.

CAPABILITY UNIT II-2, IRRIGATED

Crete silt loam, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, moderately well drained soil on stream terraces. The surface layer is medium acid silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam.

Permeability is slow, and available water capacity is high. Runoff is medium. This soil absorbs moisture slowly and releases it slowly to plants. The intake rate is slow. Organic-matter content is moderate, and natural fertility is high. Tilth is good, and the soil is easy to work.

Water erosion is a moderate hazard on this soil. Conserving irrigation water by slowing its movement downslope helps to prevent the erosion. Maintaining good tilth, high fertility, and organic-matter content are important.

The soil is suited to corn, sorghum, small grain, soybeans, and alfalfa. A cropping system that includes small grain and legumes and the use of mulch tillage is desirable. This system, with the incorporation of crop residue into the soil, helps to control erosion and to maintain tilth, organic-matter content, and high fertility. It also keeps the soil open and allows moisture to enter easily.

Furrow, border, and sprinkler irrigation methods are suitable. Some land leveling generally is needed to control erosion and to ensure uniform distribution of irrigation water. Irrigation runoff at the ends of fields can be collected in pits and recycled into the irrigation system.

CAPABILITY UNIT II-4, IRRIGATED

This unit consists of deep, very gently sloping, well-drained soils on uplands. The surface layer is medium acid silt loam. The subsoil is silty clay loam. The underlying material is silt loam.

Permeability is moderate or moderately slow, and available water capacity is high. Runoff is slow. The soils absorb moisture easily and release it readily to plants. Organic-matter content is moderate, and natural fertility is high. The soils are easy to work.

Water erosion is a moderate hazard on the soils. Slowing runoff is a concern of management. Maintaining high fertility is important. Soil blowing can be a hazard where the surface is not adequately protected.

Corn, sorghum, soybeans, and alfalfa are the main irrigated crops. A conservation tillage system of planting row crops is most satisfactory for controlling erosion. This system helps to maintain organic-matter content, to increase the intake rate, and to prevent soil blowing.

Land leveling generally is needed for efficient gravity irrigation, but sprinkler irrigation is satisfactory where leveling is not used. Leveling helps to slow runoff, control erosion, and control irrigation water.

Irrigation runoff at the ends of fields can be collected in pits and recycled into the irrigation system.

CAPABILITY UNIT IIc-6, IRRIGATED

Hord silt loam, terrace, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, well-drained soil on stream terraces. The surface layer is slightly acid silt loam. The transitional layer and underlying material are silt loam.

Permeability is moderate, and available water capacity is high. Runoff is medium. This soil absorbs and releases moisture readily to plants. Organic-matter content is moderate, and natural fertility is high.

Water erosion is a moderate hazard on this soil. Slowing runoff is important. Maintaining high fertility is a concern of management. In a few low places, excess water can damage crops when they are small.

This soil is well suited to corn, small grain, sorghum, soybeans, and alfalfa. A cropping system that includes a legume is desirable. Leaving crop residue on the surface helps to increase the intake rate, to maintain tilth, to increase organic-matter content, and to conserve moisture.

Land leveling is needed to ensure uniform and efficient distribution of irrigation water, and it helps to slow runoff and control erosion. Irrigation runoff at the ends of the fields can be collected in pits and recycled into the irrigation system.

CAPABILITY UNIT IIw-2, IRRIGATED

This unit consists of deep, nearly level, somewhat poorly drained soils in shallow basins on uplands and on stream terraces. The surface layer is medium acid or slightly acid silt loam. The subsoil is silty clay or silty clay loam. Surface drainage has been established in most areas.

Permeability is slow or very slow, and available water capacity is high. Runoff is slow. The soils absorb moisture readily until the surface layer is saturated. The subsoil releases moisture slowly to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good if the soils are worked when they are not too wet.

In early spring, the soils commonly are too wet for timely cultivation. The clayey subsoil restricts movement of moisture and roots. High fertility needs to be maintained.

The soils are best suited to corn, sorghum, and tame grasses. Small grain, soybeans, and alfalfa are also grown,

but excess water generally limits timely cultivation. A cropping sequence that includes alfalfa helps to open the soil for easier moisture penetration. The use of crop residue, barnyard manure, and green manure crops helps the movement of moisture in the soil. It also helps to maintain good tilth, organic-matter content, and high fertility. Irrigation water needs to be applied frequently but only in an amount needed by the crop.

CAPABILITY UNIT IIw-6, IRRIGATED

Hobbs silt loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, moderately well drained soil on bottom lands that are occasionally flooded. The surface layer is slightly acid silt loam. The underlying material is also silt loam.

Permeability is moderate, and available water capacity is high. Runoff is slow. This soil absorbs moisture readily and releases it readily to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good.

Occasional flooding is a hazard on this soil, generally in spring after heavy rains. Crops can be damaged by siltation or scouring. Water generally drains off after several hours. Planting, harvesting, and tilling commonly are delayed in some areas. Fertility needs to be maintained.

Corn and sorghum are the most suitable irrigated crops. In areas protected from flooding, alfalfa, small grain, and soybeans can be grown. Mulch tillage provides useful protection for this soil where irrigated crops are grown. The use of crop residue, barnyard manure, and commercial fertilizers, along with a legume in the cropping system, helps to maintain tilth, organic-matter content, and high fertility.

Furrow, border, or sprinkler irrigation systems are suitable. Land leveling and an irrigation system that provides for the diversion or interception of floodwaters generally are needed. Reducing and controlling irrigation runoff at the ends of fields are important.

CAPABILITY UNIT IIc-2, IRRIGATED

Crete silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, nearly level, moderately well drained soil on uplands and stream terraces. The surface layer is medium acid silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam.

Permeability is slow, and available water capacity is high. Runoff is slow. This soil absorbs moisture slowly and releases it slowly to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good.

Most of the available moisture is stored in the surface layer, because the subsoil is slowly permeable. Therefore, irrigation water needs to be applied more frequently than in areas where the subsoil is more friable. Care needs to be taken that crops do not lack sufficient moisture, particularly in midsummer. Fertility needs to be maintained. During wet seasons, tillage is delayed in places because of excessive wetness.

This soil is suited to corn, grain sorghum, small grain, soybeans, alfalfa, and tame grasses. A cropping sequence that periodically includes a legume helps to open the subsoil for easier moisture penetration. Leaving crop residue on the surface, applying commercial fertilizers, and incorporating barnyard manure help to maintain high fertil-

ity and allow more water to enter the soil for plant use. This soil needs to be irrigated frequently in midsummer.

CAPABILITY UNIT III-3, IRRIGATED

This unit consists of deep, gently sloping, well-drained, eroded soils on uplands. The surface layer is medium acid silty clay loam. The subsoil is also silty clay loam. The underlying material is silt loam.

Permeability is moderately slow, and available water capacity is high. Runoff is medium. The soils absorb moisture easily and release it readily to plants. Organic-matter content is low or moderately low, and natural fertility is medium or low. Tilth is only fair and is more difficult to maintain than in similar uneroded soils.

Water erosion is the main hazard on the soils. Conserving moisture, maintaining high fertility, and controlling runoff are important concerns of management. Organic-matter content needs to be increased.

Tame grasses and alfalfa are suitable irrigated crops. Where erosion is controlled, corn and sorghum are also suitable. Terracing, contour irrigation, contour bench leveling, grassed waterways, and maximum use of crop residue as a mulch help to control erosion. Using barnyard manure and commercial fertilizer helps to maintain or improve fertility and organic-matter content. These practices also help to maintain good tilth so that the soil will absorb water at a faster rate.

Sprinkler irrigation helps to avoid water erosion. Irrigation water needs to be applied at a rate that permits absorption. Furrow or border irrigation is suitable on bench-leveled areas.

CAPABILITY UNIT III-4, IRRIGATED

This unit consists of deep, well-drained, gently sloping soils on uplands. The surface layer is medium acid silt loam. The subsoil is silty clay loam. The underlying material is silt loam.

Permeability is moderate or moderately slow, and available water capacity is high. Runoff is medium. The soils absorb moisture at a moderate rate and release it readily to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good, and the soils are easy to work.

Water erosion is a severe hazard on the soils. Irrigation water needs to be conserved by slowing water movement. Maintaining fertility is an important concern of management.

Corn, alfalfa, sorghum, small grain, and tame grass are suitable irrigated crops. A cropping system that keeps the soil covered most of the time helps to reduce erosion. Using barnyard manure and commercial fertilizer helps to improve organic-matter content, fertility, and tilth. Leaving crop residue on the surface helps to reduce erosion. These practices also help to increase the intake rate of the soil and to reduce runoff. Terracing, contour bench leveling, grassed waterways, and contour farming help to conserve water and control erosion.

Sprinkler irrigation is a good water-distribution method, but furrows or borders are suitable on the contour. To reduce runoff, irrigation water should be applied at a rate that does not exceed the intake rate of the soil in order to reduce runoff.

CAPABILITY UNIT III-6, IRRIGATED

Hord complex, 3 to 6 percent slopes, is the only soil in this unit. It is a deep, well-drained soil on stream terraces. The surface layer is medium acid or slightly acid silt loam or, in a few areas, silty clay loam. The subsoil and underlying material are silt loam.

Permeability is moderate or moderately slow, and available water capacity is high. Runoff is medium. This soil absorbs moisture at a moderate rate and releases it readily to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good, and the soil is easy to work.

Water erosion is a hazard where this soil is irrigated. Slowing runoff helps to control erosion. Maintaining high fertility is important under irrigation management, because production generally is higher than under dryland management.

Corn, sorghum, small grain, tame grasses, and alfalfa are suitable irrigated crops. Terracing, contour bench leveling, and grassed waterways help to control erosion by reducing runoff. Using crop residue, barnyard manure, and commercial fertilizer helps to maintain tilth and fertility and makes the soil more receptive to absorbing and storing water for plant use.

Sprinkler irrigation is a good water-distribution method, but furrows or borders are suitable on contour bench-leveled areas. Irrigation water should be applied at a rate that does not exceed the intake rate of the soil.

CAPABILITY UNIT III-2, IRRIGATED

Fillmore silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, poorly drained soil in basins on uplands where there is no natural outlet. It floods after heavy rains. The surface layer is slightly acid silt loam. The subsoil is silty clay or silty clay loam. The underlying material is silt loam.

Permeability is very slow, and available water capacity is high. Runoff is very slow or ponded. This soil absorbs moisture readily until the surface layer is saturated. The subsoil absorbs water slowly. The soil releases moisture slowly to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is only fair, because the soil generally is too wet for easy working.

Wetness in spring and droughtiness in hot, dry periods in summer are concerns in management because of the very slow permeability of the subsoil. Wetness caused by flooding is a hazard. Excess water accumulates in the basins, primarily as a result of runoff from higher surrounding soils. Slow drying in spring commonly delays tillage. After heavy rains, water remains in the areas until it slowly seeps into the soil or evaporates. Replanting is needed in places where small plants are flooded and killed by drowning.

Corn, alfalfa, sorghum, and tame grass are suitable irrigated crops. A cropping system that includes a legume or a legume-grass mixture can help to maintain fertility, tilth, and water-absorbing capacity. Using commercial fertilizer and barnyard manure also helps to maintain fertility. A cropping system that returns crop residue to the soil increases organic-matter content.

Furrows and borders are suitable water-distribution methods. Only minor land leveling generally is needed for surface drainage. Where outlets are available, drainage



Figure 13.—This reuse pit recycles irrigation water that collects as a result of runoff.

ditches or tile drains can be installed to remove excess surface water. Irrigation reuse pits (fig. 13) can be used in areas to trap excess runoff water.

CAPABILITY UNIT IVc-3, IRRIGATED

This unit consists of deep, strongly sloping, well-drained, eroded soils on uplands. The surface layer is medium acid silty clay loam. The subsoil is also silty clay loam. The underlying material is silt loam. Most areas are light colored at the surface.

Permeability is moderately slow, and available water capacity is high. Runoff is rapid. The soils absorb moisture readily, but much of the water runs off. They release moisture readily to plants. Organic-matter content is low or moderately low, and natural fertility is low or medium. Tilth is only fair, because the firm subsoil is incorporated into the surface layer during tillage.

Water erosion is a severe hazard on the soils. Gulleys and small rills are common. Conserving water by slowing runoff is important, and it helps to prevent erosion. Organic-matter content needs to be increased. Fertility needs to be improved and then maintained.

Tame grasses, alfalfa, and small grain are suitable irrigated crops. A cropping sequence that keeps the soil covered with vegetative material most of the year is desirable. Returning crop residue and adding barnyard or green

manure help to prevent rill and gully erosion and to maintain tilth, organic-matter content, and fertility. These practices also help the soil to more readily absorb water for plant use. Terracing, grassed waterways, and contour farming are all good erosion-control practices.

Sprinkler irrigation is the most suitable water-distribution method, but the rate at which water is applied should not exceed the intake rate of the soil. Irrigation runoff at the ends of fields can be collected in pits and recycled into the irrigation system.

CAPABILITY UNIT IVc-4, IRRIGATED

Hastings silt loam, 6 to 11 percent slopes, is the only soil in this unit. It is a deep, well-drained soil on uplands. The surface layer is medium acid silt loam. The subsoil is silty clay loam. The underlying material is silt loam.

