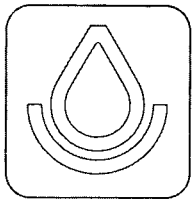
SOIL SURVEY OF

Hopkins and Rains Counties, Texas



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

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 1963 to 1971. Soil names and descriptions were approved in 1973. 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 Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Hopkins-Rains Soil and Water Conservation 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.

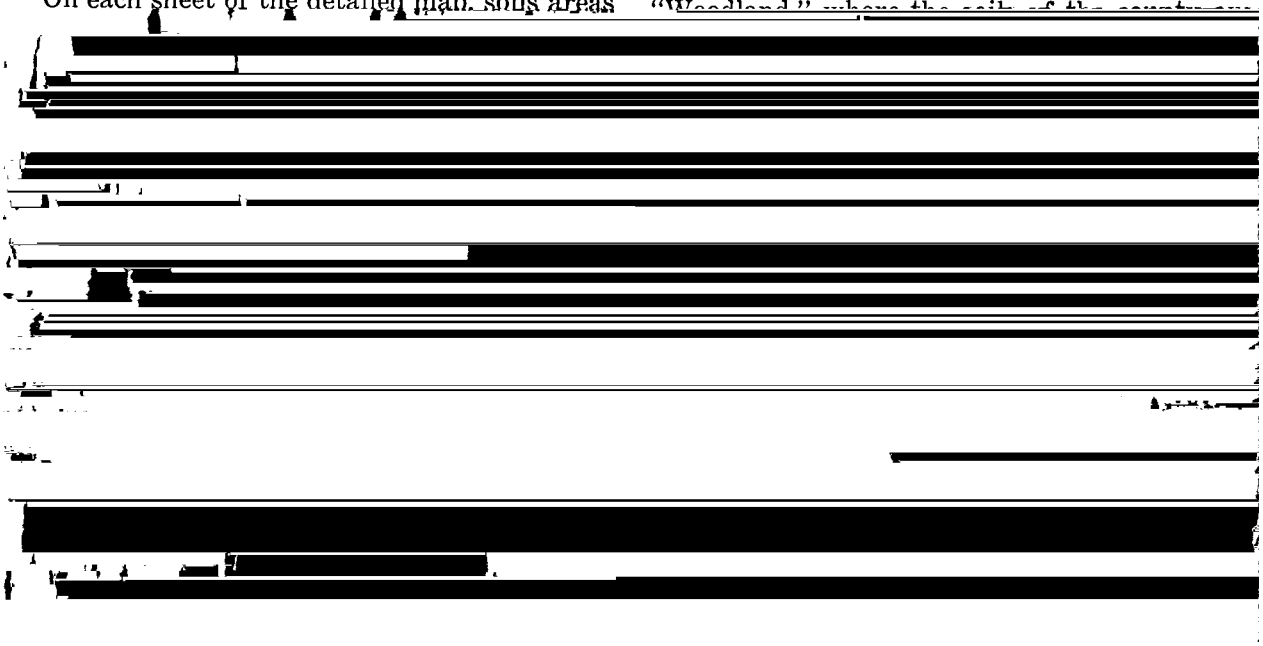
HOW TO USE THIS SOIL SURVEY

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

Locating Soils

All the soils of Hopkins and Rains Counties 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, soils areas



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, the range sites, and the pasture and hayland groups.

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.

Foresters and others can refer to the section "Woodland," where the soils of the county are

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SOIL SURVEY OF HOPKINS AND RAINS COUNTIES, TEXAS

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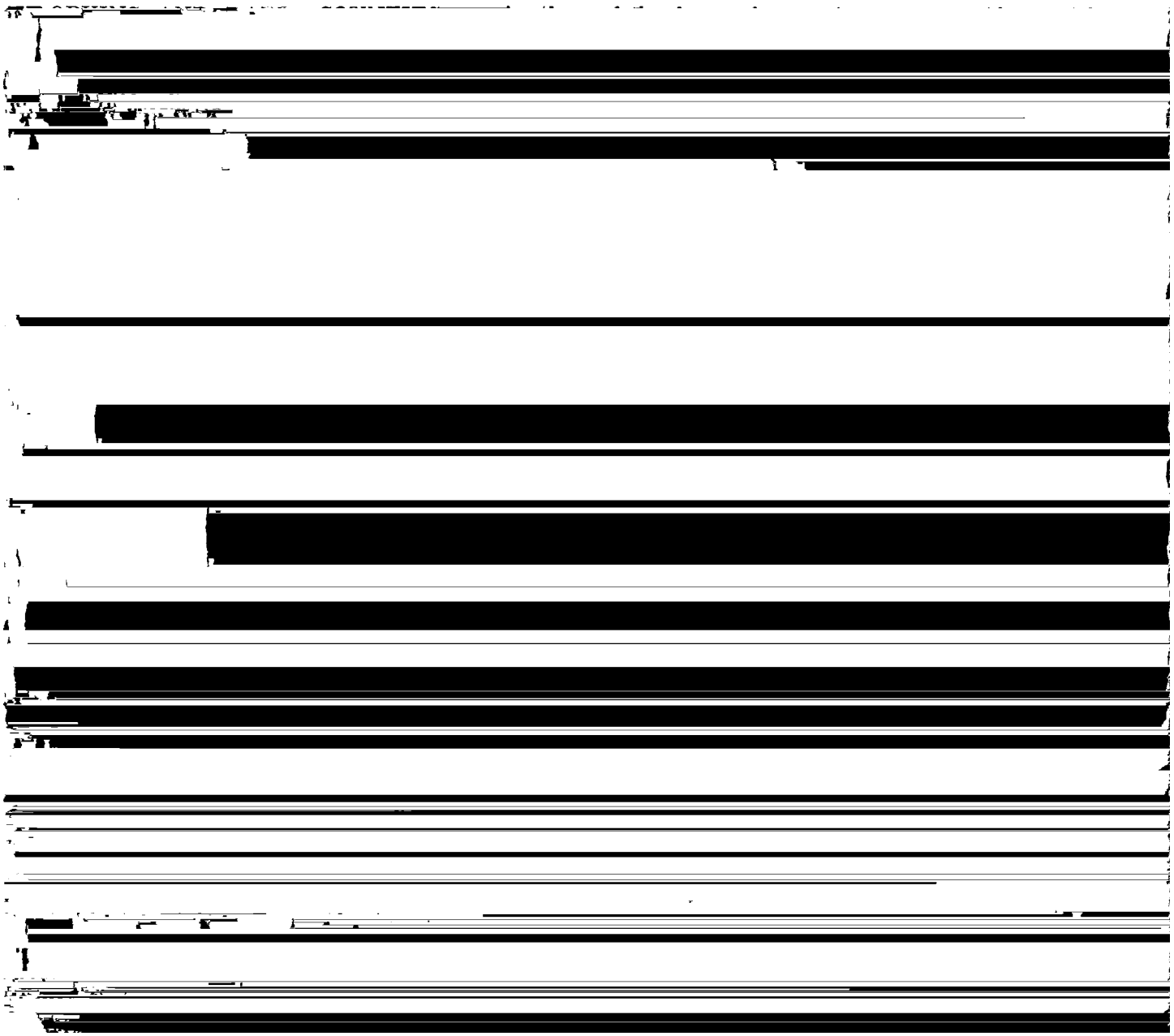


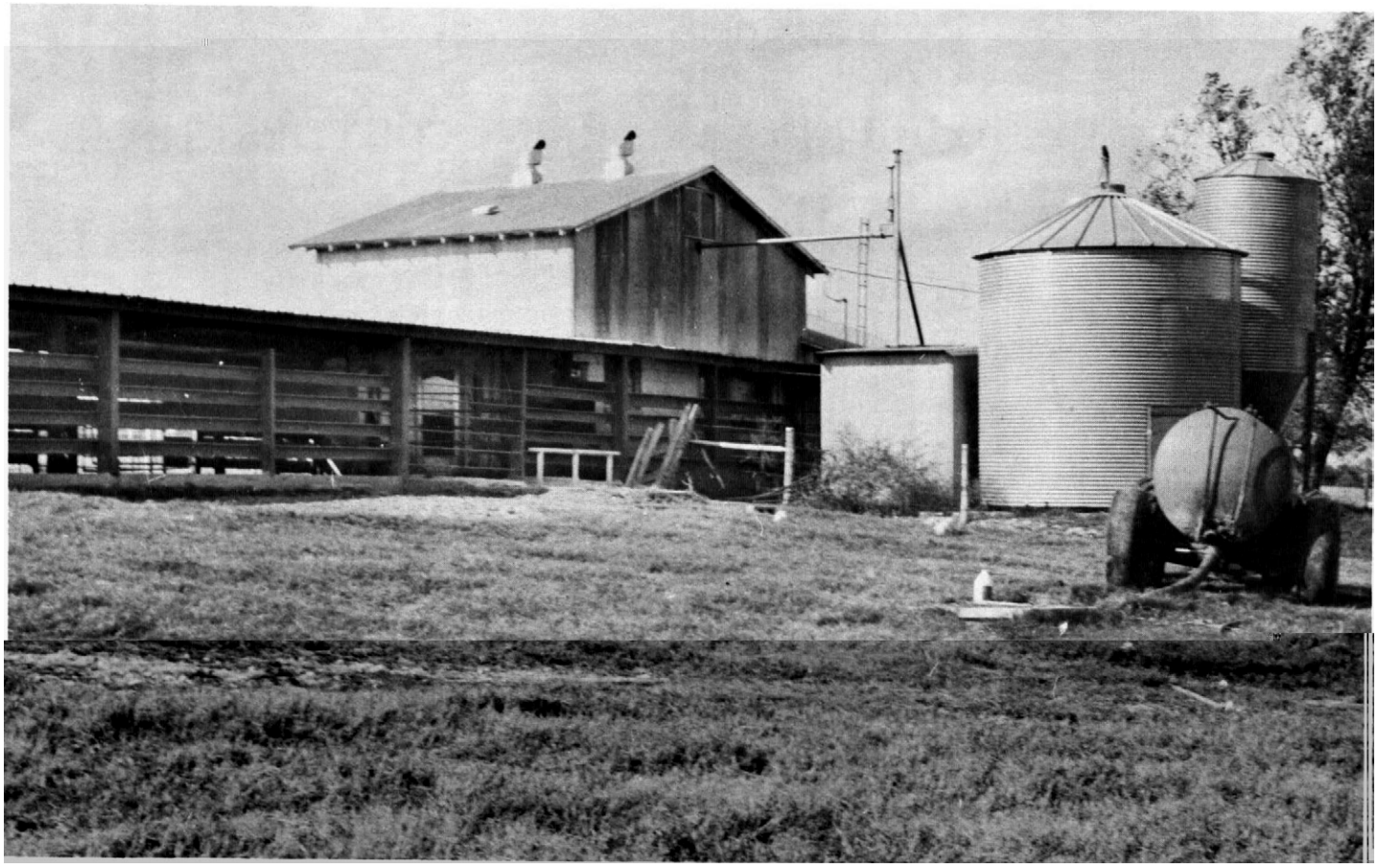


Figure 2.—**Dairy barn and grain storage tanks on Wolfpen loamy fine sandy soils.**

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 kind of soil. 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

For example, in the title of association 1, the word loamy refers to the texture of the surface layer.

1. Crockett Association

Deep, loamy, moderately well drained, very slowly permeable soils

This association consists of nearly level to gently sloping soils on uplands. These soils are in large, broad areas that make up about 35 percent of the survey area. Crockett soils make up about 75 percent of the association, and minor soils of the Nahatche, Wilson, Lufkin, and Woodtell series make up the remaining 25 percent.

The Crockett soils have a surface layer of dark grayish-brown loam about 9 inches thick. The subsoil is clay about 36 inches thick. The upper part of it is dark reddish brown, the middle part is dark grayish brown, and the lower part is light olive brown. The un-

loam that has brownish-yellow and reddish-yellow mottles.

Woodtell and Freestone soils are used mainly for pasture and hay. While many areas of these soils are in improved pasture, some are in oak forest, and a small percent are cultivated.