Permeability is moderately slow, and available water capacity is high. Runoff is rapid. This soil absorbs moisture easily and releases it readily to plants. Organic-matter content is moderate, and natural fertility is high. Tilth is good.

Water erosion is a severe hazard on this soil. Runoff needs to be reduced; this helps to control erosion. Fertility needs to be maintained.

Tame grasses, alfalfa, and small grain are suitable irrigated crops. Corn and sorghum need to be used sparingly

in the cropping sequence to avoid water erosion. Terracing, grassed waterways, and contour farming help to control erosion. Incorporating crop residue and barnyard manure into the soil also helps to reduce erosion. The addition of this vegetative material and applying commercial fertilizer to the soil help to maintain fertility and good tilth.

Sprinkler irrigation is the most suitable water-distribution method, but the rate at which water is applied should not exceed the intake rate of the soil. Furrows and borders are suitable on the contour.

Predicted yields

Crop yield predictions are an important interpretation that can be made from a soil survey. The predicted acre yields for the main crops grown on soils of York County are given in table 2. These predictions are based on average yields for seeded acres over the most recent 5-year period. They do not represent anticipated yields that might be obtainable in the future under a new and possibly different technology.

Yield estimates for various crops were derived from information obtained from interviews with farmers, directors of the Natural Resource Districts, representatives of the Soil Conservation Service and Agricultural Extension Service, and others familiar with the soils and agriculture of the county. Yield information from the Agriculture Stabilization and Conservation Service and research data from Agricultural Experiment Stations were also used.

Yield records, trends, research, and experience were taken into consideration.

Crop yields are influenced by many factors, particularly soil depth, texture, slope, and drainage. Also important are erosion, available water capacity, permeability, and fertility. Management practices such as the cropping pattern, timeliness of operations, plant population, and crop variety also affect crop yields. Weather is significant both on a day-to-day basis and for longer seasonal or yearly fluctuations. All of these factors were taken into account in the preparation of table 2.

The predicted yields listed in table 2 are those under a high level of management. Under this management, fertility is maintained and fertilizer or lime is applied at rates indicated by soil tests and field experiments; crop residue is returned to the soil to improve tilth and maintain or increase organic-matter content; suited varieties of seed are used and plant populations are maximized; weeds, insects, and diseases are well controlled; under irrigation, water is applied in a timely manner and in the proper amount; water erosion and soil blowing are controlled; where needed for crop production, the soil is leveled for irrigation; tilling and seeding practices are performed at the proper time and are adequate; and the soil is protected from deterioration and used in accordance with its capacity.

One of the best ways to use the yield table is to compare the productivity of one soil to that of other soils within the county. The table makes no recommendations, and the

TABLE 2.—Predicted average acre yields of principal irrigated and dryfarmed crops

[Yields are those predicted under improved management. Absence of data indicates the crop is not suited or is grown only in small amounts]

Soil	Corn		Grain sorghum		Wheat	Alfalfa hay	
	Dryfarmed	Irrigated	Dryfarmed	Irrigated	Dryfarmed	Dryfarmed	Irrigated
Butler silt loam, 0 to 1 percent slopes	Bu 56	Bu 125	Bu 72	Bu 115	Bu 35	Tons 3.5	Tons 5.8
Crete silt loam, 0 to 1 percent slopes	58	125	74	115	36	3.4	5.5
Crete silt loam, 1 to 3 percent slopes	55	120	69	110	34	3.1	5.3
Fillmore silt loam, 0 to 1 percent slopes	43		59		23	2.2	
Fillmore silt loam, drained, 0 to 1 percent slopes	54	120	70	115	31	3.5	5.5
Geary silty clay loam, 3 to 6 percent slopes, eroded	49	110	55	95	30	3.0	5.2
Geary silty clay loam, 6 to 11 percent slopes, eroded	35		41		23	2.3	4.5
Geary-Hobbs silt loams, 11 to 30 percent slopes							
Hall silt loam, terrace, 0 to 1 percent slopes	76	145	86	125	45	4.5	6.5
Hastings silt loam, 0 to 1 percent slopes	68	140	78	125	42	3.8	6.5
Hastings silt loam, 1 to 3 percent slopes	65	135	75	120	40	3.6	6.2
Hastings silt loam, 3 to 6 percent slopes	57	125	66	110	36	3.0	5.8
Hastings silt loam, 6 to 11 percent slopes	46		53		29	2.6	5.0
Hastings silty clay loam, 3 to 6 percent slopes, eroded	49	115	62	100	34	2.8	5.4
Hastings silty clay loam, 6 to 11 percent slopes, eroded	40		45		26	2.4	4.5
Hobbs silt loam, 0 to 2 percent slopes	73	140	81	130	27	4.4	6.0
Holder silt loam, 0 to 1 percent slopes	70	145	81	125	43	3.9	6.5
Holder silt loam, 1 to 3 percent slopes	67	140	77	120	41	3.7	6.2
Holder silt loam, 3 to 6 percent slopes	59	130	69	110	37	3.3	5.8
Hord silt loam, terrace, 0 to 1 percent slopes	79	145	89	125	46	4.5	6.5
Hord silt loam, terrace, 1 to 3 percent slopes	65	135	75	120	39	3.6	6.0
Hord complex, 3 to 6 percent slopes	56	125	65	105	35	3.0	5.8
Marsh							
Scott silt loam, 0 to 1 percent slopes			32		16		
Silty alluvial land							
Uly-Hobbs silt loams, 11 to 30 percent slopes							

yields given do not apply to specific farms or farmers.

Yields in any one year on a particular soil can vary considerably from the figures given because of the effect of weather, sudden infestations of diseases or insects, or other unpredictable hazards. The use of long-time averages makes it possible to consider such hazards in predicting crop yields. Yield data will then need to be updated if increased knowledge and improvements in technology show the need.

Range ³

About 4 percent of the total farmland acreage in York County is used as range. Range is scattered throughout the county, generally associated with the broken land adjacent to the major drainageways. Most of it is not suitable for cultivation. The major soil association in range is the Hastings association. The success of the rangeland program depends upon the way that livestock farmers manage their grass and feed reserves.

It is important to the livestock farmer who has rangeland to know that different kinds of rangeland produce different kinds and amounts of native grass. To properly manage rangeland, a land user needs to know the different kinds of land or range sites in his holding and the plants each site can grow. Management that favors the growth of the best forage plants on each kind of land is most desirable.

Management practices that maintain or improve range condition are needed on all rangeland. Suitable practices are: (a) *proper grazing use*, which is grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity and quality of desirable vegetation; (b) *deferred grazing*, which is postponing grazing or resting grazing land for a prescribed period; and (c) *planned grazing system*, in which two or more grazing units are alternately rested from grazing in a planned sequence over a period of years. The rest period can be throughout the year or during the growing season of key plants.

Range seeding is a practice that improves range condition. It is the establishment, by seeding or reseeding, of native grasses, either improved strains or wild harvest. Livestock farmers who have soils that are presently being cropped, but who desire to reseed the land to grass, can obtain technical help from the local Soil Conservation Service office. The kind of soil and the range site assigned to that soil are important facts to know in determining the best seeding program. No care other than management of grazing is needed to maintain the forage composition.

Range sites and condition classes

Range sites are distinctive kinds of rangeland that differ in their ability to produce a significantly different kind, proportion, or amount of climax or original vegetation. A significant difference is one that is great enough to require some variation in management, such as a different stocking rate. Climax vegetation is the combination of plants that originally grew on a given site. The most productive combination of range plants on a site generally is the climax type of vegetation.

Range condition is classified according to the percentage of vegetation on the site that is original or climax vegetation. This classification is used for comparing the kind and amount of present vegetation with that which the site can produce. Changes in range condition are caused mainly by the intensity of grazing and by drought.

Livestock graze selectively, in that they constantly seek the more palatable and nutritious plants. Plants are grouped according to their reaction to grazing. These groups are *decreasers*, *increasers*, and *invaders*.

Decreasers and increasers are climax plants that can be altered by intensive grazing. Generally, *decreasers* are the most heavily grazed and, consequently, the first to be injured by overgrazing. *Increasers* withstand grazing better or are less palatable to the livestock. They increase under grazing and replace the *decreasers*. *Invaders* are weeds that become established after the climax vegetation has been reduced by grazing.

Range condition is expressed in four condition classes to show the present condition of the vegetation on a range site in relation to the vegetation that grew on it originally. The condition is *excellent*, if 76 to 100 percent of the vegetation is climax; *good*, if 51 to 75 percent is climax; *fair*, if 26 to 50 percent is climax; and *poor*, if 0 to 25 percent is climax.

Range plants

Following is a list of dominant range plants that are used in the descriptions of the range sites in this soil survey:

Common name	Scientific name
Baldwin ironweed	<i>Vernonia baldwini</i> Torr.
Big bluestem	<i>Andropogon gerardi</i> Vitman.
Blue grama	<i>Bouteloua gracilis</i> (H.B.V.) Lag. ex Steud.
Buffalograss	<i>Buchloe dactyloides</i> (Nutt.) Engelm.
Canada wildrye	<i>Elymus canadensis</i> L.
Common ragweed	<i>Ambrosia artemisiifolia</i> L.
Green muhly	<i>Muhlenbergia racemosa</i> (Michx.) B.S.P.
Indiangrass	<i>Sorghastrum nutans</i> (L.) Nash.
Kentucky bluegrass	<i>Poa pratensis</i> L.
Little bluestem	<i>Andropogon scoparius</i> Michx.
Porcupinegrass	<i>Stipa spartea</i> Trin.
Prairie cordgrass	<i>Spartina pectinata</i> Link.
Prairie dropseed	<i>Sporobolus heterolepis</i> (A. Gray).
Sand dropseed	<i>Sporobolus cryptandrus</i> (Torr.) A. Gray.
Scribner panicum	<i>Panicum scribnerianum</i> Nash.
Sedges	<i>Carex</i> spp.
Side-oats grama	<i>Bouteloua curtipendula</i> (Michx.) Torr.
Switchgrass	<i>Panicum virgatum</i> L.
Tall dropseed	<i>Sporobolus asper</i> (Torr.) Torr.
Western ragweed	<i>Ambrosia psilostachya</i> DC.
Western wheatgrass	<i>Agropyron smithii</i> .

Descriptions of range sites

The range sites in York County are described in this section. The descriptions include (1) topography on each site, (2) a brief description of the mapping units in each site, (3) the dominant vegetation on the site when range is in excellent condition, (4) the dominant vegetation when range is in poor condition, and (5) the total annual acre yield of air-dry herbage, in pounds per acre, for favorable and unfavorable years, when the site is in excellent condition.

The soil series and land types represented in a range site are named in the description of the range site, but this does not mean that all the soils of a given series appear in that range site. To find the names of all the soils in any given site or the range site of a specified soil, refer to the "Guide to Mapping Units" at the back of this publication.

³ By PETER N. JENSEN, range conservationist, Soil Conservation Service.

SILTY OVERFLOW RANGE SITE

This site consists of deep, nearly level and very gently sloping soils on bottom lands. The surface layer and underlying material are silt loam. The soils and land types of this site are flooded by stream overflow or by runoff from higher elevations.

Permeability is moderate. The soils absorb moisture easily and release it readily to plants. Available water capacity is high. The type of vegetation on this site is mainly a result of additional moisture from occasional flooding.

At least 80 percent of the climax plant community is made up of such decreasers as big bluestem, indiangrass, switchgrass, prairie cordgrass, little bluestem, porcupinegrass, and Canada wildrye. Other grasses and forbs make up the rest. Kentucky bluegrass, green muhly, and various members of the sedge family are the main increasers. The typical plant community when the site is in poor range condition consists of Kentucky bluegrass, members of the sedge family, common ragweed, and Baldwin ironweed.

When the site is in excellent range condition, the total annual acre yield of air-dry herbage ranges from 4,000 pounds per acre in unfavorable years to 5,500 pounds in favorable years.

CLAYEY OVERFLOW RANGE SITE

Fillmore silt loam, 0 to 1 percent slopes, is the only mapping unit in this site. It is a deep soil in shallow, nearly level basins on uplands. The basins lack a drainage outlet. The surface layer is silt loam. The subsoil is silty clay and silty clay loam, and the underlying material is silt loam. Some flooding occurs after each heavy rain.

The soil absorbs moisture slowly and releases it slowly to plants. Available water capacity is high. The type of vegetation on this site is mainly a result of flooding and the very slow permeability of the claypan subsoil.

At least 65 percent of the climax plant community is made up of such decreasers as big bluestem, switchgrass, prairie cordgrass, indiangrass, little bluestem, and Canada wildrye. Other grasses and forbs make up the rest. Kentucky bluegrass and various members of the sedge family are the main increasers. The typical plant community when the site is in poor range condition consists of Kentucky bluegrass, common ragweed, Baldwin ironweed, and members of the sedge family (fig. 14).

When the site is in excellent range condition, the total annual acre yield of air-dry herbage ranges from 3,000 pounds per acre in unfavorable years to 4,500 pounds in favorable years.

SILTY LOWLAND RANGE SITE

This site consists of deep, nearly level and very gently sloping, well-drained soils on foot slopes and stream terraces. The surface layer is silt loam. The subsoil is silt loam or silty clay loam, and the underlying material is silt loam.