3. Wolfpen Association

Deep, sandy, well drained, moderately permeable soils

These soils are used mostly for pasture and hay (fig. 3). A few areas are used mainly to grow truck crops. A few small areas are in pine plantations. These soils also provide a source of sand for construction purposes.

4. Wilson-Bazette Association

Deep and moderately deep, loamy, somewhat poorly drained and well drained, very slowly permeable to slowly permeable soils

gray clay. It extends to a depth of 66 inches. The underlying material, to a depth of 82 inches, is gray and strong brown stratified shale and clay.

Bazette soils are gently sloping to strongly sloping. They are on narrow ridges and along sides of drainageways. The surface layer is very dark grayish-brown clay loam about 4 inches thick. The subsoil is clay about 24 inches thick. The upper part is light olive brown with yellowish-brown mottles, while the lower part is olive brown. The underlying material, to a depth of 60 inches, is layers of variegated gray, grayish-brown, and light olive-brown clay and shale.

Most areas of the Wilson soils were formerly cultivated. The trend of land use is now toward pasture and hay. The Bazette soils are mainly in oak timber areas.

5. Nahatche Association

Deep, loamy, somewhat

lumber. They also provide cover for white-tailed deer and squirrels.

7. Bernaldo-Kirvin Association

Deep, loamy, well-drained, moderately permeable to moderately slowly permeable soils

This association consists of gently sloping and sloping soils on uplands. They make up about 3 percent of the survey area. Bernaldo soils make up about 52 percent of the association; Kirvin soils, 19 percent; and minor soils, 29 percent. Minor soils include Nahatche, Freestone, Annona, Raino, and Woodtell.

Bernaldo soils are gently sloping. They are on ridges and interstream divides. These soils have a surface layer of fine sandy loam about 10 inches thick. The upper 3 inches is dark grayish brown, and the lower 7 inches is yellowish brown. The subsoil, to a depth of about 80 inches, is sandy clay loam. The upper part is

the profile of a given mapping unit is different from the one described for the series, these differences are either stated in describing the mapping unit or are apparent in the name of the mapping unit.

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 is the capability unit and pasture and hayland group in which the mapping unit has been placed. The page for each soil mapping unit and each capability unit, range site, pasture and hayland group, or other interpretative group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used

roots; common clay films; few pressure faces; few black concretions; very strongly acid; gradual, wavy boundary.

B23t—24 to 43 inches, yellowish-brown (10YR 5/8) clay; many, medium, distinct light-gray (10YR 7/1) and common, medium, distinct yellowish-red (5YR 5/6) mottles; moderate, medium, blocky structure; extremely hard, very firm; few roots; many clay films; common pressure faces; few black concretions; very strongly acid; gradual, wavy boundary.

B24t—43 to 54 inches, yellowish-brown (10YR 5/4) clay; common, medium, distinct light-gray (10YR 7/1) and few, fine, distinct reddish-yellow (7.5YR 6/6) mottles; moderate, medium, blocky structure; extremely hard, very firm; few roots; many clay films; common slickensides; few black concretions; strongly acid; gradual, wavy boundary.

B25t—54 to 68 inches, light yellowish-brown (10YR 6/4) clay; many, medium, faint, light brownish-gray (10YR 6/2) and common, medium, faint, yellowish-

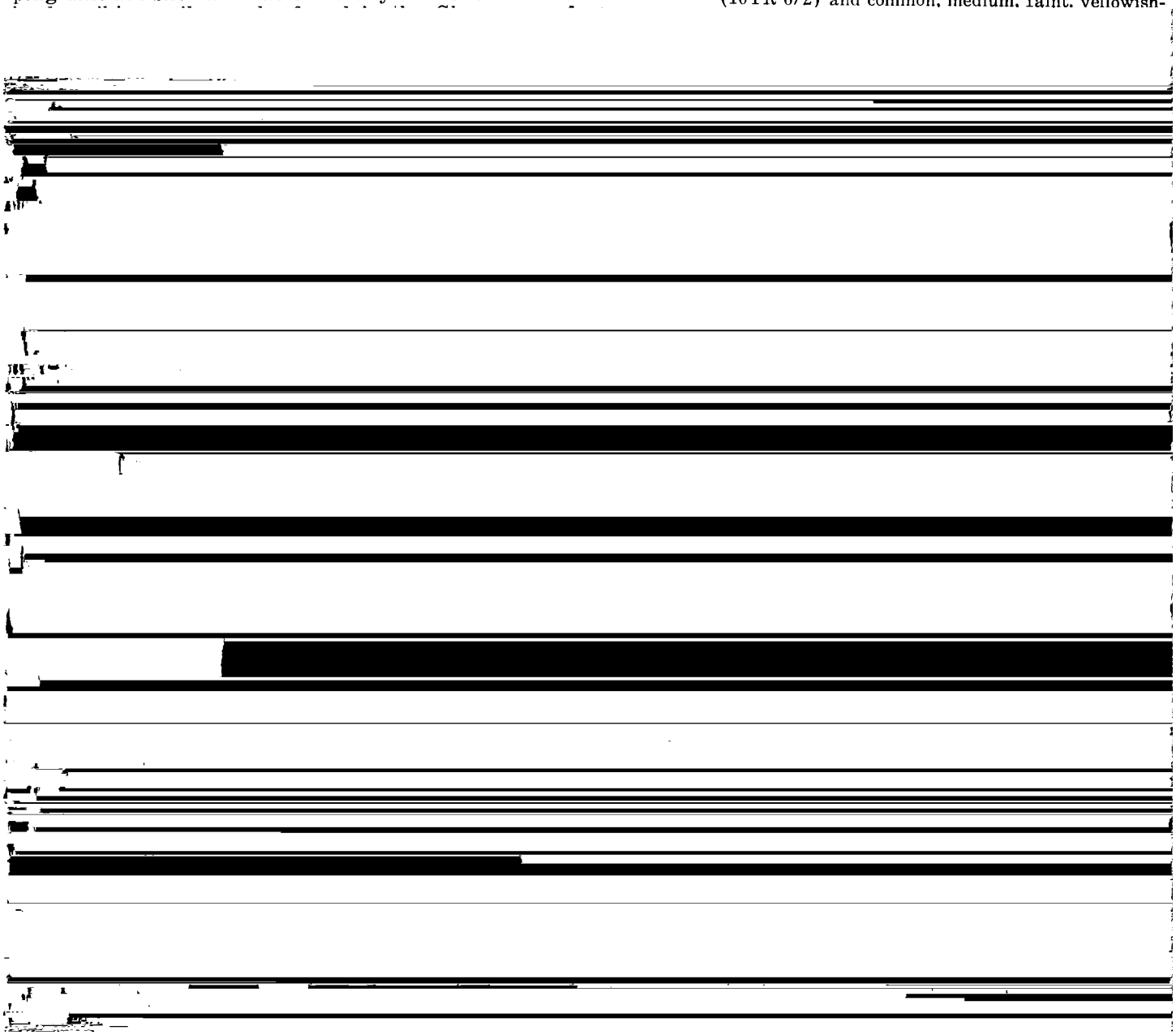


TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Hopkins County		Rains County		Survey Area	
	Acres	Percent	Acres	Percent	Acres	Percent
Annona-Raino complex	15,500	3.0	5,450	3.6	20,950	3.2
Bazette clay loam, 3 to 5 percent slopes	4,000	.8	380	.3	4,380	.7
Bazette clay loam, 5 to 12 percent slopes	9,100	1.8	1,300	.9	10,400	1.6
Bernaldo fine sandy loam, 1 to 3 percent slopes	11,200	2.2	1,550	1.0	12,750	2.0
Crockett loam, 0 to 1 percent slopes	9,400	1.9	600	.4	10,000	1.5
Crockett loam, 1 to 3 percent slopes	95,784	18.9	18,000	12.1	113,784	17.3
Crockett loam, 3 to 5 percent slopes	3,900	.8	200	.1	4,100	.6
Crockett loam, 2 to 5 percent slopes, eroded	44,900	8.9	5,000	3.3	49,900	7.6
Ellis clay, 5 to 12 percent slopes	2,800	.5	80	(1)	2,880	.5
Ferris clay, 5 to 12 percent slopes, eroded	4,400	.9	120	(1)	4,520	.7
Freestone fine sandy loam, 1 to 3 percent slopes	51,494	10.1	22,652	15.1	74,146	11.3
Gladewater clay	2,000	.4	11,250	7.5	13,250	2.0
Heiden clay, 3 to 5 percent slopes, eroded	700	.1	------	------	700	.1
Hopco silty clay loam	2,600	.5	------	------	2,600	.4
Kaufman clay	14,600	2.9	------	------	14,600	2.2
Kirvin gravelly fine sandy loam, 3 to 8 percent slopes	3,400	.7	------	------	3,400	.5
Kirvin soils, 3 to 8 percent slopes	500	.1	150	.1	650	.1
Leson clay, 1 to 3 percent slopes	3,000	.6	350	.2	3,350	.5
Leson clay, 3 to 5 percent slopes	4,100	.8	60	(1)	4,160	.6
Lufkin-Raino complex	15,500	3.0	6,480	4.3	21,980	3.3
Nahatche soils	75,024	14.8	16,400	10.9	91,424	13.9
Pickton loamy fine sand, 1 to 5 percent slopes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[redacted]

brown and yellow. The B3 horizon is 5 to 20 percent gray and yellow shale fragments. Soft masses, films, and concretions of calcium carbonate are in the lower part of the B3 horizon and in the C horizon of most of these soils.

The C horizon is massive and consists of gray, brown, and yellow clay, silty clay, and silty clay loam thinly bedded with shale. It is slightly acid to moderately alkaline.

BaC—Bazette clay loam, 3 to 5 percent slopes. This gently sloping soil occupies narrow ridges and is along sides of small drainageways. Mapped areas are about 20 to 75 acres in size.

The surface layer is dark grayish-brown clay loam about 5 inches thick. The subsoil is olive-brown clay about 24 inches thick. The next lower layer is light olive-brown clay. The underlying material is olive-brown, yellowish-brown, and gray layers of shale and clay. It contains a few calcium carbonate concretions and soft masses.

Runoff is rapid on this soil. The erosion hazard is very severe if the surface is bare and unprotected.

The vegetation on this soil consists of native and introduced grasses used mostly for pasture. About 50 percent of the total area is in oak trees that have an understory of native grasses.

In places adapted grasses and legumes are grown on this soil. Examples of these are bermudagrass, bahiagrass, lovegrass, vetch, crimson clover, and annual [redacted]

unconsolidated sediment under mixed oak and pine trees.

In a representative profile the surface layer is fine sandy loam about 10 inches thick. This layer is dark grayish brown in the upper 3 inches and yellowish brown in the lower 7 inches. The subsoil is sandy clay loam to a depth of 80 inches. The upper part of it is yellowish brown. The lower part is mottled and is red, yellowish brown, reddish yellow, gray, and red.

Bernaldo soils are well drained. Permeability is moderate and available water capacity is high. These soils are used mainly for pasture.

Representative profile of Bernaldo fine sandy loam, 1 to 3 percent slopes, 11.5 miles east of Sulphur Springs on Texas Highway 11, 2.6 miles south on county road, and 80 feet south of county road:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, very fine, subangular blocky structure; hard, very friable; many roots; slightly acid; clear, smooth boundary.

A2—3 to 10 inches, yellowish-brown (10YR 5/4) fine sandy loam; single grained; hard, very friable; many roots; few fine and medium pores; slightly acid; clear, smooth boundary.

B21t—10 to 16 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, fine, subangular blocky structure; [redacted]

zon is 5 to 15 percent uncoated sand and silt grains in the [redacted] few [redacted] openings in lower part of

[redacted]

of Crockett loam, 2 to 5 percent slopes, eroded, and small areas of Wilson soils. The eroded Crockett soil occupies the more sloping parts of the landscape. The Wilson soils are in low, wet spots. These inclusions make up less than 10 percent of the acreage.

Runoff is slow, and the erosion hazard is moderate

a depth of 60 inches, is layers of variegated gray and olive-yellow shale and clay loam.

Included with this soil in mapping are spots of Crockett loam, 1 to 3 percent slopes, on foot slopes or in small concave areas. These are 1 to 5 acres in size, and

grayish shale fragments in the lower part. The B and C horizons are 0 to 3 percent calcium carbonate concretions and masses.

The C horizon is clay and shale in shades of gray, olive, and yellow. Reaction in this material is neutral to moderately alkaline.

EsD—Ellis clay, 5 to 12 percent slopes. This sloping to strongly sloping soil is along sides of drainageways. Mapped areas are long and narrow, ranging from about 30 to 150 acres in size. A few gullies are present in most areas.

Included with this soil in mapping are small spots of Bazette, 12 percent slopes, and Ferris soils. These inclusions make up less than 15 percent of the acreage.

Runoff is rapid on this Ellis soil. The hazard of erosion is very severe.

This soil is used mainly for native pasture, but other pasture grasses have been introduced and established in some areas. Such adapted grasses and legumes as

ensides; about 20 percent visible calcium carbonate soft masses and concretions; calcareous; moderately alkaline; gradual, wavy boundary.

AC2ca—23 to 36 inches, light olive-brown (2.5Y 5/4) silty clay; few, medium, faint, olive-yellow (2.5Y 6/6) vertical streaks and common, medium, distinct, grayish-brown shale fragments; moderate, medium, blocky structure; very hard, firm; few roots; few small slickensides; about 15 percent visible calcium carbonate concretions and soft masses; calcareous; moderately alkaline; gradual, wavy boundary.

C—36 to 66 inches, olive (5Y 5/3) shaly clay with layers and splotches of olive yellow (2.5Y 6/6) and gray (10YR 5/1); massive; bedding planes evident; extremely hard, very firm; about 10 percent visible calcium carbonate concretions and masses in upper part; calcareous; moderately alkaline.

The solum is 30 to 50 inches thick. Typically, the soil is moderately alkaline and calcareous throughout. The A horizon is dark grayish brown, olive gray, light olive brown, and olive brown.

The AC horizon is clay or silty clay. In places this horizon

brown sandy clay loam that has light brownish-gray, brown, and yellowish-red mottles. The next 34 inches of it is mottled, light-gray, red, and yellowish-brown clay. Below this, to a depth of 90 inches, the subsoil is light-gray sandy clay loam that has brownish-yellow and yellowish-red mottles.

The Freestone soils are moderately well drained. Permeability is slow in these soils, and available water capacity is medium. They are used mainly for pasture.

alkaline sandy clay loam, loam, and clay loam. It is mottled in shades of brown, gray, and yellow.

FrB—Freestone fine sandy loam, 1 to 3 percent slopes. This gently sloping soil occupies broad interstream divides. Mapped areas range from 10 to about 1,000 acres in size and vary considerably in shape. The average size is about 40 acres.

Included with this soil in mapping are small areas of Lufkin, Bernaldo, and Raino soils. Lufkin soils are

***Figure 4.*—A good stand of purple hull peas on Freestone fine sandy loam, 1 to 3 percent slopes.**

structure; extremely hard, very firm; few roots; many pressure faces; few black concretions;

Included with this soil in mapping, and making up

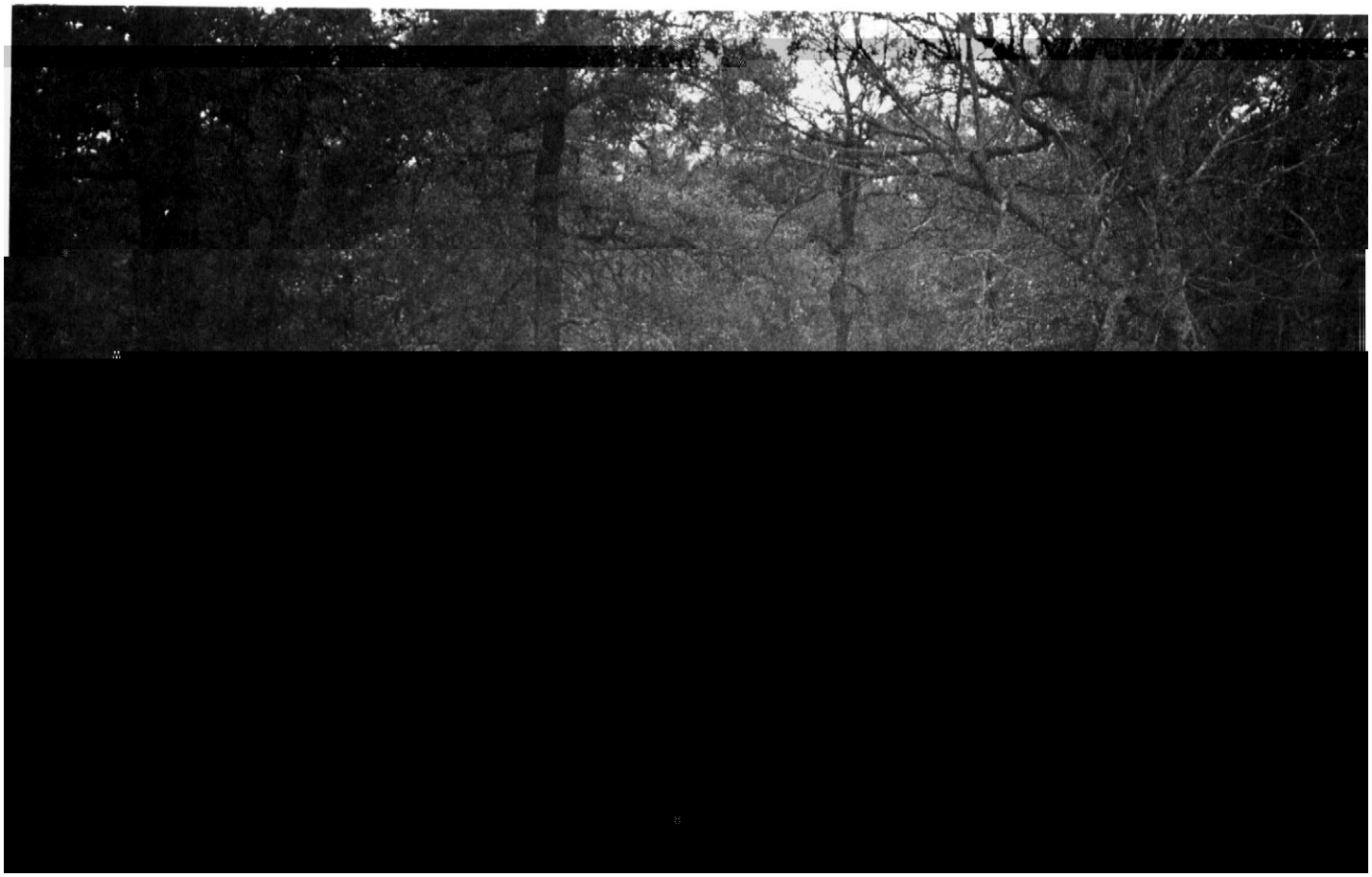


Figure 5.—**Water standing on nearly level flood plain. The soil is Gladewater clay.**

upper part is weathered and is intermingled with soil and massive shale. It contains few to common calcium carbonate concretions and soft masses.

HeC2—Heiden clay, 3 to 5 percent slopes, eroded. This gently sloping soil is on interstream divides and narrow ridgetops. Mapped areas are irregular in shape and range from 15 to about 80 acres in size. Shallow gullies are at intervals of 20 to 200 feet. There are 20 to

fine, faint olive-yellow (2.5Y 6/6) mottles; weak, subangular blocky structure; very hard, firm; few black concretions; neutral.

Reaction in the solum ranges from neutral to moderately alkaline. Texture is silty clay loam, silt loam, loam, and clay loam. Between depths of 10 and 40 inches the soil material is 25 to 35 percent clay. Less than 15 percent of this material is fine or coarser sand.

The A horizon is 24 to 35 inches thick. It is more dark

ate concretions and soft masses; few black concretions; mildly alkaline.

The solum ranges from 40 to about 100 inches thick. These soils are clayey throughout. The soil material is 60 to 72 percent clay. Reaction ranges from medium acid to mildly alkaline. The A horizon is black or very dark gray. In places the lower part is mottled in shades of brown, yellowish brown, or dark yellowish brown. When the soil is dry, cracks 1 to 3 inches wide extend to a depth of more than 20 inches.

The Cca horizon is dark gray, very dark gray, or gray. In places mottles in shades of brown or gray are present.

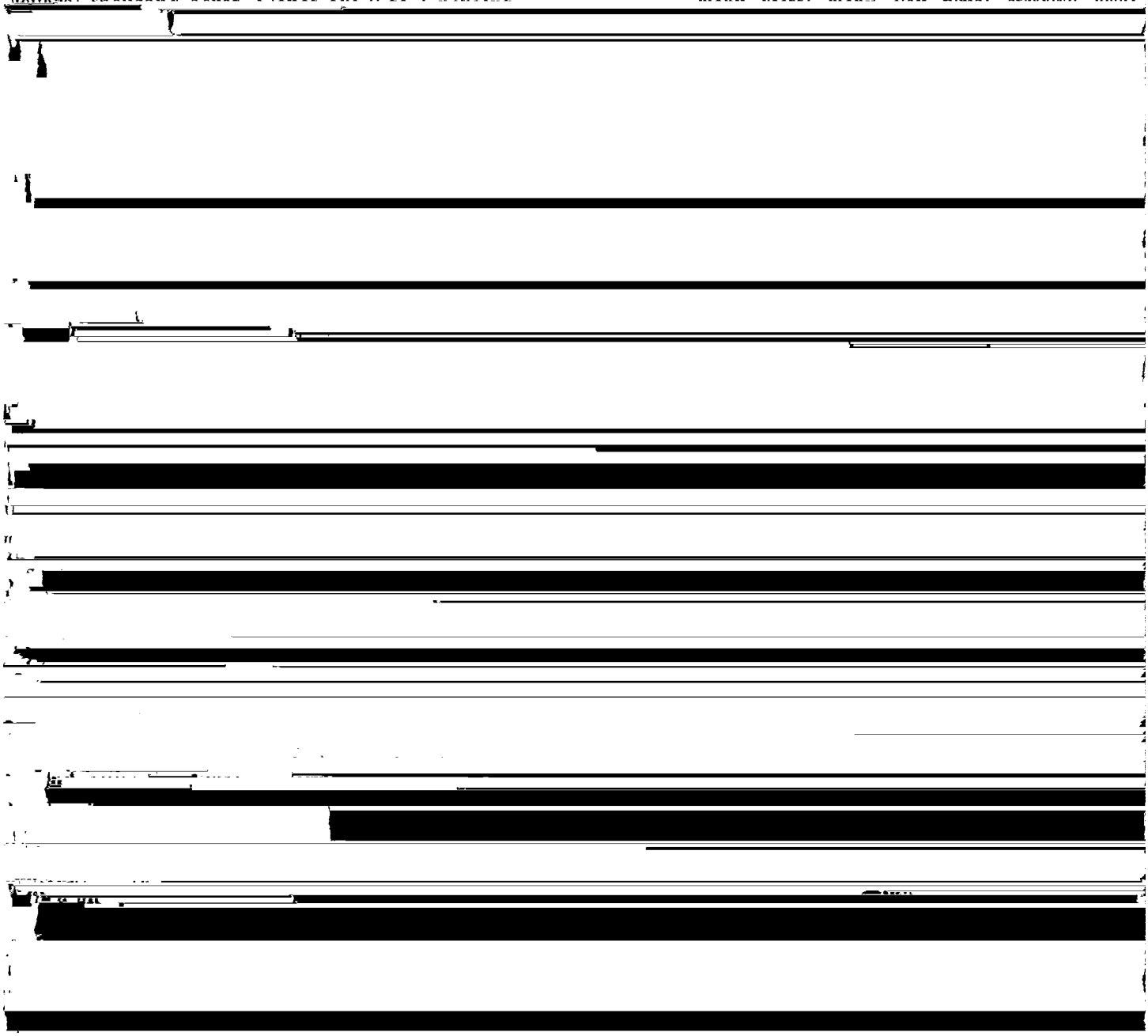
Ka—Kaufman clay. This nearly level soil is in long flood plains that are 200 feet to about 2 miles wide. Mapped areas vary considerably in size, ranging from 30-acre spots to flood plains that have an area of several thousand acres. Slopes are 0 to 1 percent.

on Farm Road 269, 0.3 mile southeast on Farm Road 852, and 10 feet south of road:

A1—0 to 4 inches, dark-brown (7.5YR 3/2) gravelly fine sandy loam; weak, fine, granular structure; hard, very friable; many roots; 15 percent iron-enriched pebbles and fragments that are 2 millimeters to 50 millimeters in diameter; a few fragments up to 18 inches across the long axis; neutral; clear, smooth boundary.