Permeability is moderate or moderately slow. The soils absorb moisture easily and release it readily to plants. Available water capacity is high. The type of vegetation on this site is mainly a result of runoff from higher elevations.

At least 75 percent of the climax plant community is made up of such decreasers as big bluestem, indiangrass, switchgrass, little bluestem, porcupinegrass, and Canada



Figure 14.—Prairie cordgrass and big bluestem are the main grasses in the native plant community that is associated with Clayey Overflow range site.

wildrye. Other grasses and forbs make up the rest. Kentucky bluegrass, green muhly, tall dropseed, and various members of the sedge family are the main increasers. The typical plant community when the site is in poor range condition consists of Kentucky bluegrass, common ragweed, and members of the sedge family.

When the site is in excellent range condition, the total annual acre yield of air-dry herbage ranges from 3,500 pounds per acre in unfavorable years to 5,000 pounds in favorable years.

SILTY RANGE SITE

This site consists of deep, nearly level to steep, dominantly well-drained soils on uplands and stream terraces. The surface layer and subsoil are silt loam or silty clay loam. The underlying material is silt loam. A few areas are eroded.

Permeability is moderate or moderately slow. The soils absorb water easily and release it readily to plants. Available water capacity is high. Natural fertility is high to low. The type of vegetation on this site is mainly a result of the favorable soil moisture on the deep, silty soils.

At least 70 percent of the climax plant community is made up of such decreasers as little bluestem, big bluestem,

indiangrass, switchgrass, and porcupinegrass. Other perennial grasses, forbs, and shrubs make up the rest. Side-oats grama, blue grama, tall dropseed, western wheatgrass, Scribner panicum, and various members of the sedge family are the main increasers. The typical plant community when the site is in poor range condition consists of blue grama, sand dropseed, Scribner panicum, western wheatgrass, and western ragweed.

When the site is in excellent range condition, the total annual acre yield of air-dry herbage ranges from 2,000 pounds per acre in unfavorable years to 4,000 pounds per acre in favorable years.

CLAYEY RANGE SITE

This site consists of deep, nearly level and very gently sloping, poorly drained to moderately well drained soils on uplands and stream terraces. The surface layer is silt loam. The subsoil is silty clay and silty clay loam, and the underlying material is silt loam and silty clay loam.

The soils absorb moisture slowly and release it slowly to plants. Available water capacity is high. The type of vegetation on this site is mainly a result of the slow and very slow permeability of the clayey subsoil.

At least 65 percent of the climax plant community is made up of such decreasers as big bluestem, little bluestem, switchgrass, indiangrass, prairie dropseed, porcupinegrass, and Canada wildrye. Other perennial grasses, forbs, and shrubs make up the rest. Side-oats grama, blue grama, tall dropseed, Scribner panicum, western wheatgrass, and various members of the sedge family are the main increasers. The typical plant community when the site is in poor range condition consists of blue grama, buffalograss, sand dropseed, and western ragweed.

When the site is in excellent range condition, the total annual acre yield of air-dry herbage ranges from 1,500 pounds per acre in unfavorable years to 3,500 pounds in favorable years.

Windbreaks ⁴

Native woodland in York County is limited to relatively narrow strips of land along the larger streams. The most extensive stands of trees are on the bottom lands of Lincoln Creek, Beaver Creek, the West Fork Big Blue River, and their tributaries. These stands primarily consist of American elm, boxelder, green ash, hackberry, willows, black walnut, bur oak, eastern cottonwood, and some woody shrubs. They are mainly on Silty alluvial land.

Early settlers in York County planted trees for protection from wind, for shade, and for a source of fenceposts. Throughout the years, landowners have continued to plant trees to protect their buildings, crops, and livestock. Native trees and shrubs contribute to the natural beauty of the landscape of York County. They also produce food and cover for wildlife.

Because of the scarcity of trees and the severe weather that prevails, windbreaks are needed for farmstead, crop, and livestock protection. Windbreaks help to reduce home heating costs, control snow drifting, reduce soil erosion,

provide shelter for livestock, improve wildlife habitat, and beautify the home and countryside (fig. 15).

Narrow windbreaks, or screen plantings, are also useful in urban areas where they slow the speed of wind, reduce soil blowing, and help to reduce the noise level.

Although trees are not easily established every year in York County, the observance of basic rules of tree culture can result in a high degree of tree survival. Healthy seedlings of suited species, properly planted in a well-prepared soil and carefully tended after planting, can survive and grow well.

Trees suitable for use in windbreaks

Table 3 gives the relative vigor and expected height of trees and shrubs at 20 years of age for species suitable for windbreaks in York County. Detailed measurements were taken for most tree and shrub species listed in this table. However, some tree heights and ratings of vigor are estimated. The soils were grouped into four windbreak suitability groups. The soils in each group are similar in characteristics that affect the growth of trees.

The ratings of vigor given in table 3 are based on observations of relative vigor and the general condition of the trees. Those species that have a rating of *good* for a particular windbreak group are best suited to soils of that group. A rating of *good* indicates that one or more of the following conditions generally applies: leaves (or needles) are normal in color and growth; a small amount of deadwood (tops, branches, and twigs) occurs in the live crown of the trees; or damage caused by disease, insects, and climate is limited. A rating of *fair* indicates that one or more of the following conditions generally applies: leaves (or needles) are obviously abnormal in color and growth; a substantial amount of deadwood (tops, branches, and twigs) occurs in the live crown; damage caused by disease, insects, and climate is moderate; or the current year's growth is obviously less than normal. A rating of *poor* indicates that one or more of the following conditions applies: leaves (or needles) are very abnormal in color and growth; a very large amount of deadwood (tops, branches, and twigs) occurs within the live crown; or damage caused by disease, insects, and climate is extensive.

The conifers, cedar and pine, are best suited for windbreaks in York County. Measurements show that eastern redcedar, ponderosa pine, Austrian pine, and Scotch pine are the most reliable species for windbreaks. All rated high in survival and vigor in the studies that were made. These species hold their leaves in winter, thus giving maximum protection when it is most needed. Eastern redcedar can reach a height of 30 to 40 feet at maturity, depending on the kind of soil on which they are grown. Ponderosa pine, Austrian pine, and Scotch pine grow slightly faster and are somewhat taller at maturity than eastern redcedar. Table 3 also indicates several broadleaf species that are well suited for use in windbreaks in York County.

Rate of growth in a windbreak varies widely, relative to the variation in soil moisture and fertility. Exposure and arrangement of trees within the planting also have a marked effect on tree growth. Some kinds of trees, especially eastern cottonwood, grow faster but tend to die younger than other species. Siberian elm and Russian-olive also grow faster and often are short lived; furthermore, they

⁴ By JAMES W. CARR, JR., forester, Soil Conservation Service.



Figure 15.—A 2-year old windbreak of eastern redcedar and Scotch pine designed to supplement an older, inadequate windbreak around a farmstead. These trees are on irrigated Hastings silt loam.

TABLE 3.—Relative vigor and average height, by windbreak suitability group, of specified trees and shrubs 20 years of age

[Heights are not given for species that have poor vigor. Data are not shown for group 10, because soils of this group generally are not suited to windbreak plantings]

Trees and shrubs	Group 1		Group 2		Group 4	
	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height
		<i>Feet</i>		<i>Feet</i>		<i>Feet</i>
Conifers:						
Austrian pine	Good	30	Good	26	Good	28
Black Hills spruce	Good	24	Fair	18	Fair	18
Blue spruce	Good	24	Poor		Fair	22
Eastern redcedar	Good	24	Good	22	Good	24
Ponderosa pine	Good	30	Poor		Good	28
Scotch pine	Good	28	Good	26	Good	28
Broadleaf trees:						
American sycamore	Good	36	Good	32	Fair	26
Black walnut	Good	28	Fair	24	Fair	22
Bur oak	Good	26	Poor		Good	22
Eastern cottonwood	Fair	60	Fair	55	Poor	
Golden willow	Fair	30	Good	30	Poor	
Green ash	Good	30	Fair	26	Good	26
Hackberry	Good	28	Fair	22	Good	24
Honeylocust	Good	34	Fair	30	Good	26
Midwest Manchurian crabapple	Good	20	Poor		Fair	16
Russian mulberry	Good	26	Good	24	Good	22
Russian-olive	Good	22	Poor		Fair	20
Silver maple	Good	36	Good	30	Fair	24

TABLE 3.—*Relative vigor and average height, by windbreak suitability group, of specified trees and shrubs 20 years of age—Continued*

Trees and shrubs	Group 1		Group 2		Group 4	
	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height
		<i>Feet</i>		<i>Feet</i>		<i>Feet</i>
Shrubs:						
American plum	Good	8	Fair	6	Fair	6
Amur honeysuckle	Good	10	Fair	8	Good	8
Amur maple	Good	14	Fair	10	Good	12
Autumn-olive	Good	14	Fair	10	Good	12
Common chokecherry	Good	12	Good	8	Good	10
Hansen rose	Good	8	Poor		Good	6
Lilac	Good	10	Fair	8	Good	8
Nanking cherry	Poor		Poor		Poor	
Peking cotoneaster	Good	8	Poor		Good	6
Red-osier dogwood	Good	8	Good	8	Poor	
Silver buffaloberry	Fair	8	Fair	8	Fair	6
Skunkbush sumac	Good	10	Poor		Good	8
Tatarian honeysuckle	Good	8	Fair	6	Good	6
Winterberry euonymus	Good	16	Poor		Good	14

are likely to spread into areas in which they are not wanted. Boxelder and Russian mulberry commonly freeze back in severe winters. Green ash is susceptible to damage by borers.

Windbreak suitability groups

The soils of York County have been grouped according to the characteristics that affect tree growth. The group to which each soil belongs is listed in the "Guide to Mapping Units." In the following part of this section, the soils in each windbreak group and their characteristics that affect tree growth are briefly discussed.

WINDBREAK SUITABILITY GROUP 1

This group consists of deep, nearly level and very gently sloping, well drained or moderately well drained soils on bottom lands and stream terraces. The surface layer is medium textured. The subsoil is medium textured or moderately fine textured. Available water capacity is high. The soils absorb moisture easily and release it readily to plants. Runoff is slow or medium. Some areas receive addi-

tional runoff from higher elevations.

These soils generally provide good tree-planting sites and the capability for good survival and good growth of adapted species. Moisture competition from weeds and grasses is the main hazard.

WINDBREAK SUITABILITY GROUP 2

This group consists of poorly drained and somewhat poorly drained soils in slightly depressed areas on uplands. The surface layer is medium textured. The subsoil is fine textured and moderately fine textured, and the underlying material is medium textured. Available water capacity is high. The soils absorb moisture slowly and release it slowly to plants. Runoff is very slow.

These soils generally provide good tree-planting sites. They furnish capability for good survival and good growth if the species adapted are those that tolerate occasional excessive wetness. Establishing seedlings is difficult in some wet years. Abundant and persistent herbaceous vegetation on these sites is a concern in establishing and maintaining trees.

TABLE 4.—*Potential of principal soils in soil associations for*

Soil association and soil	Wildlife habitat elements—			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees and shrubs
Holder:				
Holder	Good	Good	Good	Good
Hastings-Fillmore:				
Hastings	Good	Good	Good	Good
Fillmore	Fair	Fair	Fair	Fair
Hastings:				
Hastings	Good	Good	Good	Good
Hord-Silty alluvial land:				
Hord	Good	Good	Good	Good
Silty alluvial land	Very poor	Poor	Poor	Fair

WINDBREAK SUITABILITY GROUP 4

This group consists of deep, nearly level to strongly sloping, well-drained to somewhat poorly drained soils on uplands, on stream terraces, and in drained depressions on uplands. The surface layer is medium textured or moderately fine textured. The subsoil ranges from medium textured to fine textured, and the underlying material is medium textured. Available water capacity is high. The soils generally release moisture readily to plants, but soils that have a claypan subsoil release it slowly. Runoff ranges from slow to rapid.

These soils generally provide good tree-planting sites and the capability for good survival and fair growth of adapted species. Drought and competition from weeds and grasses for moisture are the main hazards. Water erosion is a hazard in areas of gently sloping to strongly sloping soils. Lack of sufficient moisture reduces growth of trees on the steeper slopes because of the rapid runoff.

WINDBREAK SUITABILITY GROUP 10

This group consists of many soils and land types. Collectively, they have a wide range of slope, texture, wetness, and topography. They are on uplands, in depressions on uplands, and on low bottom lands along major streams and creeks. These areas are either too wet or too steep for planting trees with machinery.

Soils of this group generally are not suited to windbreak planting of any kind because of their unfavorable properties. Some areas can be used for recreation, forestation, and wildlife plantings of tolerant tree and shrub species if hand planting or special approved practices are used.

Wildlife ⁵

Wildlife populations are determined largely by the quality and quantity of vegetation that the land is capable of producing. Cover, food, and water, in proper combination, are the three essential elements in determining wildlife abundance.

Topography and soil characteristics, such as fertility, play major roles in determining wildlife numbers. Fertile

soils produce more and higher quality wildlife, both game and nongame species, than infertile soils. Game species are discussed here primarily, although nongame species are becoming increasingly important. Where living conditions for game species improve, nongame species also benefit.

In many cases, the soils rated highest for wildlife potential do not have the highest wildlife populations. This does not result from the inability of soils to produce wildlife but rather from many other factors, such as hunting pressure, clean tillage, and improved harvesting methods. The potential remains, and wildlife value can be enhanced with little cost and effort. Wildlife has a place in both rural and urban settings and needs to be considered when planning for optimum use of these areas. Fish ponds that are filled with runoff from fertile fields generally produce more fish than other ponds because of the increased food production.

Zooplankton are microscopic animals and phytoplankton are microscopic plants that are produced in fertile ponds. They provide food for larger aquatic animals such as frogs, which, in turn, are used as food by fish.

Areas of steep slopes and rough, irregular topography present hazards to livestock and are poorly suited for crop production. In these areas the natural undisturbed landscape can become escape cover for wildlife and can provide a source of food. In many instances, where vegetation is lacking, escape cover can be developed by planting flowering and fruiting trees and shrubs. The section on windbreaks should be consulted for species that are suited.

Wetness, permeability, and available water capacity are important soil characteristics to consider when selecting pond sites for wildlife and recreation.

Table 4 shows the potential of the main soils in the soil associations in York County for producing elements of wildlife habitat and kinds of wildlife. The elements of wildlife habitat and kinds of wildlife are described as follows:

Grain and seed crops consist of domestic grain or other seed-producing annuals planted to produce wildlife food. Examples are corn, sorghum, wheat, oats, barley, millet, soybeans, and sunflowers.

Domestic grasses and legumes consist of domestic perennial grasses and herbaceous legumes that are planted for wildlife cover and food. Examples are fescue, bluegrass, bromegrass, timothy, orchardgrass, clover, alfalfa, trefoil, and crownvetch.

⁵ By ROBERT O. KOERNER, biologist, Soil Conservation Service.

producing wildlife habitat elements and kinds of wildlife

Wildlife habitat elements—Continued			Kinds of wildlife—		
Coniferous plants	Wetland food and cover	Shallow-water areas	Open-land wildlife	Woodland wildlife	Wetland wildlife
Good -----	Poor -----	Very poor -----	Good -----	Good -----	Very poor.
Good -----	Poor -----	Very poor -----	Good -----	Good -----	Very poor.
Fair -----	Good -----	Good -----	Fair -----	Fair -----	Fair.
Good -----	Very poor -----	Very poor -----	Fair -----	Good -----	Very poor.
Good -----	Poor -----	Very poor -----	Good -----	Good -----	Very poor.
Fair -----	Good -----	Good -----	Poor -----	Fair -----	Good.



Figure 16.—This area of Marsh has bulrushes and other aquatic plants. These areas provide good habitat for wetland wildlife.

Wild herbaceous plants are native or naturally established dryland herbaceous grasses and forbs (including weeds) that provide food and cover for wildlife. Examples are bluestem, indiangrass, goldenrod, beggarweed, partridgepea, pokeweed, wheatgrasses, fescues, and gramas.

Hardwood trees and shrubs include nonconiferous trees and associated woody understory plants that provide wildlife cover or that produce nuts, buds, catkins, twigs, bark, or foliage used as food by wildlife. Shrubby plants are shrubs that produce buds, twigs, bark, or foliage used as food by wildlife, or that provide cover and shade for some wildlife species. Examples are snowberry, honeysuckle, and Russian-olive.

Coniferous plants include cone-bearing trees, shrubs, or ground cover that furnish wildlife cover or supply food in the form of browse, seeds, or fruitlike cones. Commonly established through natural processes, they can be planted or transplanted. Examples are pine, spruce, fir, cedar, and juniper.

Wetland food and cover consists of annual and perennial wild herbaceous plants on moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover used extensively by wetland forms of wildlife. Examples are smartweed, wild millet, rushes, sedges, reeds, cordgrass, and cattail.

Shallow water areas are areas useful to wildlife where the average depth of surface water is less than 5 feet. They may be natural wet areas or wet areas created by dams or levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, wildlife ponds, and beaver ponds.

Soils are rated according to their suitability for producing various kinds of wildlife habitat. The kinds of wildlife

habitat in York County are: open-land, woodland, and wetland.

Open-land wildlife are birds and mammals that inhabit croplands, pastures, meadows, and lawns and areas overgrown with grasses, herbs, shrubs, and vines. Examples are bobwhite quail, pheasant, meadowlark, killdeer, cottontail rabbit, red fox, and woodchuck.

Woodland wildlife are birds and mammals that inhabit wooded areas consisting of hardwood or coniferous trees and shrubs, or a mixture of both. Examples are wild turkey, ruffed grouse, thrushes, vireos, woodpecker, squirrel, gray fox, raccoon, and white-tailed deer.

Wetland wildlife are birds and mammals of swampy, marshy, or open-water areas (fig. 16). Examples are ducks, geese, herons, shorebirds, rails, kingfishers, muskrat, mink, and beaver.

Kinds of wildlife by soil association

The Holder and the Hastings-Fillmore associations have similar potential for producing wildlife habitat. The topography is nearly level to gently sloping. Nearly all of the acreage is cultivated, and much of it is irrigated.

Pheasants are the main wildlife species in these two associations. They utilize crop aftermath as food. Scarcity of winter cover is a limiting factor. Additional farmstead and field windbreaks are desirable to furnish additional cover. Many shelterbelts have been removed to make way for center-pivot irrigation systems. Odd areas in corners where the irrigation systems do not reach can be planted to woody or herbaceous cover.

Other wildlife in the Holder and Hastings-Fillmore associations include songbirds and small mammals. Bobwhite quail are more predominant in the southern part of the county where there are more hedgerows of osage-

orange and where plum thickets are along many roadsides. The bobwhite favors brushy cover that is adjacent to cultivated areas. Some of the depressional or pothole areas are flooded by irrigation runoff water. These areas provide a resting place for migrating waterfowl and shorebirds.

The Bureau of Sport Fisheries and Wildlife manages two wildlife areas in the county. One is west of Waco, and the other is in the southeastern part of the county on the Fillmore-York county line. Marsh areas suitable for water fowl, shorebirds, and muskrats are in the south tract. The tract near Waco provides excellent habitat for pheasant, bobwhite quail, songbirds, fox, coyote, and white-tailed deer. Adjacent cultivated areas provide food.

Water for wildlife is from several different sources. In winter, melting snow provides some water; in early spring, natural rainfall fills the shallow depressions. In summer and early autumn, excess water from irrigation systems, along with dew and water of succulence from plants, is adequate.

The Hastings association provides travel lanes for wildlife between the upland areas and the valleys. In the Hastings association, about 20 percent of the acreage is in grassland and provides good nesting cover and escape cover for wildlife. Hedgerows of native plum and osage-orange are common. They provide good cover for bobwhite quail and pheasant.

The Hord-Silty alluvial land association contains most of the woody and herbaceous cover in the county. Ash, elm, and hackberry trees are common. This association provides habitat for squirrel, deer, raccoon, opossum, mink, and weasel that venture into the other adjacent soil associations for food.

Scarcity of winter cover is the limiting factor in all areas of the county. Growth of winter cover would greatly increase the wildlife resources of York County.

Table 4 gives the potential of the main soils in the soil association for producing wildlife habitat elements and lists habitat by class. The soil associations of York County are shown on the General Soil Map.

Recreation ⁶

Interstate Highway 80 traverses the county and provides locations for private campgrounds near the interchanges. Pheasant hunting is a common form of recreation in York County.

York County has numerous historic sites. These include Charleston Townsite, 5 miles west of York interchange I-80; the county courthouse in York; Elias Gilmore House in West Blue Township; Round Barn, 6 miles west and 1 mile south of York; Six Mile Hollow, 6 miles south of Waco; Jack Smith Road Ranch, 6 miles east of York; Site 25YK1, an earthlodge, prehistoric aboriginal village on the York-Fillmore county line; and the George Cabin at the York County Fairground.

The West Fork Big Blue River provides some fishing, and farm ponds provide limited additional fishing. The number of farm ponds is not expected to increase substantially.

Developing good wildlife habitat requires proper location and distribution of vegetation. Technical assistance in planning wildlife developments and determining which species of vegetation to use can be obtained at the local offices of the Soil Conservation Service in York.

Additional information and assistance can be obtained from the Nebraska Game and Parks Commission, the Bureau of Sport Fisheries and Wildlife, and the Federal Extension Service.

The Soil Conservation Service also provides technical assistance in the planning and application of conservation practices for developing outdoor recreation facilities.

Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissioners, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soils on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soils in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 5 and 6, and it can be used to make other useful maps.

This information, however, is not intended for use in design, and it does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed, because many delineated

⁶ By ROBERT O. KOERNER, biologist, Soil Conservation Service.

⁷ JOHN OVERING, area engineer, Soil Conservation Service, assisted in preparing this section.

areas of a given soil mapping unit may contain small areas of other kinds of soils that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have different meanings in soil science than in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying

samples of soils for engineering are the Unified system (2) used by the SCS engineers, Department of Defense, and others, and the AASHTO system (1) adopted by the American Association of State Highway and Transportation Officials.

The Unified system is used to classify soils according to engineering uses for building material. Soils are classified according to particle size, size distribution, liquid limit, plasticity index, and organic-matter content. Soils are divided into coarse-grained or fine-grained groups. The coarse-grained group is further divided into sands or grav-

TABLE 5.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping appear in the first column of this table. The symbol >

Soil series and map symbols	Depth from surface	USDA texture	Classification		Percentage less than 3 inches passing sieve—
			Unified	AASHTO	No. 10 (2.0 mm)
Butler: Bu -----	0-17	Silt loam -----	ML, CL, or CL-ML	A-4 or A-6	
	17-33	Silty clay -----	CH	A-7	
	33-38	Silty clay loam -----	CL or CH	A-7	
	38-60	Silt loam -----	CL	A-6 or A-7	
Crete: Ce, CeB -----	0-14	Silt loam -----	CL	A-6 or A-7	
	14-18	Silty clay loam -----	CL	A-6 or A-7	
	18-32	Silty clay -----	CH	A-7	100
	32-60	Silty clay loam -----	CL or CH	A-7	
Fillmore: Fm, Fo -----	0-13	Silt loam -----	ML or CL	A-4	
	13-34	Silty clay -----	CH	A-7	
	34-40	Silty clay loam -----	CL or CH	A-7	
	40-60	Silt loam -----	CL or CH	A-6 or A-7	
*Geary: GeC2, GeD2, GhG. For Hobbs part of GhG, see Hobbs series.	0-7	Silty clay loam -----	CL	A-6 or A-7	
	7-60	Silty clay loam -----	CL	A-6 or A-7	
Hall: Ha -----	0-13	Silt loam -----	CL or ML	A-4 or A-6	100
	13-41	Silty clay loam -----	CL or CH	A-6 or A-7	100
	41-60	Silt loam -----	CL or ML	A-6 or A-7	100
Hastings: Hs, HsB, HsC, HsD -----	0-6	Silt loam -----	CL or ML	A-6 or A-7	
	6-48	Silty clay loam -----	CL or CH	A-7	
	48-60	Silt loam -----	CL	A-6 or A-7	
HuC2, HuD2 -----	0-42	Silty clay loam -----	CL or CH	A-7	
	42-60	Silt loam -----	CL	A-6 or A-7	
Hobbs: Hv -----	0-8	Silt loam -----	CL or ML	A-6 or A-4	100
	8-60	Silt loam -----	CL or ML	A-6 or A-4	100
Holder: Hw, HwB, HwC -----	0-14	Silt loam -----	CL or ML	A-4 or A-6	100
	14-41	Silty clay loam -----	CL	A-6 or A-7	100
	41-60	Silt loam -----	ML or CL	A-4, A-6, or A-7	100
Hord: Hx, HxB, HyC -----	0-16	Silt loam -----	CL or ML	A-4 or A-6	
	16-50	Silt loam -----	CL or ML	A-6 or A-4	
	50-60	Silt loam -----	CL or ML	A-4 or A-6	
Marsh: Ma. Properties are too variable to estimate.					
Scott: Sc -----	0-8	Silt loam -----	CL or CL-ML	A-4 or A-6	
	8-45	Silty clay -----	CH	A-7	
	45-60	Silty clay loam -----	CL or CH	A-7	
Silty alluvial land: Sy. Properties are too variable to estimate.					
*Uly: UhG ----- For Hobbs part, see Hobbs series.	0-10	Silt loam -----	CL or ML	A-4 or A-6	
	10-60	Silt loam -----	CL or ML	A-4 or A-6	

els according to grain-size distribution. Sands are divided into four main classes on the basis of gradation or classification of the fines that they contain. These classes are identified by the symbols SW, SP, SM, and SC. Gravels are also divided into four main classes by gradation or classification of the fines that they contain. These classes are identified by the symbols GW, GP, GM, and GC. Coarse-grained soils that have 5 to 12 percent fines are considered borderline and have dual symbols such as GW-GM, or SW-SC. The fine-grained group is divided into six main classes on the basis of liquid limit, plasticity index, and organic-matter

content. Nonplastic classes are ML, MH, OL, and OH; plastic classes are CL and CH and one transition class identified by the dual symbol CL-ML. There is one class in the system of highly organic soils, identified as Pt.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups, ranging from A-1 through A-7, on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the

significant in engineering

units may have different properties and limitations. For this reason, it is necessary to follow carefully the instructions for referring to other series that means more than; the symbol < means less than]