A2—4 to 12 inches, brown (7.5YR 4/4) gravelly fine sandy loam; weak, fine, granular structure; hard, very friable; many roots; 40 to 50 percent of iron-enriched pebbles and fragments that are 2 millimeters to 50 millimeters in diameter; slightly acid; abrupt, wavy boundary.

B21t—12 to 24 inches, yellowish-red (5YR 4/6) clay; strong, medium, blocky structure; very hard, firm; many roots; many clay films; strongly acid;



mapping. They are at the apex of slopes and are 1 to 3 acres in size. These areas make up about 5 to 10 percent of the total acreage.

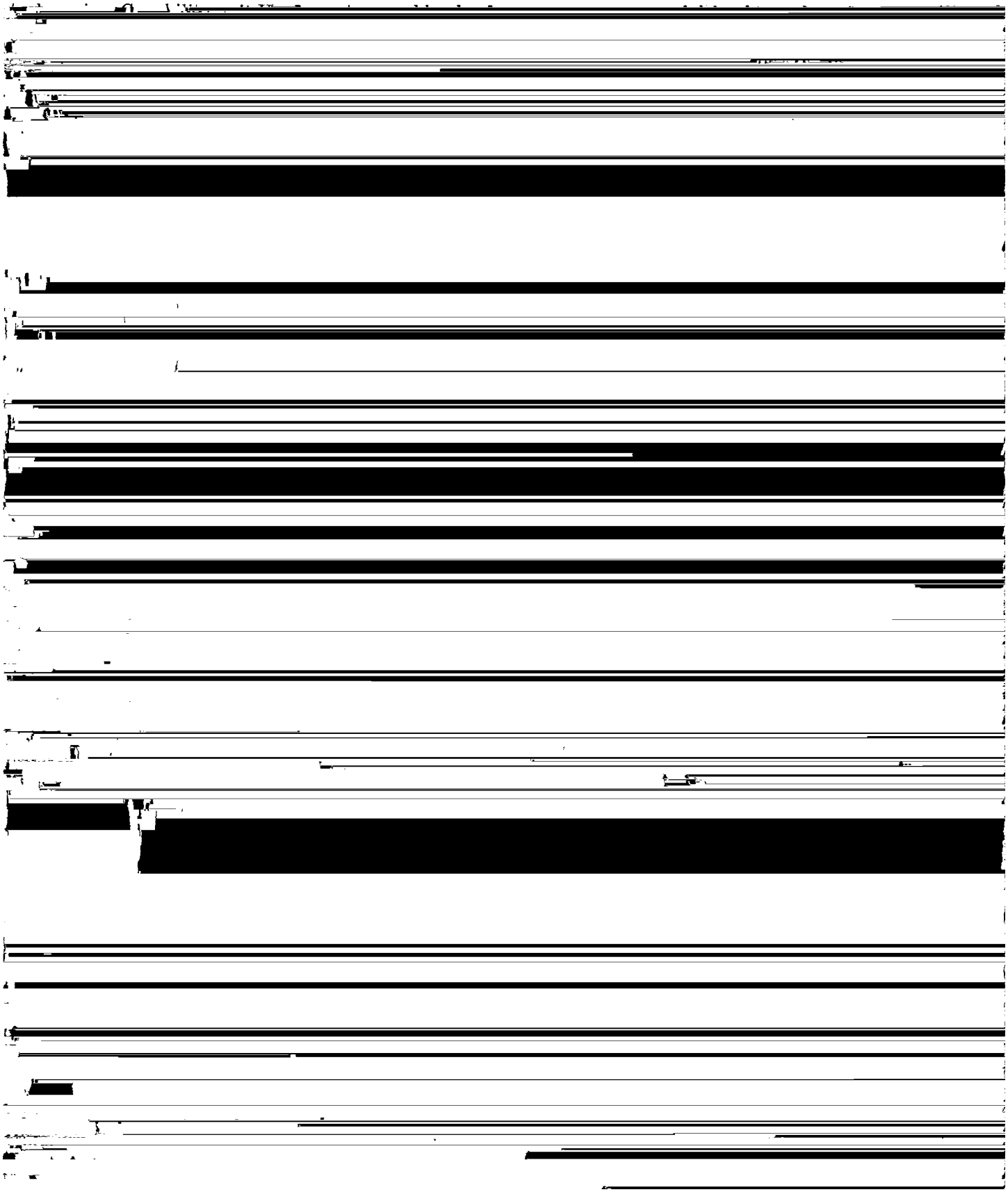
Runoff is medium to rapid on this Kirvin soil. The hazard of erosion is very severe.

This soil is used mainly for pasture of improved and native grasses. A few small areas are in pine trees. This soil provides a source of gravel for fill material. Adapted grasses and legumes are grown in places on this soil. Examples of these are bermudagrass, bahiagrass, lovegrass, crimson clover, arrowleaf clover, vetch, singletary peas, and lespedeza. A few areas are

Representative profile of Leson clay, 1 to 3 percent slopes, 225 feet north of Texas Highway 11, which is 10.8 miles west of intersection of Texas Highways 11 and 19 in Sulphur Springs:

Ap—0 to 10 inches, black (10YR 2/1) clay; moderate, fine, blocky structure; extremely hard, very firm; common shiny pressure faces; few fine black concretions; moderately alkaline; gradual, wavy boundary.

A1—10 to 30 inches, black (10YR 2/1) clay; weak, coarse, blocky parting to moderate, medium, blocky structure; extremely hard, very firm; common intersecting slickensides and wedge-shaped aggregates having long axis tilted 30 to 45 degrees from the



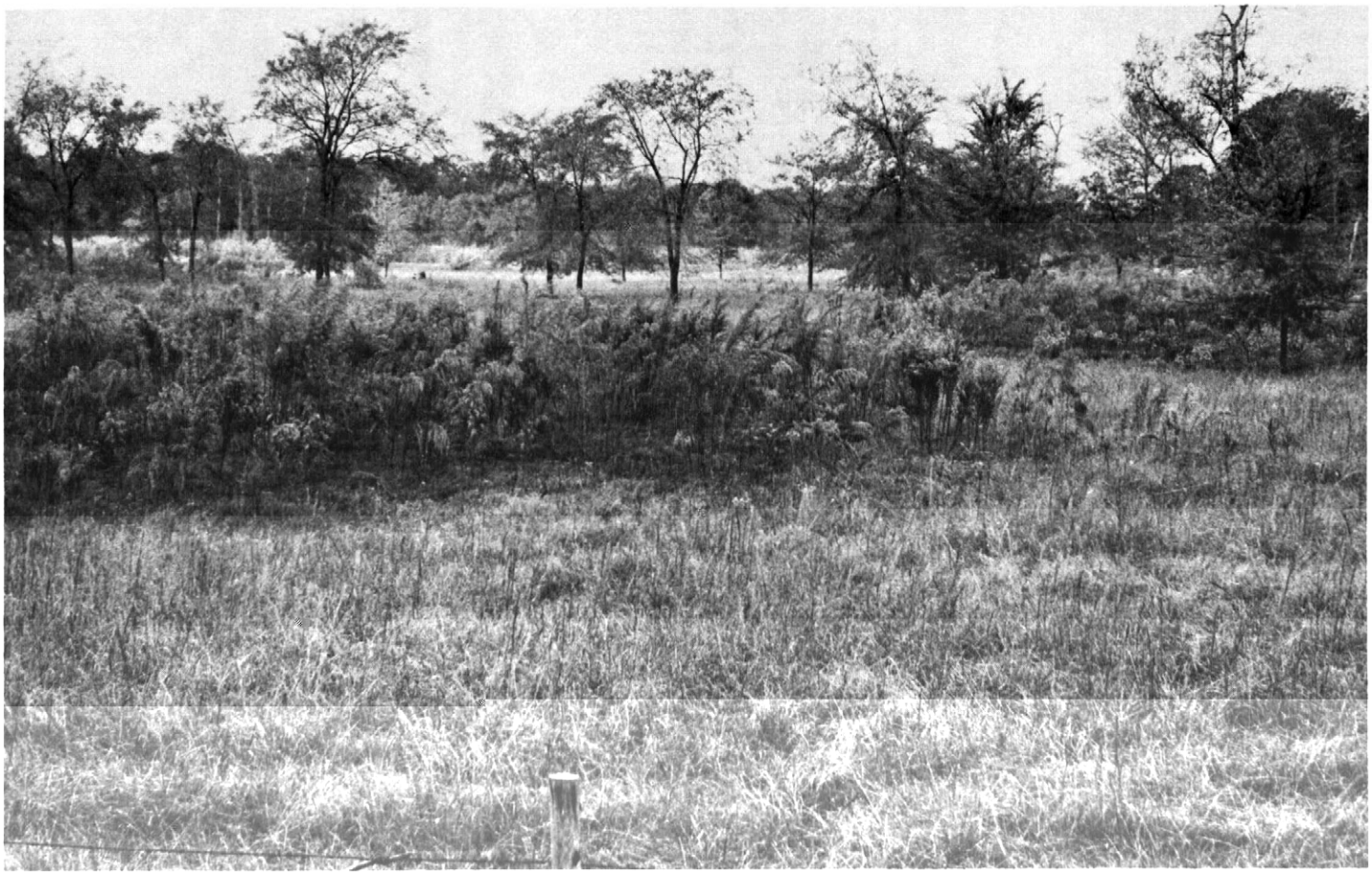


Figure 6.—Lufkin soils are in the foreground where vegetation is short; Raino soils are on mounds where vegetation is tall.

A1—0 to 5 inches, dark yellowish-brown (10YR 4/4) loam; moderate, very fine, subangular blocky structure; hard, very friable; many roots; strongly acid; clear, smooth boundary.

B1—5 to 25 inches, strong-brown (7.5YR 5/6) loam; moderate, fine and medium, subangular blocky structure; hard, very friable; few pores; few uncoated sand grains in lower part; few black concretions; very

gently sloping, loamy soils on uplands. These soils formed in alkaline clay under prairie grasses.

In a representative profile the surface layer is a very dark gray clay loam about 5 inches thick. The subsoil is a clay about 61 inches thick. The upper 35 inches is very dark gray and has dark grayish-brown mottles.

stream divides. Mapped areas are irregular in shape, and they range from about 20 to 400 acres in size.