Percentage less than 3 inches passing sieve— <i>Continued</i>		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 40 (0.42 mm)	No. 200 (0.074 mm)						
		<i>Pet</i>		<i>In per hour</i>	<i>In per in of soil</i>	<i>pH</i>	
100	95-100	20-40	5-15	0.6-2.0	0.22-0.24	5.6-6.0	Moderate.
100	95-100	51-65	30-45	0.06-0.2	0.11-0.13	6.6-7.3	High.
100	95-100	40-55	20-35	0.2-0.6	0.18-0.20	7.9-8.4	High.
100	95-100	35-45	15-25	0.6-2.0	0.20-0.22	7.9-8.4	Moderate.
100	95-100	30-45	10-20	0.6-2.0	0.22-0.24	5.6-6.0	Moderate.
98-100	95-100	30-50	15-25	0.2-0.6	0.18-0.20	5.6-6.5	High.
100	95-100	51-65	25-40	0.06-2.0	0.11-0.13	6.6-7.3	High.
100	95-100	40-55	20-35	0.2-0.6	0.18-0.20	7.4-7.8	High.
100	95-100	20-35	<10	0.6-2.0	0.22-0.24	6.1-6.5	Moderate.
100	95-100	51-70	30-50	<0.06	0.11-0.13	7.4-7.8	High.
100	95-100	40-55	20-35	0.2-0.6	0.18-0.20	7.4-7.8	High.
100	95-100	35-55	11-30	0.6-2.0	0.20-0.22	7.9-8.4	Moderate.
100	95-100	35-50	15-25	0.2-0.6	0.21-0.23	5.6-6.0	Moderate.
100	95-100	35-50	20-35	0.2-0.6	0.18-0.20	6.1-7.3	Moderate.
98-100	95-100	30-40	5-15	0.6-2.0	0.22-0.24	6.1-6.5	Moderate.
98-100	95-100	35-55	20-35	0.2-0.6	0.18-0.20	6.1-7.3	Moderate to high.
98-100	95-100	30-45	11-20	0.6-2.0	0.20-0.22	6.6-7.8	Moderate.
100	95-100	30-45	11-20	0.6-2.0	0.22-0.24	5.6-6.0	Moderate.
100	95-100	40-55	20-35	0.2-0.6	0.18-0.20	5.6-6.5	High.
100	95-100	30-45	11-25	0.6-2.0	0.20-0.22	6.6-7.3	Moderate.
100	95-100	40-55	20-35	0.2-0.6	0.18-0.20	5.6-6.5	High.
100	95-100	30-45	11-25	0.6-2.0	0.20-0.22	6.6-7.3	Moderate.
95-100	90-100	30-40	10-20	0.6-2.0	0.22-0.24	6.1-6.5	Low.
95-100	90-100	30-40	10-20	0.6-2.0	0.20-0.22	6.1-7.3	Low.
98-100	95-100	25-40	5-15	0.6-2.0	0.22-0.24	5.6-6.0	Moderate.
98-100	95-100	30-50	15-25	0.6-2.0	0.18-0.20	6.1-7.8	Moderate.
98-100	95-100	30-45	5-20	0.6-2.0	0.20-0.22	7.9-8.4	Moderate.
100	95-100	25-40	10-20	0.6-2.0	0.22-0.24	6.1-6.5	Low.
100	95-100	30-40	8-20	0.6-2.0	0.20-0.22	6.6-7.3	Low.
100	95-100	25-40	8-20	0.6-2.0	0.20-0.22	6.6-7.3	Low.
100	95-100	20-40	5-20	0.6-2.0	0.22-0.24	6.1-6.5	Low.
100	95-100	51-65	30-45	<0.06	0.11-0.13	6.6-7.3	High.
100	95-100	40-55	20-35	0.2-0.6	0.18-0.20	6.6-7.3	High.
100	90-100	30-40	8-15	0.6-2.0	0.22-0.24	6.1-7.3	Moderate.
100	90-100	25-40	8-20	0.6-2.0	0.20-0.22	6.6-7.8	Moderate.

TABLE 6.—*Engineer-*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping appear in the first

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill	Local roads and streets
Butler: Bu -----	Severe: slow permeability.	Severe: subject to flooding.	Severe: clayey subsoil; somewhat poorly drained.	Severe: high shrink-swell potential in subsoil; subject to frost action.	Severe for trench type: clayey material. Moderate for area type: wetness.	Severe: high shrink-swell potential; subject to frost action.
Crete: Ce, CeB -----	Severe: slow permeability to a depth of 3 feet; moderately slow permeability below a depth of 3 feet.	Slight: moderately slow permeability below a depth of 3 feet.	Severe: clayey subsoil and silty clay loam underlying material.	Severe: high shrink-swell potential in subsoil.	Moderate for area and trench types: clayey material.	Severe: high shrink-swell potential; subject to frost action.
Fillmore: Fm, Fo -----	Severe: very slow permeability; subject to ponding.	Severe unless adequately protected from flooding.	Severe: wet in places; subject to flooding; clayey subsoil.	Severe: high shrink-swell potential; subject to ponding.	Severe for trench and area types: subject to ponding.	Severe: high shrink-swell potential; subject to frost action and ponding.
*Geary: GeC2, GeD2, GhG ----- For Hobbs part of GhG, see Hobbs series.	Severe: moderately slow permeability; steep in GhG.	Moderate where slopes are 3 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate: moderate shrink-swell potential; slope. Severe in GhG where slopes are more than 15 percent.	Moderate for trench type: too clayey. Slight for area type where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Severe: moderate to high shrink-swell potential; subject to frost action; erodible on slopes.
Hall: Ha -----	Moderate: moderately slow permeability in subsoil; moderate permeability in underlying material.	Moderate: moderate permeability in underlying material.	Slight -----	Moderate: moderate to high shrink-swell potential.	Slight for area and trench types.	Moderate: subject to frost action; moderate to high shrink-swell potential.
Hastings: Hs, HsB, HsC, HsD, HuC2, HuD2.	Severe: moderately slow permeability in subsoil; moderate permeability in underlying material.	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are more than 8 percent.	Severe: high shrink-swell potential in subsoil; subject to frost action.	Moderate for trench type: too clayey. Slight for area type.	Severe: high shrink-swell potential; subject to frost action.

ing interpretations

units may have different properties and limitations. For this reason, it is necessary to follow carefully the instructions for referring to other series that column of this table]

Suitability as source of—			Soil features affecting—				
Road fill	Cover material for sanitary landfill	Topsoil	Pond reservoir areas	Embankments dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: high shrink-swell potential; difficult compaction control; subject to frost action.	Good to a depth of 12 inches. Poor in subsoil.	Fair to a depth of 12 inches. Poor below a depth of 12 inches.	Suited to excavated ponds where surface water is available; slow permeability in subsoil; moderate permeability in underlying material.	Slow permeability in compacted soil; fair to poor compaction characteristics; poor workability; high shrink-swell potential.	Subject to ponding during wet periods; slow internal drainage; outlets not available in places; slow permeability; nearly level.	High available water capacity; slow permeability; improved surface drainage generally needed.	Nearly level. ¹
Poor: high shrink-swell potential; difficult compaction control.	Good to a depth of 12 inches. Poor in subsoil.	Good to a depth of 12 inches. Poor below a depth of 12 inches.	Slow permeability to a depth of 3 feet; moderate permeability below a depth of 3 feet; subject to loss of water where excavated.	Poor workability; subsoil impervious where compacted; fair to poor compaction characteristics; high shrink-swell potential.	Slow permeability in subsoil; slow internal drainage; nearly level or very gently sloping.	Slow intake rate; high available water capacity. slow permeability.	Highly plastic clayey subsoil; cuts must be held to a minimum; moderately erodible.
Poor: high shrink-swell potential; subject to frost action; difficult compaction control.	Good to a depth of 12 inches. Poor in subsoil.	Fair to a depth of 12 inches. Poor below a depth of 12 inches: wet in places.	Low seepage; depressional topography; very slow permeability in subsoil and moderately slow permeability in underlying material.	Fair to poor compaction characteristics; low permeability in compacted soil; high shrink-swell potential.	Poorly drained; subject to occasional ponding; poor internal drainage; adequate outlets not available in places; nearly level.	High available water capacity; very slow permeability in subsoil; improved surface drainage generally needed; subject to ponding; nearly level.	Diversions have a moderate hazard of erosion; poor outlets. ¹
Poor: moderate shrink-swell potential; susceptible to frost action.	Fair -----	Fair: limited depth; silty clay loam. Poor where slopes are more than 15 percent.	Moderately slow permeability.	Low permeability in compacted soil; fair to good compaction characteristics; too steep in some areas; moderate shrink-swell potential.	Well drained; moderately slow permeability; medium to rapid runoff.	High available water capacity; moderately slow permeability; not suited in GhG; easily erodible.	Erodible; moderately slow permeability; moderately fine soil material; terraces not suited in GhG.
Fair: moderate to high shrink-swell potential; fair to poor compaction characteristics.	Good to a depth of 12 inches.	Good to a depth of about 12 inches. Fair in subsoil.	Low to moderate seepage; moderate permeability in underlying material; nearly level.	Erodible on slopes; needs compaction control; fair to good compaction characteristics.	Well drained; all features favorable; nearly level.	High available water capacity; moderately slow intake rate.	All features favorable for diversions. ¹
Poor: high shrink-swell potential; difficult compaction control; subject to frost action.	Good to fair ----	Good where surface layer is silt loam. Fair where surface layer is silty clay loam.	Moderately slow permeability to a depth of 3½ feet; moderate permeability below a depth of 3½ feet.	Erodible on slopes; difficult compaction control; low permeability in compacted soil; moderate to high shrink-swell potential.	Well drained; moderately slow permeability.	High available water capacity; moderately slow permeability; too steep in some areas for gravity system.	Moderately erodible; subsoil of silty clay loam.

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage	Shallow	Dwellings with or without basements	Sanitary	Local roads and streets
Hobbs: Hv -----	Severe: subject to occasional flooding.	Severe: subject to flooding.	Severe: subject to occasional flooding.	Severe: subject to occasional flooding.	Severe for trench and area types: subject to occasional flooding.	Severe: subject to occasional flooding; subject to frost action.
Holder: Hw, HwB, HwC -----	Slight -----	Moderate: moderate permeability.	Slight -----	Moderate: moderate shrink-swell potential in subsoil.	Slight for area and trench types.	Moderate: moderate shrink-swell potential; subject to frost action.
Hord: Hx, HxB, HyC -----	Slight -----	Moderate: moderate permeability; slow permeability in compacted soil.	Slight -----	Slight -----	Slight for trench and area types.	Moderate: subject to frost action; low strength.
Marsh: Ma. Properties too variable to rate. Severe limitations for most uses because of excessive wetness caused by flooding and ponding.						
Scott: Sc -----	Severe: very slow permeability; subject to surface ponding.	Severe: poorly drained; subject to flooding by ponding if not protected.	Severe: poorly drained; clayey subsoil; subject to ponding.	Severe: poorly drained; subject to ponding; high shrink-swell potential.	Severe for trench and area types: poorly drained; clayey sod material.	Severe: poorly drained; high shrink-swell potential; subject to frost action; subject to ponding.
Silty alluvial land: Sy. Properties too variable to rate. Severe limitations for uses because of flooding.						
Uly: UhG ----- For Hobbs part, see Hobbs series.	Moderate where slopes are 11 to 15 percent. Severe where slopes are more than 15 percent.	Severe: slope; moderate permeability.	Moderate where slopes are 11 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 11 to 15 percent: subject to frost action. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are more than 15 percent.	Moderate where slopes are less than 15 percent: subject to frost action. Severe where slopes are more than 15 percent.

¹ Terraces generally not suited because soils are nearly level or too steep.

other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classifica-

tion, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Soil properties significant to engineering

Several estimated soil properties significant to engineering are given in table 5. Estimates are made by layers of representative soil profiles that have significantly different soil properties. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soils in other counties. Following are explanations

interpretations—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Cover material for sanitary landfill	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Fair: subject to frost action.	Good -----	Good -----	Moderate seepage.	Erodible on slopes; needs close compaction control; fair to good workability; subject to occasional flooding.	Subject to occasional flooding; moderate permeability.	High available water capacity; subject to occasional flooding; moderate intake rate.	Erodible on diversion slopes. ¹
Fair: moderate shrink-swell potential; subject to frost action.	Good -----	Good to a depth of 12 inches. Fair in subsoil.	Moderate permeability.	Moderate permeability; erodible on slopes; fair compaction characteristics.	Well drained; nearly level to gently sloping; moderate permeability.	High available water capacity; moderate intake rate; slope.	Moderately erodible; subsoil of silty clay loam.
Fair: subject to frost action.	Good -----	Good -----	Low to moderate seepage; moderate permeability.	Erodible on slopes; fair compaction characteristics; medium to low permeability in compacted soil.	Well drained; moderate permeability; nearly level or very gently sloping.	High available water capacity; moderate intake rate; nearly level to gently sloping.	Erodible on slopes; features favorable.
Poor: high shrink-swell potential; poorly drained; subject to ponding.	Poor -----	Poor: poorly drained; clayey subsoil; subject to ponding.	Low seepage; good sites for dugouts; poorly drained; depressional topography.	Low permeability in compacted soil; poor workability; high compressibility.	Subject to frequent ponding; slow internal drainage; outlets not available in places; depressional topography.	High available water capacity; slow intake rate; poor surface drainage; subject to ponding.	Diversion borrow soil is difficult to load, haul, and compact. ¹
Fair: moderate shrink-swell potential; subject to frost action.	Good -----	Fair where slopes are 11 to 15 percent. Poor where slopes are more than 15 percent.	Moderate seepage; moderate permeability.	Fair compaction characteristics; low permeability in compacted soil; moderately steep and steep.	All features favorable; moderately steep and steep; moderate permeability; rapid runoff.	Not suited: too steep.	Features favorable; exposed subsoil is erodible and has low fertility; diversions erodible where moderately steep and steep. ¹

of some of the columns in table 5.

No soils in York County have bedrock within a depth of 5 feet from the surface.

No regional water table was found within a depth of 5 feet from the surface in York County. Wet soil conditions or a perched water table are found in Butler, Fillmore, and Scott soils, mainly in spring, when rainfall is highest.

Soil texture is described in table 5 in the standard terms used by the United States Department of Agriculture (USDA). These terms are based on the percentage of sand, silt, and clay in the soil material that is less than 2 mill-

meters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index are measurements of water content obtained by specified methods. As the water content of a clayey soil, from which the particles coarser

TABLE 7.—*Engineer-*

[Tests performed by the Nebraska Department of Roads in accordance with standard procedures

Soil name and location	Parent material	Report No. S72-	Depth	Moisture-density ¹		Specific gravity	Mechanical analysis ²	
				Maximum dry density	Optimum moisture		Percentage passing sieve—	
							No. 10 (2.0 mm)	No. 40 (0.42 mm)
Fillmore silt loam: 1,700 feet south and 500 feet east of the northwest corner of sec. 28, T. 12 N., R. 4 W. (Modal)	Peoria loess.	1594	0-7			2.60		
		1595	13-34			2.69		
		1596	40-63			2.70		
Geary silty clay loam: 2,240 feet north and 400 feet west of the southeast corner of sec. 1, T. 9 N., R. 2 W. (Modal)	Loveland loess.	1597	0-7			2.65		
		1598	7-30			2.69		100
Hastings silt loam: 150 feet south and 80 feet west of the northeast corner of sec. 4, T. 10 N., R. 2 W. (Modal)	Peoria loess.	31248	0-15	102	20	2.61		
		31249	20-37	99	23	2.62		
		31250	48-60	105	20	2.68		
Holder silt loam: 1,300 feet north and 70 feet east of the southwest corner of sec. 7, T. 12 N., R. 4 W. (Modal)	Peoria loess.	1602	7-14			2.61		
		1603	20-32			2.69		
		1604	41-60			2.70		
Hord silt loam: 1,400 feet north and 30 feet east of the southwest corner of sec. 8, T. 9 N., R. 2 W. (Modal)	Silty alluvium.	1599	7-30			2.64	100	99
		1600	30-59			2.59		
		1601	59-80			2.65		

¹ Based on AASHTO Designation T 99-49 (1).² Mechanical analyses according to AASHTO Designation T 88-47 (1). Results by this procedure frequently may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material including that coarser than 2 millimeters in diameter.

than 0.42 millimeter have been removed, increases from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material changes from a semisolid to a plastic state; and the *liquid limit*, from a plastic state to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of water content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability, as used in table 5, is an estimate of the rate at which saturated soil would transmit water in a vertical direction under a unit head of pressure. It is estimated on the basis of those soil characteristics observed in the field, particularly structure, porosity, and texture. Lateral seepage or such transient soil features as plowpans and surface crusts are not considered.

Available water capacity is an estimate of the capacity of soils to hold water for use by most plants. It is defined here

as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most plants.

Reaction refers to the acidity or alkalinity of a soil, expressed in pH values for a stated soil-solution mixture. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential refers to the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils can damage building foundations, roads, and other structures. Soils that have a *high* shrink-swell potential are the most hazardous. Shrink-swell potential is not indicated for organic soils or certain soils that shrink markedly on drying but do not swell quickly when rewetted.

Engineering interpretations of soils

The estimated interpretations in table 6 are based on the

ing test data

of the American Association of State Highway and Transportation Officials (AASHTO)

Mechanical analyses ² - <i>Continued</i>						Liquid limit	Plasticity index	Classification	
Percentage passing sieve— <i>Continued</i>		Percentage smaller than—						AASHTO ³	Unified ⁴
No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
						<i>Pct</i>			
100	99	91	44	22	16	30	4	A-4(8)	ML
-----	100	96	70	50	48	67	45	A-7-6(27)	CH
-----	100	95	59	38	32	50	28	A-7-6(17)	CL
100	99	92	59	38	32	43	19	A-7-6(12)	CL
99	97	94	59	39	33	45	26	A-7-6(15)	CL
100	99	94	60	36	32	38	18	A-6(11)	CL
-----	100	97	68	44	39	52	28	A-7-6(18)	CH
-----	100	96	61	38	27	37	14	A-6(10)	CL
100	99	92	50	32	27	40	15	A-6(10)	CL
100	99	92	60	38	36	49	25	A-7-6(16)	CL
100	99	92	52	27	17	38	13	A-6(9)	ML
98	95	88	42	22	20	35	12	A-6(9)	CL
100	99	93	50	27	20	36	10	A-4(8)	ML
100	99	96	49	23	20	33	10	A-4(8)	CL

In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

³ Based on AASHTO Designation M 145-49 (1).

⁴ Based on the Unified soil classification system (2).

engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of York County. In table 6, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage of cropland and pasture, irrigation, pond reservoir areas, embankments, and terraces and diversions. For these particular uses, table 6 lists those soil features that should not be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally are favorable for the rated use, or in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special design, or intensive maintenance.

Soil suitability is rated by the terms good, fair, and poor, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 6:

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and also the risk of erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those properties that

affect the pond floor are permeability, organic-matter content, and slope; and, if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified soil classification, and the amount of stones, if any, that influence ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slope, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 6, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks. Onsite investigation is required for determining load-supporting capacity.

Sanitary landfill is a method of disposing of refuse in dug trenches. Waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, the hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 6 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid for deeper trenches. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but every site should be investigated before it is selected.

Local roads and streets, as rated in table 6, have an all-weather surface that is expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope and wetness of the soil affect ease of excavation and the amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate

drainage and (2) the relative ease of excavating the material at borrow areas.

Only a few areas have sand and gravel that are commercially available in York County. These areas are mainly along the West Fork Little Blue River and Lincoln Creek. Coarse-grained material for aggregate and road surfacing is mostly imported from operational sand pumping sites near the Platte River.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material. In York County, however, bedrock does not occur near the surface.

Embankments, dikes, and levees require soil material that is resistant to seepage and piping and that has favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil is an unfavorable factor.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence the rate of water movement; depth to water table; slope and stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; texture; content of stones; accumulation of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and of fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage or depth to water table or bedrock.⁸

Terraces and diversions are embankments or ridges constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Engineering test data

Table 7 contains engineering test data for some of the major soil series in York County. Tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. The mechanical analyses were made by combined sieve and hydrometer methods.

⁸ Further information on soil use for irrigation is contained in "Irrigation Guide for Nebraska." Soil Conservation Service, 1971.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with an increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material as has been explained for table 5.

Specific gravity is the ratio of the unit weight of the soil solids to the unit weight of water. It is a measure of, and a means of expressing, the heaviness of soil. The specific gravity of the solid particles of a soil, exclusive of the void spaces, is also called the "true" or "real" specific gravity. This property has an important influence on the density of the soil.

Formation and Classification of the Soils

This section discusses the major factors of soil formation as they have existed in York County and provides the classification of the soils of the county according to the system currently used by the National Cooperative Soil Survey.

Factors of Soil Formation

The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and bring about the development of genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme instances, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. Generally, a long time is needed 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 development are unknown.

Parent material

York County soils developed in two kinds of parent material—loess (fig. 17) and alluvium. They are of Pleistocene or Recent age (3).

Peoria Loess is the most extensive parent material in the county. It is light-gray or pale-brown, wind-deposited, silty material. It mantles most of the uplands in the county. Thickness of this material is more than 40 feet in the northwestern part of the county, but it decreases to less

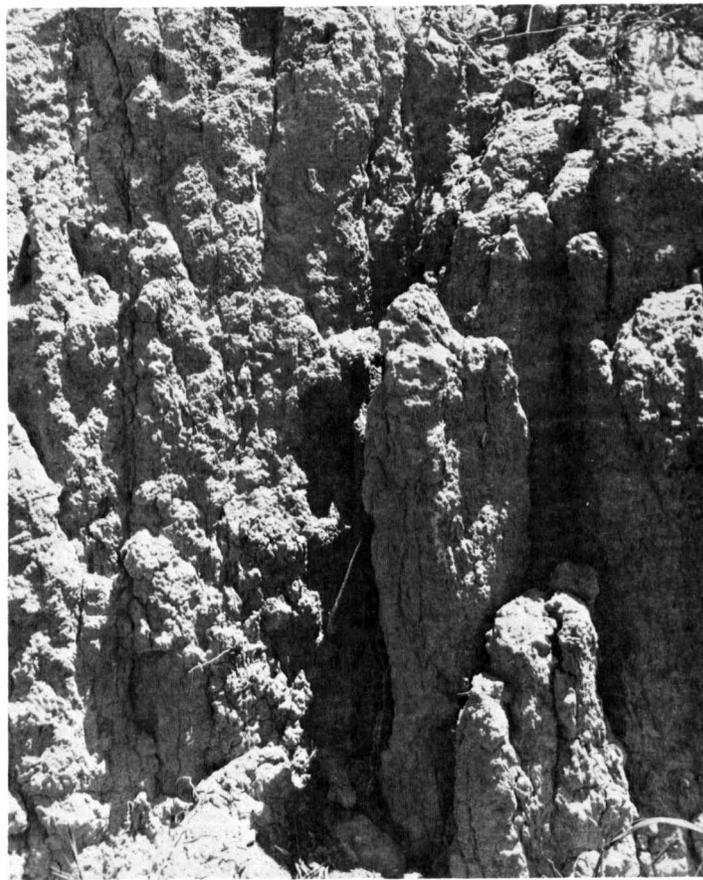


Figure 17.—Peoria Loess in a road cut. This is the most common parent material of the soils in York County.

than 20 feet in the southeastern part (4). Soils that formed in Peoria Loess are in the Hastings, Holder, Butler, Fillmore, and Scott series.

Loveland Loess is a wind-deposited sediment beneath Peoria Loess on the lower side slopes on uplands. It has a stronger brown or more reddish color than Peoria Loess and is not so silty. Loveland Loess is more variable in texture than Peoria Loess, ranging from clay loam to sandy loam. Silty clay loam is the more common texture. Small pockets of gravel are common in some areas of Loveland Loess.

Beneath the Loveland Formation are sandy areas of the Beaver Creek Formation. No soils formed in material of the Beaver Creek Formation in York County.

Alluvium covers nearly all of the bottom lands and stream terraces along flowing streams and their major tributaries. The largest areas are along the Blue River, Beaver Creek, and Lincoln Creek. Much of the alluvium is medium textured, and a few sandy areas are near streambeds. Soils that formed in alluvium are Hobbs, Hord, and Hall soils on stream terraces.

Colluvium is parent material that formed on foot slopes as a result of the forces of gravity and moving water. It generally is mixed with alluvium. Areas of colluvium generally are narrow and small. A part of the material in Hobbs soils is colluvial in origin.

Climate

Weathering and reworking of parent material are affected by rainfall, temperature, humidity, and wind. Moving surface water from rains often shifts, reworks, and deposits soil material over a long period of time. Leaching of plant nutrients and fine-textured soil particles to lower levels in the soil profile is a contributing factor in soil formation. In nearly level soils, for example, lime is leached to a depth of more than 60 inches in many places.

Temperature changes marked by alternate freezing and thawing are important in disintegration and loosening of soil material. The number of frost-free days per year is 161. Wetting and drying are also important factors. Chemical action and the speed with which it takes place are affected by temperature. Production and decomposition of organic matter are influenced by temperature.

Wind has carried and deposited the loess that is the parent material for most of the soils in York County. It also affects transpiration from plants and evaporation from open-water areas, damages growing plants, and drifts snow when it falls.

York County has warm to hot summers and cold winters. The climate is reasonably uniform throughout the county. Autumn and spring are pleasant. They have mild temperatures and varied amounts of moisture.

Plant and animal life

The native plants of York County consisted mainly of tall, mid, and short native grasses and forbs. Trees grew along the flowing streams but were not as important in soil formation as the grasses. Aquatic vegetation grew in the nearly level basins that are scattered throughout the uplands. All of these plants supplied an abundance of organic matter that affected the chemical and physical properties of the soil. These conditions produced a thick, dark, friable, and fertile surface layer in most soils in York County.

The fibrous roots of the native grasses bring up moisture and nutrients from below. When the plants die and decay, the surface layer is enriched by the organic matter and granulation is stimulated. Root channels leave the soil more porous or loose. Legumes remove nitrogen from the air and, in conjunction with soil bacteria, make it available to plants. Grasses that cover the soil reduce erosion and increase the intake of water. Fungi, algae, and bacteria are other plants that aid in soil formation.