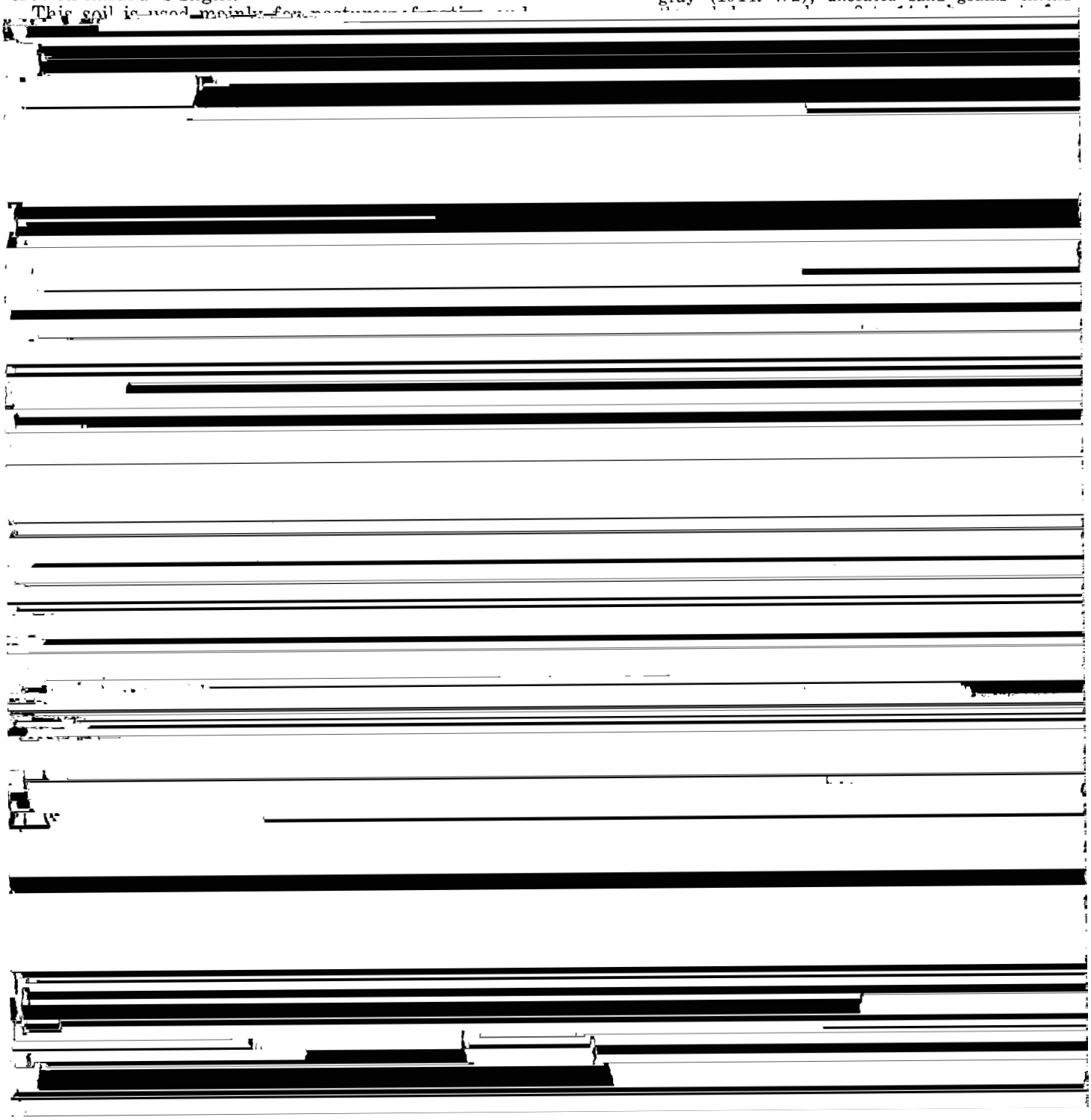
Included with this soil in mapping are small areas of Crockett soils. These are on small low mounds or ridges and are less than 3 acres in size. The Crockett soils make up less than 5 percent of the mapped areas.

Runoff is slow to very slow on this Wilson soil. The erosion hazard is slight.

This soil is used mainly for pasture and [illegible]

structure; very hard, friable; common roots; common clay films; dark yellowish-brown (10YR 4/4) coatings on faces of peds; medium acid; gradual, wavy boundary.

B24t & A 2—45 to 83 inches, yellowish-brown (10YR 5/6) sandy clay loam; common, coarse, distinct red (2.5YR 4/6) mottles; moderate, coarse, subangular blocky structure; very hard, friable; common roots; vertical streaks, 1/2 to 1 1/2 inches wide, of light-gray (10YR 7/2), uncoated sand grains extend



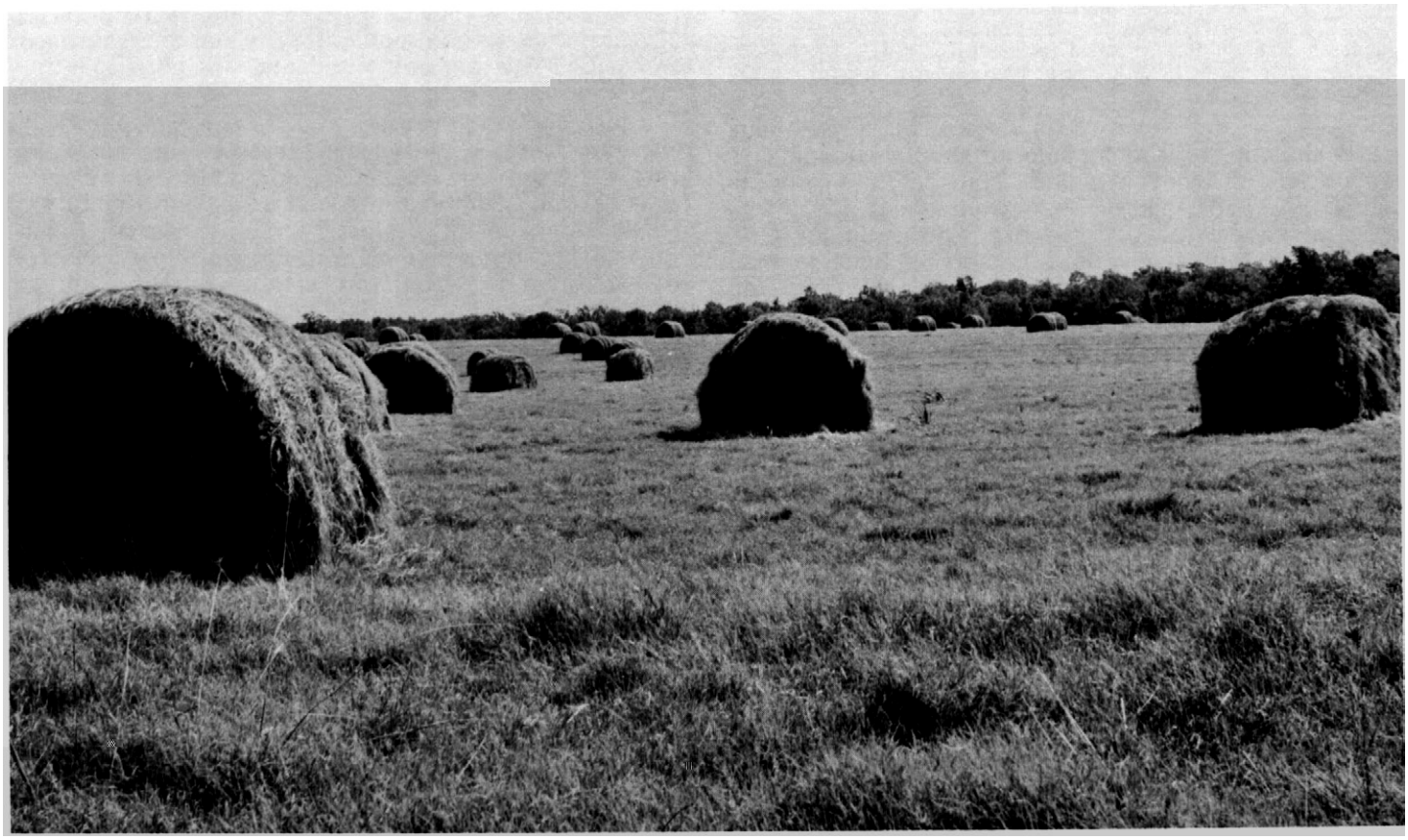


Figure 7.—**Coastal hay in large round bales on Wolfpen loamy fine sand, 1 to 5 percent slopes.**

lower layer, to a depth of 58 inches, is light-gray clay with red and brownish-yellow mottles. The underlying material, to a depth of 72 inches, is light olive-brown clay loam and shale that has variegated layers of gray and yellow.

Woodtell soils are moderately well drained. Permeability is very slow and available water capacity is high.

These soils are used mainly for pasture.

Representative profile of Woodtell loam, 5 to 12

hard, very firm; many roots; many clay films; common slickensides; very strongly acid; gradual, wavy boundary.

B23t—24 to 46 inches, gray (10YR 5/1) clay; common, fine, distinct red (2.5YR 4/6) and yellowish-brown (10YR 5/4) mottles; moderate, medium, blocky structure; extremely hard, very firm; common roots; many clay films; common slickensides; very strongly acid; gradual, wavy boundary.

B3—46 to 58 inches, light-gray (10YR 7/1) clay; common, fine and medium, distinct brownish-yellow (10YR 6/6) and few, fine, prominent red (2.5YR 4/6)

in these colors and in shades of red and yellow.

The C horizon is loam, shale, sandy clay loam, clay loam, or shaly clay. It is mottled in shades of red, gray, yellow, brown, or olive. Reaction is strongly acid to neutral in the C horizon.

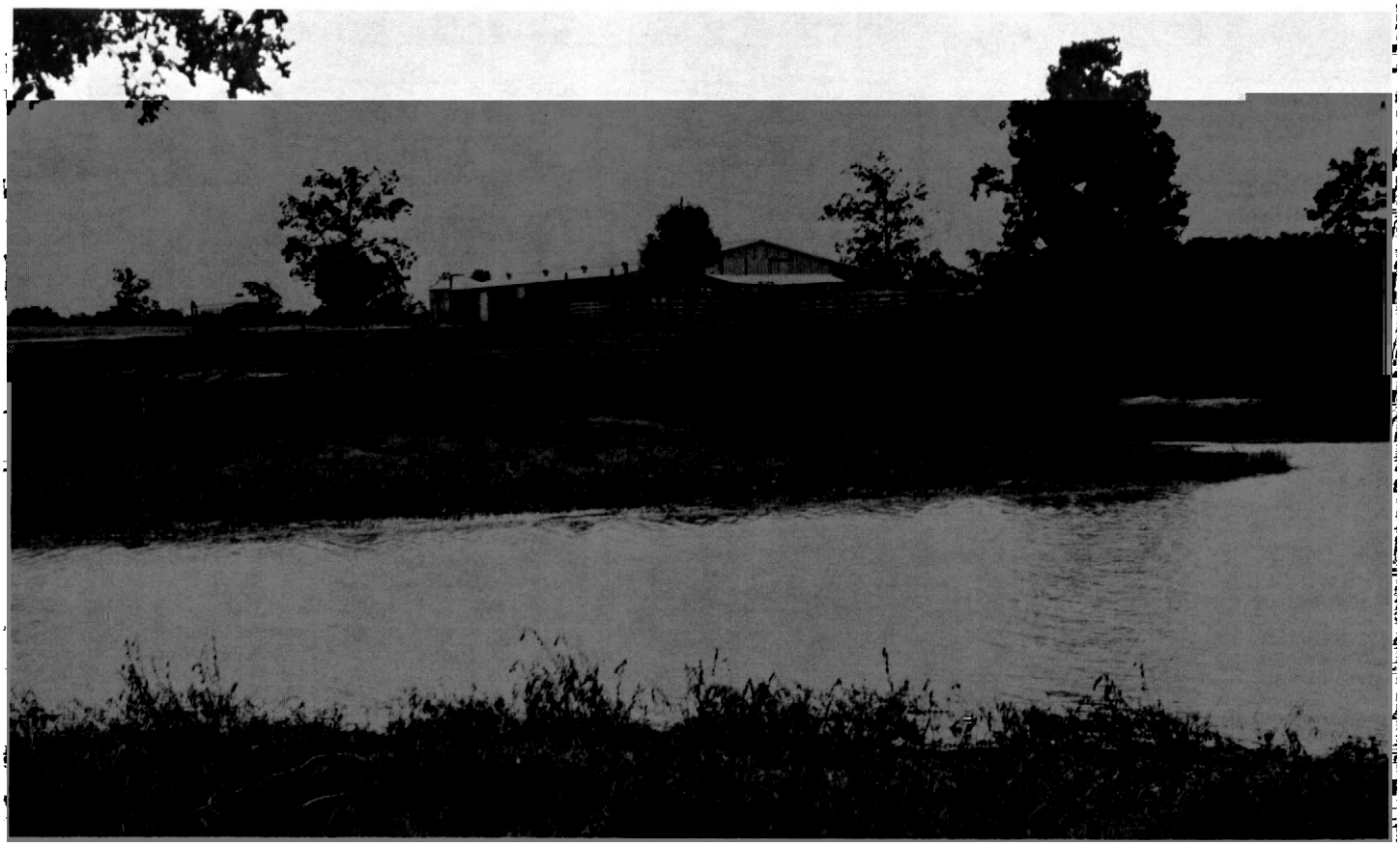
WtC—Woodtell loam, 2 to 5 percent slopes. This gently sloping soil is along sides of small drainageways and on oblong, convex ridges. Mapped areas are irregular in shape. They range from about 15 to 200 acres in size, but the average size is about 30 acres.