Animal life, such as nematodes, protozoa, and millipedes, transform organic matter to stable humus that releases plant nutrients. Micro-organisms and earthworms help to change organic matter to a form available to themselves and plants. Earthworms digest organic matter and mix it with soil particles. Burrowing animals, such as gophers, moles, and badgers, mix soil material and provide more openings for air and water to enter and move through the soil.

Man's activities have an important effect on soils, mainly by causing accelerated erosion. Less obvious are changes brought about by additions of fertilizer and organic matter, drainage of the soil, the kinds of crops that are grown, irrigation, and compaction of the soil.

Relief

Relief, or lay of the land, is a major factor affecting soil formation. Relief affects runoff, drainage, and water erosion. Degree of slope, shape of the surface, intake

rate, and permeability all work together to determine runoff, internal drainage, and the moisture available in the soil.

Soils in depressions are poorly drained and receive runoff from higher elevations. They are characterized by a strongly developed, clayey subsoil, as in the Fillmore soils. Runoff from depressional soils is very slow or ponded.

Nearly level soils, such as some soils in the Crete series, have a thicker, darker colored surface layer and a thicker subsoil than soils that have steeper slopes. Much of the rain that falls soaks in. This increases plant growth, biological activity, and, consequently, soil development.

Very gently sloping to gently sloping soils are common in York County. Runoff is slow to medium, depending on the amount of vegetation on the surface and the soil texture. Some soils in the Hastings and Holder series are in this group.

Steep slopes generally have rapid runoff. Most of the rain that falls runs off rather than soaks in. Consequently, less moisture is available for soil formation on steep slopes than on the flatter slopes that have the same parent material. Less moisture is also available for plant and biological activity in the soil. Lime is not leached so deep in steep soils as in soils that have lesser slopes, because much of the moisture runs off rather than through the soil. Uly soils are in this group.

Time

Time is required for all soil formation. The amount of time required depends on the kind of parent material, relief, plants and animals present, the climate of the area, and the characteristics of the soil being formed.

The soils in York County range from immature or young soils that have little horizon development to mature soils that have a thick profile and definite horizons. The youngest soils in York County formed in recently deposited alluvium or colluvium. They are the least developed of the major soils. Hobbs soils are examples of these young soils.

Soils on stream terraces are not so young as those on bottom lands, although they may have formed in a similar kind of parent material. Hord soils are examples of soils on stream terraces. They have a thick surface layer and a weakly formed subsoil.

The oldest soils mainly are on uplands. They have been in place long enough to develop a genetic subsoil horizon. The subsoil generally is finer textured than the parent material. Hastings, Holder, and Fillmore soils are examples of mature soils on uplands.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils of specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and

woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (8). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (5).

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. The same property or subdivision of this property can be used in several different categories. In table 8, the soil series of York County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. Three exceptions to this, the Entisols, Histosols, and Vertisols, occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Moll-i-sol).

SUBORDER: Each order is subdivided into suborders using those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders are more narrowly defined than the orders. The soil properties used to separate suborders mainly are those that reflect either the presence or absence of a water table at a shallow depth; soil climate; the accumulation of clay, iron, or organic carbon in the upper solum; cracking of soils caused by a decrease in soil moisture; and fine stratification. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquoll* (Aqu, meaning water or wet, and *oll*, Mollisol).

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of soil horizons and features. The horizons used to make separations are those in which clay, carbonates, and other constituents have accumulated or have been removed; and

those that have pans that interfere with growth of roots, movement of water, or both. Some features used are soil acidity, soil climate, soil composition, and soil color. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquoll (*Hapl*, meaning simple horizons, *aqu* for wetness or water, and *oll*, from Mollisols).

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and one or more properties of another great group, suborder, or order. Other subgroups may have soil properties unlike those of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplaquolls (a typical Haplaquoll).

FAMILY: Subgroups are separated into soil families primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, soil depth, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 8). An example is the fine-silty, mixed, mesic family of Typic Haplustolls.

Physical and Chemical Properties

Much data on physical and chemical properties of soils can be obtained by analysis of the soils in a laboratory. This information is useful to soil scientists in classifying soils and in developing concepts of soil genesis. It is also helpful in estimating available water capacity, susceptibility to soil blowing, fertility, tilth, and other factors important to soil management.

Useful data on soil series that are in York County, but that were sampled in nearby counties, are recorded in Soil Survey Investigations Report Number 5 (9). In this group are the Crete, Hall, Hastings, and Hord series. Also, data on the Crete series are published in the Soil Survey of Gage County, Nebraska, and data on the Hall soils are published in the Soil Survey of Hall County, Nebraska.

TABLE 8.—Classification of soil series ¹

Series	Family	Subgroup	Order
Butler -----	Fine, montmorillonitic, mesic -----	Abruptic Argiaquolls -----	Mollisols.
Crete -----	Fine, montmorillonitic, mesic -----	Pachic Argiustolls -----	Mollisols.
Fillmore -----	Fine, montmorillonitic, mesic -----	Typic Argialbolls -----	Mollisols.
Geary ² -----	Fine-silty, mixed, mesic -----	Udic Argiustolls -----	Mollisols.
Hall -----	Fine-silty, mixed, mesic -----	Pachic Argiustolls -----	Mollisols.
Hastings -----	Fine, montmorillonitic, mesic -----	Udic Argiustolls -----	Mollisols.
Hobbs -----	Fine-silty, mixed, nonacid, mesic -----	Mollic Ustifluvents -----	Entisols.
Holder -----	Fine-silty, mixed, mesic -----	Udic Argiustolls -----	Mollisols.
Hord -----	Fine-silty, mixed, mesic -----	Pachic Haplustolls -----	Mollisols.
Scott -----	Fine, montmorillonitic, mesic -----	Typic Argialbolls -----	Mollisols.
Uly ² -----	Fine-silty, mixed, mesic -----	Typic Haplustolls -----	Mollisols.

¹ Classification as of January 1974.

² In York County, Geary and Uly soils are taxadjuncts to the series. Geary soils have a surface layer that is thinner than defined in the range for the series. Uly soils have lime at a greater depth than defined in the range for the series.

General Nature of the County

This section provides information about the settlement and organization of York County. In addition, it discusses the geology, relief and drainage, climate, water supply, and natural vegetation of the county. This section also gives significant facts about cultural and industrial features of the survey area and about trends in the use of the soils.

Settlement and Organization

Prior to the coming of the white man, York County was covered with a luxuriant growth of native grasses and forbs and had narrow strips of trees along the larger streams. In 1861, the Nebraska City Cut Off of the Oregon Trail was established and crossed the area now included in York County. During the next few years, temporary ranches and relay stations for the overland stagecoach were established along this road. Because of the demand for food and supplies by emigrants enroute to western points, ranchers started to grow corn, potatoes, and garden vegetables. The farming potential of the land soon became apparent.

The first permanent settlement in York County was in the southeastern corner of the county on the West Fork Big Blue River in 1865. It was followed by additional settlements along streams where food and water were plentiful. Settlement in the uplands was slow.

In 1877 the first railroad reached York. During the following few years, the land was rapidly homesteaded.

York County originally was attached to Seward County for judicial, revenue, and election purposes. Then, in 1870, it was organized as a separate unit.

Geology

York County is underlain to a depth of 110 to 450 feet by unconsolidated deposits of Quaternary age (3). These deposits consist of sediment laid down by wind, water, and glacial ice. Loess, which is wind-deposited silt and loamy material, forms virtually all the upland surface and the side slopes of upland drainageways. Depressions and drainageways on uplands are floored with waterlaid deposits derived from adjacent loess. In parts of their course through York County, Lincoln and Beaver Creeks and West Fork Big Blue River have cut their valleys through the loess mantle and into underlying coarser textured stream deposits. Stream terrace deposits and alluvium in these valleys were derived in part from loess and in part from deposits of sand and sandy gravel that were exposed as the valleys were cut.

Relief and Drainage

York County is on an upland loess plain that has a downward slope of about 8 feet per mile to the east. The highest point, 5½ miles south of the northwestern corner of the county, has an altitude of 1,783 feet; and the lowest point, where the West Fork Big Blue River flows out of the county, has an altitude of 1,462 feet. Bottom lands in the main stream valleys are between 50 and 120 feet lower than the average level of the upland plain. Valley sides have gentle to steep slopes and range from ¼ mile to 1 mile

in width. Uplands between valleys are broad and are nearly level to very gently sloping. They are dotted with shallow depressions, of which many are marshy and some contain ponded water in most seasons. Precipitation that is not absorbed by the soil or retained in depressions in the uplands runs off very slowly to drainageways.

The West Fork Big Blue River, which has the largest discharge of streams in the county, drains most of the southern part of the county. Beaver Creek, which empties into the West Fork about 4 miles east of York County, drains the central part of the county. The third main stream, Lincoln Creek, drains most of the northern part. The extreme northwestern part of the county is drained by the North Fork Big Blue River and the extreme southeastern part is drained by Indian Creek.

Climate⁹

The climate of York County is continental, with cold winters and hot summers. Changes in weather conditions are frequent and extreme. The county is fully exposed to the north and south. Persistent winds that have an easterly component are likely to develop low clouds, fog, and precipitation. When westerly winds are dominant, rainfall is infrequent and of short duration. Most of the precipitation that falls in York County originates in the Gulf of Mexico and the Caribbean Sea and is carried northward on the west side of the Bermuda High. The Rocky Mountains have a pronounced warming and drying effect on the air that reaches this region from the west.

Normally, more than three-fourths of the average annual precipitation falls during the growing season, April through September. Temperature and precipitation data are shown in table 9. Deviations from the average precipitation, which is 27.5 inches, are large. In 84 years of record, the driest year, 1894, had only 14.93 inches of precipitation, compared to 39.33 inches received in 1908, the wettest year. This variability in precipitation and an ample supply of ground water have led to widespread use of irrigation.

In winter, precipitation generally is light; most of it falls as snow. However, periods of rain or freezing rain are not unusual. Slow steady rains characterize the early spring precipitation. Nearly all of the summer precipitation occurs as showers or thunderstorms. In fall, thunderstorm activity usually decreases rapidly.

Sharp temperature changes are frequent during winter. They are less frequent in summer, but days of high temperatures are often interspersed with days of cooler ones. However, successive days with high temperatures in the nineties are not unusual.

Temperature records began at York in 1894. The highest temperature recorded there was 114°F on July 25, 1940, and on July 17 and 25, 1936. The lowest reading was 31° below zero recorded on February 13, 1905.

The average date of the last 32° air temperature in spring is May 1. The average date of the first 32° air temperature in fall is October 10.

Probabilities of the last freezing temperatures in spring and the first in fall are given in table 10.

⁹ Furnished by Climatology Office, Conservation and Survey Division, University of Nebraska.

TABLE 9.—*Temperature and precipitation data*
[All data from York County]

Month	Temperature				Precipitation				
	Average daily maximum ¹	Average daily minimum ¹	Two years in 10 will have at least 4 days with—		Average monthly total ¹	One year in 10 will have—		Days with 1 inch or more snow cover ¹	Average depth of snow on days with snow cover ¹
			Maximum temperature equal to or higher than— ²	Minimum temperature equal to or lower than— ²		Equal to or less than— ³	Equal to or more than— ³		
	° F	° F	° F	° F	In	In	In		In
January ---	34	12	53	-8	0.6	0.1	1.4	14	6
February --	40	18	61	-3	1.0	.2	1.7	10	6
March ----	48	26	70	7	1.3	.2	2.8	7	6
April -----	64	39	83	25	2.7	.8	4.8	(⁴)	2
May -----	74	50	89	36	3.8	1.5	6.6	0	0
June -----	84	60	97	49	5.1	1.5	7.7	0	0
July -----	89	65	101	55	3.9	1.1	6.1	0	0
August ----	88	64	99	54	3.2	1.4	5.5	0	0
September -	79	53	96	39	2.7	.8	5.0	0	0
October ----	68	42	85	28	1.5	.2	3.3	(⁴)	3
November --	51	28	70	12	.9	(⁵)	2.8	2	3
December --	39	18	58	-3	.8	.1	1.6	8	6
Year --	63	40	104 ⁶	-15 ⁷	27.5	19.2	35.3	41	5

¹ Data based on period 1943-72.

² Data based on period 1948-63.

³ Data based on period 1884-1972.

⁴ Less than one-half day.

⁵ Trace.

⁶ Average annual highest temperature.

⁷ Average annual lowest temperature.

TABLE 10.—*Probability of last freezing temperatures in spring and first in fall*

[All freeze data are based on temperatures which are measured in a standard National Weather Service thermometer shelter; the thermometers are placed approximately 5 feet above the ground; the exposure is believed to be representative of the surrounding area. Lower temperatures will exist at times nearer the ground and in local areas subject to extreme air drainage on calm nights]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than -----	April 6	April 13	April 20	May 4	May 17
2 years in 10 later than -----	March 31	April 7	April 15	April 28	May 11
5 years in 10 later than -----	March 21	March 28	April 4	April 17	May 1
Fall:					
1 year in 10 earlier than -----	September 23	October 7	October 16	October 21	November 1
2 years in 10 earlier than -----	September 29	October 12	October 21	October 26	November 6
5 years in 10 earlier than -----	October 10	October 22	October 31	November 6	November 15

Annual free-water evaporation from small lakes and farm ponds averages 46 inches, and about 77 percent of that amount occurs from May through October.