In a representative profile the surface layer is loam about 8 inches thick. The upper 3 inches is brown and the lower 5 inches is yellowish brown. The subsoil is clay about 42 inches thick. The upper part is red and has a few strong-brown mottles, and the lower part is yellowish red and red and also has mottles. The underlying material to a depth of 72 inches or more is variegated

native grasses. About 25 percent of the acreage is in oak trees that have an understory of native grasses. A few small areas are cultivated and are used to grow truck crops and corn.

In places adapted grasses and legumes are grown in this soil. Examples are bermudagrass, bahiagrass, lovegrass, crimson clover, vetch, and arrowleaf clover. Leaving crop residue on the surface helps to maintain soil tilth and control erosion. Terracing, contour farming, and keeping grass on waterways help to control erosion. Lime is needed for certain crops. Capability unit IIIe–2; pasture and hayland group 8A.

WtD—Woodtell loam, 5 to 12 percent slopes. This sloping to strongly sloping soil is along sides of drainageways. Mapped areas are long and narrow. They range from about 20 to 300 acres in size, and the aver-



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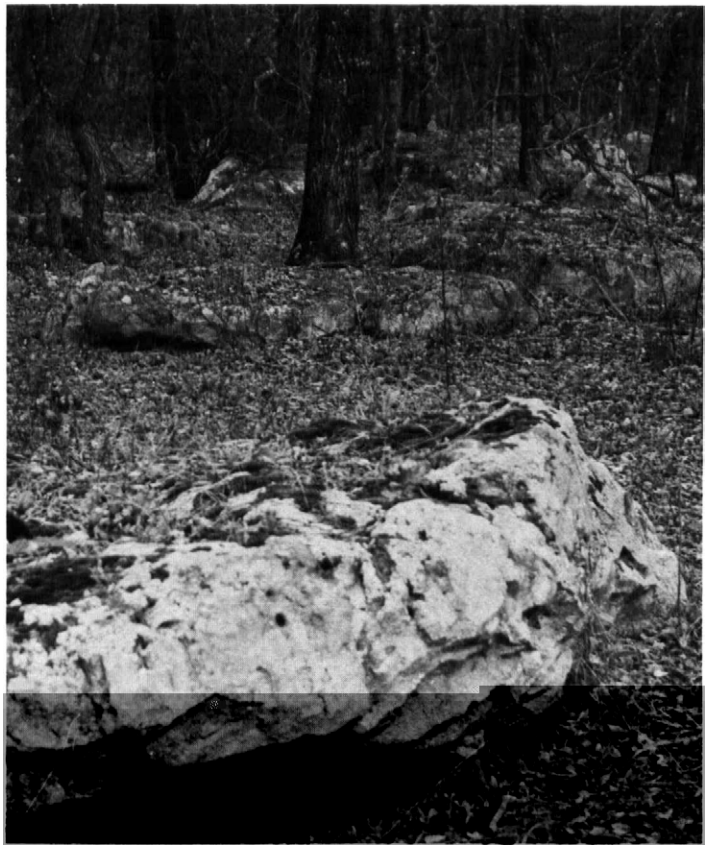


Figure 10.—Large stones exposed on surface of Woodtell stony loam, 1 to 5 percent slopes.

Figure 11.—Corn on Pickton loamy fine sand.

The principal crops grown are cotton, corn (fig. 11), grain sorghum, truck crops (fig. 12), and small grains.

In Hopkins and Rains Counties, management is needed mainly to control erosion, maintain soil tilth, and maintain soil fertility. The four most important practices used to accomplish these are discussed in the following paragraphs.

Use of crop residue.—Leaving a sufficient amount of residue on or just below the surface of the soil helps to maintain the content of organic matter and maintain soil tilth. It also helps to control water erosion and conserve moisture. All soils in the two counties benefit from proper use of crop residue.

Terraces farmed on contour.—Where slopes on terraces exceed about 1 percent, cultivating on the contour helps to decrease the hazard of erosion.

Use of cover crops.—Crops that cover the soil will protect against erosion during the period between the

crop and should be determined by soil test. Information on soil testing and fertilizer application is provided by the Soil Conservation Service or the Agricultural Extension Service.

Capability grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops, the risk of damage

Figure 12.—**Sweetpotatoes on Freestone fine sandy loam.**

not a substitute for interpretations designed to show suitability and limitations for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range

contain, at the most, only subclasses *w*, *s*, and *c*, because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, or wildlife habitat.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, require about the same management,

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

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe–1. Deep, gently sloping, moderately well drained, slightly acid loams on uplands.

Unit IIIe–2. Deep, gently sloping, moderately well drained, strongly acid on uplands.

Unit IIIe–3. Deep, gently sloping, well drained and moderately well drained clays

risk of erosion, unless protective cover is maintained.

Unit VIe–1. Deep and moderately deep, sloping to strongly sloping, well drained and moderately well drained loams and clay loams on uplands.

Unit VIe–2. Moderately deep, sloping to strongly sloping, well-drained clays on uplands.

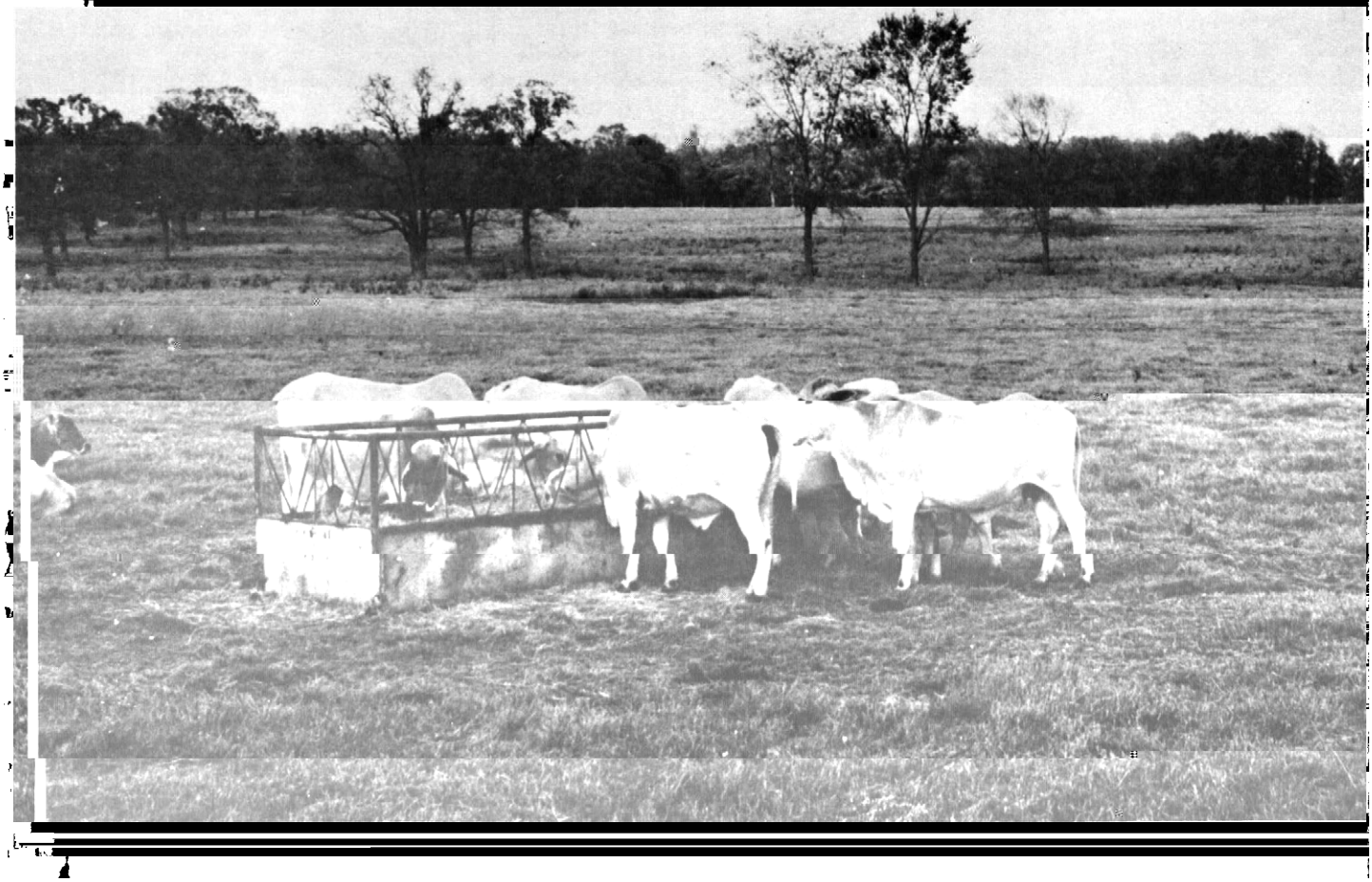
Unit VIe–3. Moderately deep, gently slop- and sloping, well-drained soils on uplands.

Class VII. Soils having very severe limitations that

TABLE 2.—*Predicted average yields of principal crops*

[Absence of data indicates that the crop is not suited to the soil or generally is not grown on it]

Soil	Corn	Cotton lint	Grain sorghum	Coastal bermuda-grass	Common bermuda-grass	Pensacola bahiagrass	Lovegrass
	Bu/acre	*Lb/acre*	*Bu/acre*	*AUM* [1]	*AUM* [1]	*AUM* [1]	*AUM* [1]
Annona-Raino complex	----	----	----	7.0	6.0	6.0	7.0
Bazette clay loam, 3 to 5 percent slopes	60	----	60	7.0	6.0	6.0	7.0
Bazette clay loam, 5 to 12 percent slopes	----	----	----	6.0	5.0	5.0	6.0
Bernaldo fine sandy loam, 1 to 3 percent slopes	65	400	65	8.0	7.0	7.0	8.0
Crockett loam, 0 to 1 percent slopes	45	400	60	7.5	6.5	6.5	7.5
Crockett loam, 1 to 3 percent slopes	40	350	55	7.5	6.5	6.5	7.5
Crockett loam, 3 to 5 percent slopes	----	----	----	6.5	5.5	5.5	6.5
Crockett loam, 2 to 5 percent slopes, eroded	----	----	----	5.5	5.0	5.0	5.5
Ellis clay, 5 to 12 percent slopes	----	----	----	5.0	4.0	----	5.0
Ferris clay, 5 to 12 percent slopes, eroded	----	----	----	5.0	4.0	----	5.0
Freestone fine sandy loam, 1 to 3 percent slopes	60	400	60	9.0	8.0	8.0	9.0
Gladewater clay	----	----	----	7.0	6.0	6.0	----
Heiden clay, 3 to 5 percent slopes, eroded	45	350	50	6.0	5.0	----	6.0
Hopco silty clay loam	----	----	----	10.0	8.0	7.0	----
Kaufman clay	----	----	----	8.0	7.0	----	----
Kirvin gravelly fine sandy loam, 3 to 8 percent slopes	50			8.0	7.0	7.0	8.0



Common and Coastal bermudagrass, pensacola bahiagrass, lovegrass, and fescue are the most commonly used grasses. The bermudagrasses are the most widely used, and they are adapted to most of the soils. Pensacola bahiagrass is adapted to most of the soils but not to calcareous soils. Lovegrass is better adapted to well

Range [4]

Range is land on which the native vegetation, whether climax or natural potential, is dominated by grasses, grasslike plants, forbs, and shrubs. These are suitable for grazing and are present in sufficient

land range site, and it is valuable winter forage. Short droughts are common in midsummer, and lengthy droughts occur about one year in five.

Range sites and condition classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some range that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded ap-

includes hawthorns, plums, Texas sophora, Alabama supplejack, peppervine, trumpetcreeper, grapes, and greenbrier. The herbaceous understory is dominated by [redacted] and Virginia wildrye. Approximate grazing [redacted] available water capacity

CLAYPAN SAVANNAH SITE

In this site are nearly level to strongly sloping, deep, loamy soils that have very slow permeability and high

overstory canopy, leaf and mulch buildup, rainfall, and other growing conditions. About 90 percent of this yield is plants that provide forage for livestock.

of the palatable and nutritious forage, the presence of large shade trees, and the proximity of the site to water. Because it is so desirable, it is one of the

oak, elm, hackberry, hickory, American beauty, yaupon, hawthorns, greenbrier, grape, and berryvines. The

in the plant community. As these and other herbaceous plants are weakened and thinned, they cannot compete

Potential productivity and management concerns for the soils in Hopkins and Rains Counties are listed in table 3. In the first column the soils are listed by their mapping unit symbols under the series name to which they belong. If a mapping unit contains the name of two series, as in a complex, the component soils are listed and evaluated separately under each series name. Soils not suited to woodland are not included in the table.

The next column gives the woodland group. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to produce these trees, and that have about the same potential productivity. Each woodland group is identified by a 3-part symbol. These parts are explained in the following paragraphs.

The first part of the symbol indicates the relative productivity of the soils: 1 means very high; 2, high; 3, moderately high; 4, moderate; and 5, low.

The second part of the symbol, a letter, indicates the important soil property that imposes a moderate or severe hazard or limitation in managing the soils for

tion or need for modification in methods or equipment. *Severe* limitations indicate the need for specialized equipment or operations.

Seedling mortality ratings indicate the degree of expected mortality of planted seedlings when plant competition is not a limiting factor. Normal rainfall, good planting stock, and proper planting are assumed. A *slight* rating indicates expected mortality is less than 25 percent, and a *moderate* rating indicates a 25 to 50 percent loss. A *severe* rating indicates more than a 50 percent loss of seedlings.

Plant competition reflects the rate of invasion by unwanted trees and shrubs on different kinds of soils when openings are made in the canopy. A rating of *slight* indicates that the understory plants would not prevent the establishment or normal development of a new stand of desirable trees. A *moderate* rating indicates that establishment or development of a new stand of desirable trees may be delayed by plant competition. A rating of *severe* indicates that adequate establishment and development would be prevented without

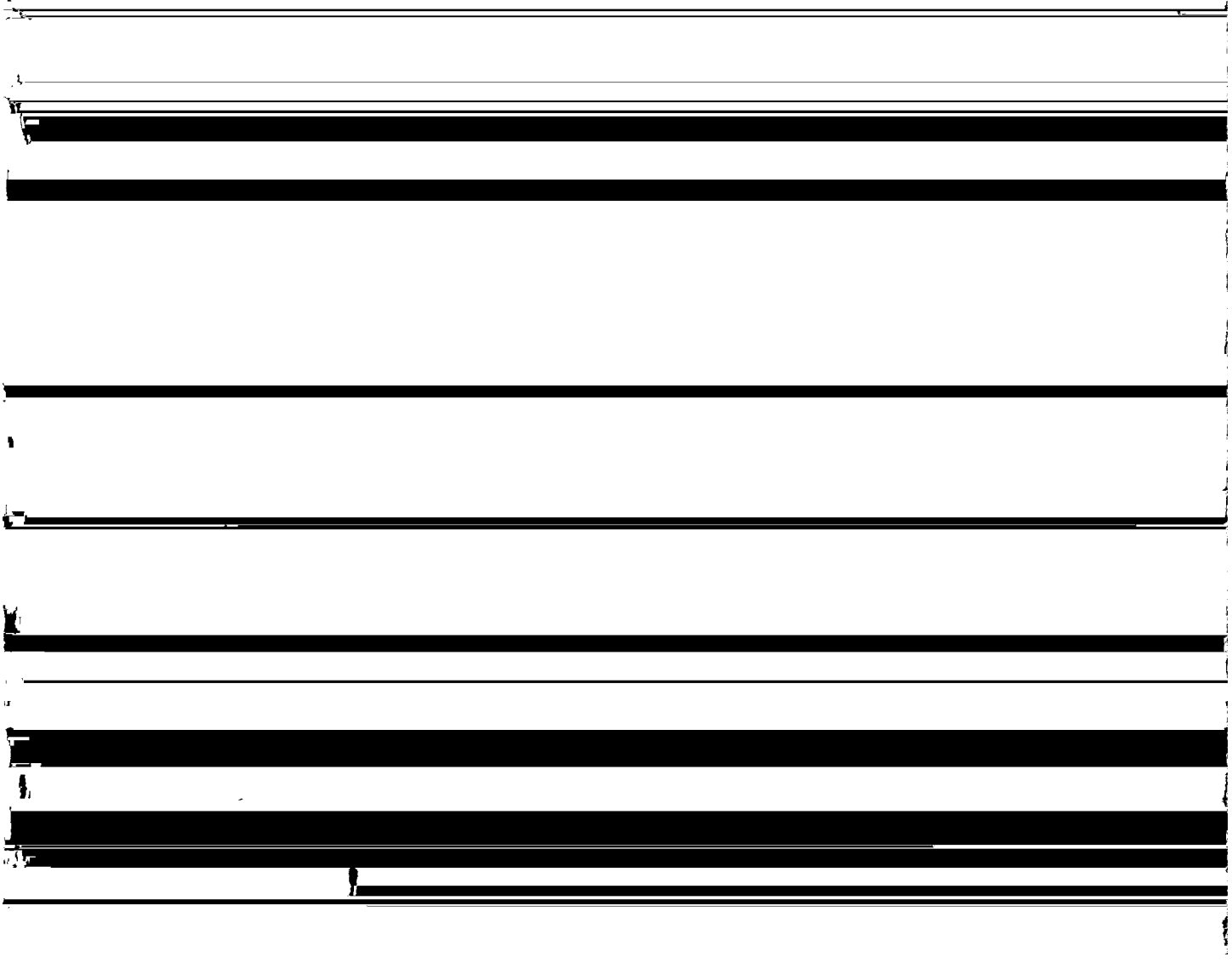


TABLE 3.—*Suitability of*

Soil series and symbols	Woodland group	Potential productivity of important trees	
		Species	Site index
Annona: Ar	4c2	Loblolly pine	70
For Raino part see Raino series.		Shortleaf pine	60
Bernaldo: BeB	2o7	Loblolly pine	90
		Shortleaf pine	80
		Southern redoak	80
		Sweetgum	90
Freestone: FrB	3w8	Loblolly pine	80
		Shortleaf pine	70
		Sweetgum	80
Gladewater: Gw	2w6	Water oak	90
		Willow oak	90
Hopco: Ho	1w5	Water oak	100
		Willow oak	100
		Cottonwood	110
Kaufman: Ka	1w6	Cottonwood	110
		Water oak	100
Kirvin:			
KnD	4f2	Loblolly pine	70
		Shortleaf pine	60
KvD	4c2	Loblolly pine	70
		Shortleaf pine	60
Lufkin: Lr	4w3	Loblolly pine	70
For Raino part, see Raino series.		Shortleaf pine	60
Nahatche: Na	1w6	Water oak	100
		Willow oak	100
Pickton: PkC	3s2	Loblolly pine	80
		Shortleaf pine	70
Raino	3w2	Loblolly pine	80
Mapped only in complexes with Annona and Lufkin.		Shortleaf pine	70
Wolfpen: WoC	3s2	Loblolly pine	80
		Shortleaf pine	70
Woodtell: WtC, WtD	4c2	Loblolly pine	70
		Shortleaf pine	60

habitat elements" and "Kinds of wildlife" in table 4 is ment as a habitat for wildlife requires inspection at

the soils for woodland

Potential productivity of important plants in understory		Management concerns				Trees to plant
Species	Air-dry forage	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	Suitable species
	Lb/acre					
Bluestems, uniola, purpletop, sedges, low panicums.	2000	Slight	Moderate	Moderate	Moderate	Loblolly pine.
Bluestems, uniola, beaked panicums, purpletop, low panicums.	2000	Slight	Slight	Slight	Slight	Loblolly pine, slash pine, sweetgum.
Bluestems, uniola, beaked panicums	2000	Slight	Moderate	Slight	Moderate	Loblolly pine

TABLE 4.—*Soil interpretations for wildlife*

Soil series and symbols	Wildlife habitat elements		
	Grain and seed crops	Grass and legumes	Wild herbaceous plants
Annona: Ar For Raino part, see Raino series.	Fair	Good	Good
Bazette:			
BaC	Fair	Good	Fair
BaD	Poor	Fair	Fair
Bernaldo: BeB	Good	Good	Good
[illegible]	[illegible]	[illegible]	[illegible]

habitat elements and kinds of wildlife

[redacted]

Figure 15.—**Recreational facilities on Lake Tawakoni. The soil is Bazette clay loam.**

ate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. *Slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. *Moderate* means that the limitations can be overcome or modified by planning, by design, or by special maintenance. *Severe* means that the degree of limitation warrants costly soil reclamation, special design, intense maintenance, or a combination of these.

Camp areas are used intensively for tents and small

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand considerable foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after precipitation and not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should

TABLE 5.—*Soil interpretations for recreation*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils]

Soil series and map symbols	Degree and kind of limitations for selected uses			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Annona: Ar	Severe: percs	Moderate: wetness	Severe: percs	Moderate: wet

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 the water table, depth to bedrock, and soil slope. In various degrees and combinations, these properties 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

In the Unified Soil Classification System, soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway con-

cians. The other system used is the AASHTO system adopted by the American Association of State Highway and Transportation Officials (*2*).

texture. These soils have a slow rate of water transmission.

D. (High runoff potential). Soils having very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

All soils are deep except Bazette soils, which are 24 to 40 inches to clay and shale.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 6 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of [illegible]

moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 6, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced by the content of sodium or magnesium sulfate, soil texture, and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are