The heaviest rainfall on record at York fell during the night of July 8-9, 1950, when a total of 13.15 inches fell in 9 hours. A storm of this size is estimated to occur in York County only once in more than 500 years.

Water Supply

Water for farming and other uses is obtained mainly from precipitation and from underground sources. Only a small amount of water enters the county as streamflow. Although precipitation during the growing season of some years is timely, well distributed, and sufficient for crop production, yields almost always are greater if supple-

mental water is applied when soil moisture becomes deficient.

Use of ground water for irrigation has increased many-fold since World War II. The number of irrigation wells in 1945 was about 60, but by 1973 it had grown to about 1,830. In 1973, irrigated cropland totaled nearly 139,000 acres, and the pumpage amounted to about 245,000 acre-feet. Withdrawals have caused a lowering of the water table, most noticeably in the northern and western parts of the county. Sufficient water for rural domestic and livestock use can be obtained in all parts of the county; except for small areas in the southwestern and eastern parts, the water-bearing sediments are capable of yielding sufficient water for irrigation. Depth to water ranges from about 15 to 40 feet below valley lands and 70 to 120 feet below the upland plain.

Runoff from precipitation and irrigation accumulates in natural depressions on the uplands and collects behind small dams in minor drainageways and in dugouts. The water is used for livestock supply, irrigation, and recreation. It also attracts wildlife.

Natural Vegetation

Only a small acreage of natural vegetation remains in York County. Trees are common along channels of Big Blue River, West Fork Big Blue River, and the major creeks in the county. American Elms were common until the Dutch Elm disease moved into the county. The acreage of native grass continues to decrease. The only areas still in grass mainly are those that are too steep or too frequently flooded for economical growth of cultivated crops. Natural vegetation, mainly coarse-textured plants such as reed-grass, rushes, tall sedges, and cattails, occurs in some of the depressions in the uplands where water accumulates as runoff from higher adjacent areas.

Transportation

Interstate 80 crosses York County from east to west at a point about 3 miles south of York. U.S. Highway 81 crosses the center of the county from north to south. U.S. Highway 34 crosses the county from east to west in the center of the county. Numerous local roads connect several towns to larger highways. Most section lines have gravelled and graded roads. Only a few are of dirt construction, are blacktopped, or lack a motor road. Roads from the main highways to Gresham and Luston have been blacktopped.

The Burlington-Northern Railroad crosses near the center of the county in an east-west direction. It serves the towns of Bradshaw, York, and Waco. Rail spurs extend from Benedict and McCool Junction to the main line at York.

Rural mail routes reach all parts of the county. Limited air facilities are available at York, and full service is available within a distance of 50 miles of York. Bus service is available in York, Waco, and Bradshaw. Rail freight service is available in York and most of the small towns in the county. Much of the hauling of freight, grain, and livestock in York County is by trucks.

Cultural Facilities

York County has a well-developed, consolidated school system from kindergarten through the second year of college. There presently are seven school districts in the county. High schools and elementary schools are located in York, Benedict, Bradshaw, Gresham, Henderson, and McCool Junction. York Junior College is a two-year liberal arts college.

York has a population of more than 7,000 and is the county seat. It supports such community facilities as a hospital, library, home for senior citizens, swimming pool, golf course, community recreation center, parks, indoor and drive-in movie theaters, and many churches.

Manufacturing and Industry

York County has a variety of small industries and manufacturing plants, most of which are in York and Hender-

son. The most important industries are related to farming and include two livestock slaughtering plants and a nursery where experiments are performed with corn and sorghum varieties. Industrial plants manufacture irrigation equipment, grain bins, mobile homes, clothing, and electronic equipment. A foundry has been manufacturing various metal products since the late 1800's.

Several gravel pits are along the West Fork Big Blue River, along Lincoln Creek, and in other locations in the county.

Trends in Soil Use

The largest recent change in soil use in York County has been the increase in the number of irrigated acres. The acreage of irrigated land increased from 97,000 in 1960 to 118,400 in 1965 and then to 157,100 in 1971. According to the Nebraska Agricultural Statistics, there were 1,078 registered irrigation wells in 1960. By 1965, 1,215 wells were registered, and in 1971, this has increased to 1,665. The number of sprinkler systems has increased greatly since 1969.

Corn, grain sorghum, and winter wheat are the main crops. The acreage of corn grown in the county has fluctuated over the past 10 years. In 1960, 165,270 acres was grown; by 1965 the amount had decreased to 80,230 acres; and by 1969 it had increased to 128,220 acres. Grain sorghum also shows a fluctuation in the number of acres grown over the past 10 years. In 1960, 35,590 acres was grown; by 1965 the amount had increased to 79,940 acres; and by 1969 it had decreased to 46,980 acres.

There has been a downward trend in the number of acres of winter wheat planted. In 1960, 53,240 acres was planted, and the acreage decreased gradually to 34,000 acres in 1971. The acreage of alfalfa hay harvested has fluctuated in the past 10 years. In 1960, 14,000 acres was harvested; by 1965 the harvest had increased to 15,460 acres; and by 1969 it had decreased to 13,700 acres. Other crops harvested in smaller acreage are oats, rye, barley, and native hay.

The number of cattle on farms increased from more than 5 million in 1960 to more than 6 million in 1970. The number of swine on farms increased from 2,502,000 in 1960 to 2,839,000 in 1970. New breeds of cattle are being imported to help improve the local beef industry.

The number of farms in the county decreased gradually from 1,360 in 1963 to 1,170 in 1970. The general trend is toward larger farms that use larger machinery to farm more acres at a faster rate. The average-sized farm in 1969 was 305 acres. In 1969, 382 farms were operated by full owners, 454 were operated by part owners, and 307, or 26.8 percent of the farms, were operated by tenants.

Machines are used for much of the work formerly done by hand. New ideas are accepted more readily than in the past. The price of farmland more than tripled from the early 1950's to the early 1970's.

Literature Cited

- (1) American Association of State Highway [and Transportation] Officials. 1955. Standard specifications for highway materials and methods of sampling and testing. Ed. 7, 2 vol., illus.
- (2) American Society for Testing Materials. 1974. Standard method for classification of soils for engineering purposes. ASTM Stand. D2487.

- In 1974 Annual Book of ASTM Standards, Part 19.
- (3) Condra, E. E., and Reed, E. C. 1959. The geological section of Nebraska. Nebr. Geo. Surv. Bull. 14A. Univ. of Nebr. Conserv. and Surv. Div. 82 pp., illus.
 - (4) Kollmorgen, H. L. 1963. Isopachus map and study on thickness of Peoria Loess in Nebraska. Soil Sci. Soc. of Amer. Proc. Vol. 27, no. 4, pp. 445-448.
 - (5) Simonson, Roy W. 1962. Soil classification in the United States. Sci. 137: 1027-1034.
 - (6) United States Department of Agriculture. 1928. Soil survey of York County. Bur. of Chem. and Soils in coop. with Univ. of Nebr. State Soil Survey. 37 pp.
 - (7) ———. 1951. Soil survey manual. U.S. Dep. Agric. Handb. No. 18, 503 pp., illus. [Supplement issued in May 1962]
 - (8) ———. 1960. Soil classification, a comprehensive system. 7th approximation. 265 pp., illus. [Supplements issued in March 1967 and September 1968]
 - (9) ———. 1966. Soil survey laboratory data and descriptions for some soils of Nebraska. Soil Surv. Invest. Rep. No. 5, 233 pp.

Glossary

- Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.
- Available water capacity** (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
- Bottom land.** The normal flood plain of a stream, part of which may be flooded frequently.
- Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
- 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.
- Claypan.** A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.
- Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- 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 and brittle; little affected by moistening.
- Drainage class** (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.
- Excessively drained* soils are commonly very porous and rapidly permeable and have a low available water capacity.
- Somewhat excessively drained* soils are also very permeable and are free from mottling throughout their profile.
- Well-drained* soils are nearly free from mottling and are commonly of intermediate texture.
- Moderately well drained* soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.
- Somewhat poorly drained* soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.
- Poorly drained* soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.
- Very poorly drained* soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.
- 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 wind (sandblast), running water, and other geological agents.
- Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:
- O horizon.*—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
- A horizon.*—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).
- B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.
- C horizon.*—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.
- R layer.*—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.
- Intake rate.** The average rate of water that enters the soil, under irrigation. Most soils have a faster initial rate which decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending upon the net irrigation application.
- Lime.** Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone-derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.
- Loess.** Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.
- Mulch.** A natural or artificially applied layer of plant residue or other material on the surface of the soil. Mulches are generally used to help conserve moisture, control temperature, prevent surface compaction or crusting, reduce runoff and erosion, improve soil structure, or control weeds. Common mulching materials are wood chips, plant residue, sawdust, and compost.
- Munsell notation.** A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.
- Parent material.** Disintegrated and partly weathered rock from which soil has formed.
- Permeability.** The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*
- Plow layer.** The soil ordinarily moved in tillage; equivalent to surface soil.
- Profile, soil.** A vertical section of the soil through all its horizons and extending into the parent material.
- Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction

because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

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

Runoff. The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of

the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

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 it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, a range site, or a windbreak suitability group, read the introduction to the section it is in for general information about its management.

Map symbol	Mapping unit	Page	Capability unit		Range site		Windbreak suitability group		
			Dryland	Irrigated	Name	Page			
Bu	Butler silt loam, 0 to 1 percent slopes-----	7	IIw-2	20	IIw-2	24	Clayey	30	2
Ce	Crete silt loam, 0 to 1 percent slopes-----	7	IIIs-2	20	IIIs-2	24	Clayey	30	4
CeB	Crete silt loam, 1 to 3 percent slopes-----	7	IIe-2	20	IIe-2	23	Clayey	30	4
Fm	Fillmore silt loam, 0 to 1 percent slopes-----	8	IIIw-2	21	IIIw-2	25	Clayey Over- flow	29	2
Fo	Fillmore silt loam, drained, 0 to 1 percent slopes-----	9	IIw-2	20	IIw-2	24	Clayey	30	4
GeC2	Geary silty clay loam, 3 to 6 percent slopes, eroded-----	9	IIIe-8	21	IIIe-3	25	Silty	29	4
GeD2	Geary silty clay loam, 6 to 11 percent slopes, eroded--	9	IVe-8	22	IVe-3	26	Silty	29	4
GhG	Geary-Hobbs silt loams, 11 to 30 percent slopes-----	9	VIe-1	22	----	--	----	--	--
	Geary soil-----	--	----	--	----	--	Silty	29	10
	Hobbs soil-----	--	----	--	----	--	Silty Over- flow	29	1
Ha	Hall silt loam, terrace, 0 to 1 percent slopes-----	10	I-1	19	I-4	23	Silty Low- land	29	1
Hs	Hastings silt loam, 0 to 1 percent slopes-----	11	I-1	19	I-4	23	Silty	29	4
HsB	Hastings silt loam, 1 to 3 percent slopes-----	11	IIe-1	20	IIe-4	23	Silty	29	4
HsC	Hastings silt loam, 3 to 6 percent slopes-----	12	IIIe-1	21	IIIe-4	25	Silty	29	4
HsD	Hastings silt loam, 6 to 11 percent slopes-----	12	IVe-1	21	IVe-4	26	Silty	29	4
HuC2	Hastings silty clay loam, 3 to 6 percent slopes, eroded-----	12	IIIe-8	21	IIIe-3	25	Silty	29	4
HuD2	Hastings silty clay loam, 6 to 11 percent slopes, eroded-----	13	IVe-8	22	IVe-3	26	Silty	29	4
Hv	Hobbs silt loam, 0 to 2 percent slopes-----	14	IIw-3	20	IIw-6	24	Silty Over- flow	29	1
Hw	Holder silt loam, 0 to 1 percent slopes-----	14	I-1	19	I-4	23	Silty	29	4
HwB	Holder silt loam, 1 to 3 percent slopes-----	15	IIe-1	20	IIe-4	23	Silty	29	4

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Range site		Windbreak suitability group		
			Dryland	Irrigated	Name	Page			
HwC	Holder silt loam, 3 to 6 percent slopes-----	15	IIIe-1	21	IIIe-4	25	Silty	29	4
Hx	Hord silt loam, terrace, 0 to 1 percent slopes-----	15	I-1	19	I-6	23	Silty Low-land	29	1
HxB	Hord silt loam, terrace, 1 to 3 percent slopes-----	15	IIE-1	20	IIE-6	24	Silty Low-land	29	1
HyC	Hord complex, 3 to 6 percent slopes-----	15	IIIe-1	21	IIIe-6	25	Silty	29	4
Ma	Marsh-----	16	VIIIw-7	23	----	--	----	--	10
Sc	Scott silt loam, 0 to 1 percent slopes-----	16	IVw-2	22	----	--	----	--	10
Sy	Silty alluvial land-----	16	VIw-7	22	----	--	Silty Over-flow	29	10
UhG	Uly-Hobbs silt loams, 11 to 30 percent slopes-----	18	VIe-1	22	----	--	----	--	--
	Uly soil-----	--	----	--	----	--	Silty	29	10
	Hobbs soil-----	--	----	--	----	--	Silty Over-flow	29	1

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.