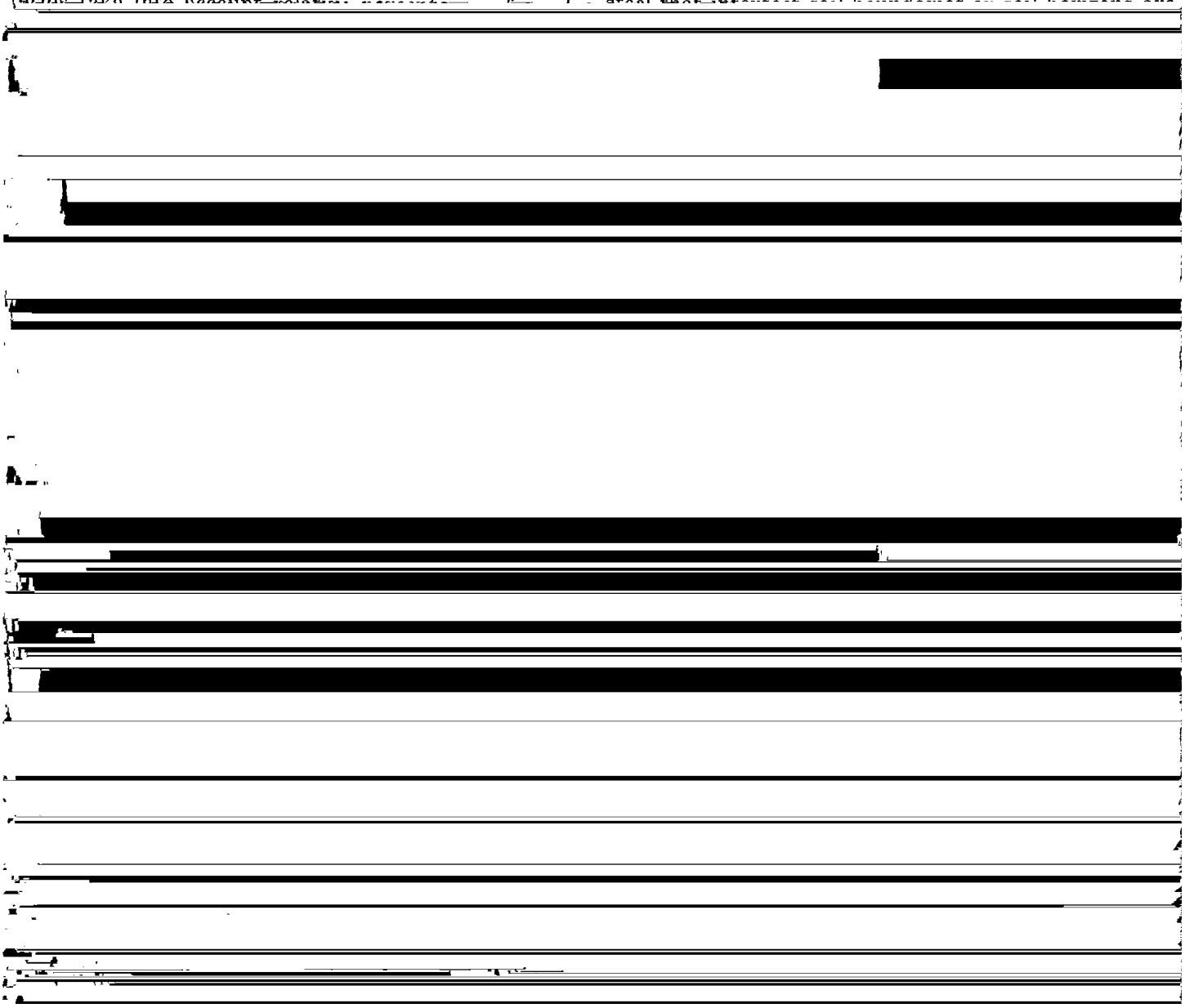


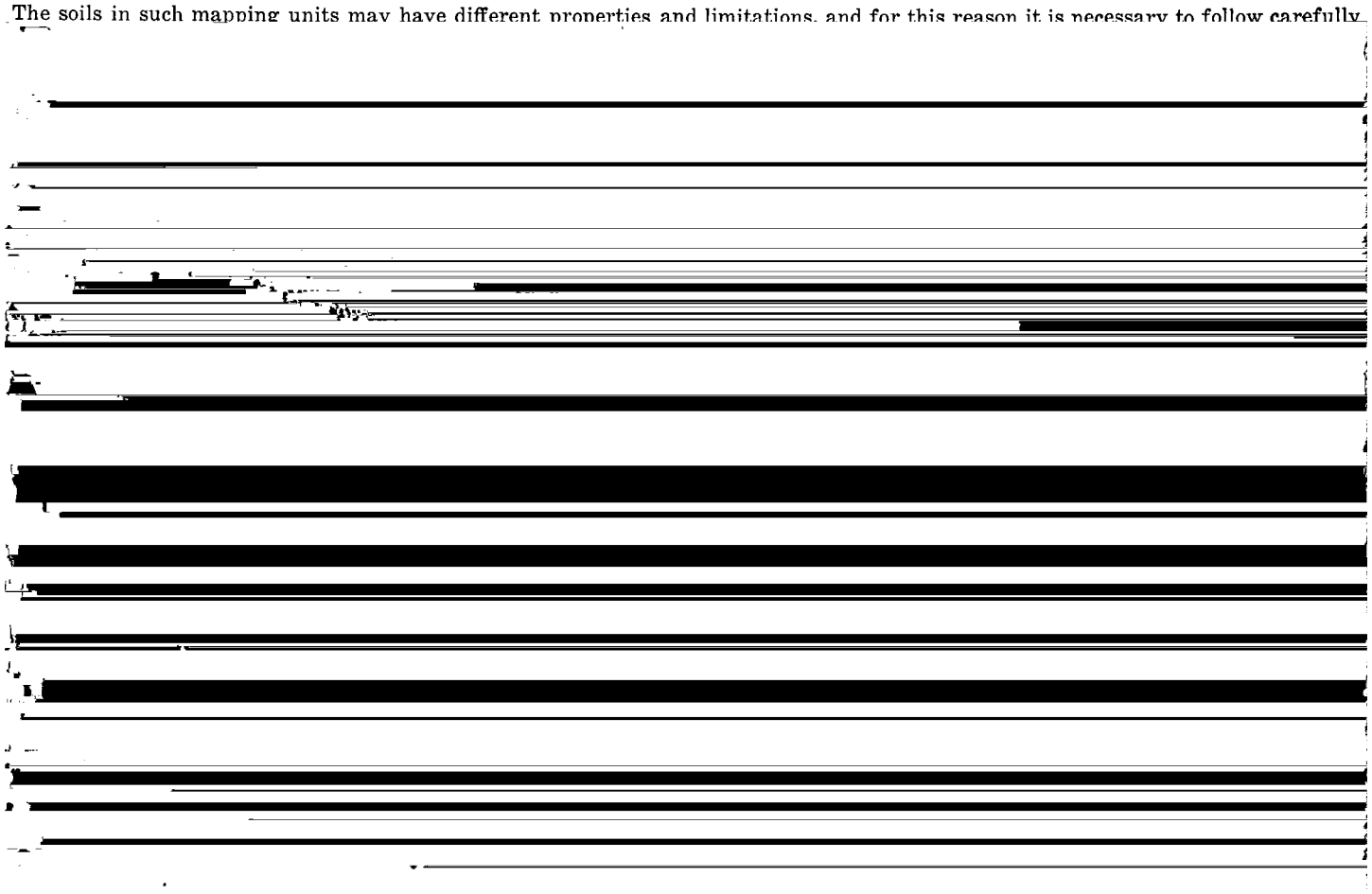
TABLE 6.—*Estimated soil properties*

[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 instructions for referring to other series

Soil series and map symbols	Hydrologic group	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Percentage less than 3 inches passing sieve—	
					Unified	AASHTO	No. 4 (4.7 mm)	No. 10 (2.0 mm)
		Inches	*Inches*					
*Annona: Ar	D	24–48	0–9	Loam	ML or SM	A–4	95–100	95–100
			9–68	Clay	CH	A–7–6	95–100	95–100
For Raino part, see Raino series.			68–95	Clay loam	CL or CH	A–7–6	95–100	95–100
Bazette: BaC, BaD	C	>120	0–4	Clay loam	CL	A–6 or A–7–6	95–100	95–100
			4–28	Clay	CL or CH	A–7–6	95–100	95–100
			28–60	Clay and shale	CL or CH	A–6 or A–7–6	95–100	95–100
Bernaldo: BeB	B	48–72	0–10	Fine sandy loam	ML, SM, CL–ML, or SM–SC	A–4	100	95–100
			10–80	Sandy clay loam	CL	A–6	100	100
Crockett: CrA, CrB, CrC, CrC2.	D	>72	0–9	Loam	CL	A–4 or A–6	95–100	95–100
			9–45	Clay	CL or CH	A–7–6	90–100	80–100
			45–84	Clay loam and shale.	CL or CH	A–7–6	95–100	95–100
Ellis: EsD	D	>72	0–31	Clay and silty clay.	CH	A–7–6	95–100	95–100
			31–66	Shale and clay	CH	A–7–6	95–100	95–100
Ferris: FeD2	D	>72	0–4	Clay	CH	A–7–6	95–100	95–100
			4–36	Silty clay	CH	A–7–6	95–100	95–100
			36–66	Shaly clay	CH	A–7–6	95–100	95–100
Freestone: FrB	C	12–36	0–16	Fine sandy loam.	CL, ML, SC, CL–ML, SM, or SM–SC	A–4	95–100	95–100
			16–38	Sandy clay loam.	CL	A–6 or A–7–6	95–100	95–100
			38–72	Clay	CL or CH	A–7–6	95–100	95–100
			72–90	Sandy clay loam.	CL	A–6 or A–7–6	100	95–100
Gladewater: Gw	D	>24	0–65	Clay	CH	A–7–6	100	100
Heiden: HeC2	D	>120	0–40	Clay	CH	A–7–6	95–100	95–100
			40–60	Shaly clay	CH	A–7–6	95–100	95–100
Hopco: Ho	C	36–60	0–48	Silty clay loam.	CL	A–6 or A–7–6	100	100
			48–80	Clay loam	CL	A–6 or A–7–6	100	100
Kaufman: Ka	D	>24	0–84	Clay	CH	A–7–6	100	100
Kirvin: KnD, KvD	C	>72	0–12	Gravelly fine sandy loam.	GM or GM–GC, SM, or SC–SM	A–1–b or A–2–4	55–75	40–75
			12–31	Clay	CL, CH, ML, or MH	A–7–6	95–100	85–100
			31–43	Sandy clay loam.	CL, ML, or SC	A–6 or A–7–6	95–100	85–100
			43–64	Sandy clay loam, clay loam and weakly cemented sandstone.	SC or SM–SC	A–4, A–6 or A–2	95–100	85–100

significant to engineering

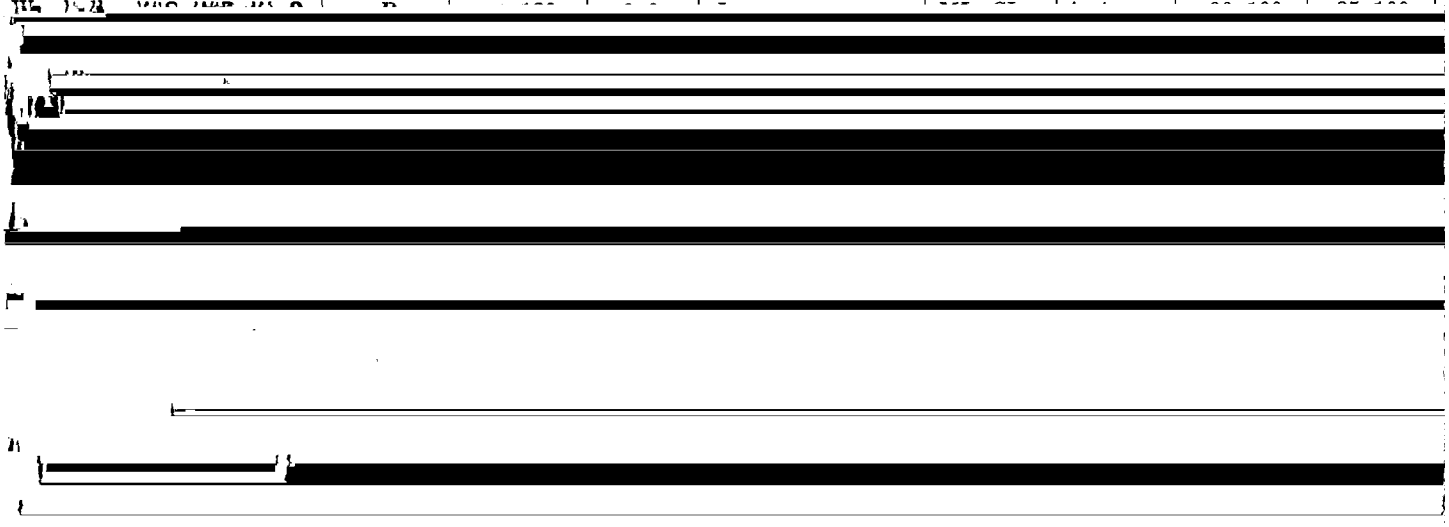
The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully



Percentage less than 3 inches passing sieve—Continued		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				In per hour	*In per in of soil*	*pH*			
75–95	45–70	15–25	1–3	0.6–2.0	0.13–0.18	4.5–6.5	Low	Moderate	Moderate.
90–100	75–95	51–70	30–45	<0.06	0.12–0.18	4.5–8.4	High	High	Moderate.
90–100	75–95	41–55	25–35	<0.06	0.12–0.18	6.1–6.5	High	High	Low.
85–100	60–90	30–43	11–21	0.06–2.0	0.15–0.20	5.6–7.3	Low	Moderate	Low.
90–100	80–95	48–66	27–40	0.06–2.0	0.16–0.18	5.6–7.3	High	High	Low.
90–100	70–95	40–60	20–35	0.06–2.0	0.16–0.18	6.1–8.4	High	High	Low.
90–100	45–65	15–25	2–5	2.0–6.0	0.11–0.15	5.1–6.5	Low	Low	Moderate.
90–100	51–75	30–40	12–24	0.6–2.0	0.15–0.20	4.5–6.5	Moderate	Moderate	Moderate.
95–100	36–95	15–35	8–15	0.6–2.0	0.11–0.15	5.6–7.3	Low	Moderate	Low.
75–100	65–91	45–55	25–35	<0.06	0.14–0.18	5.6–7.8	High	High	Low.
90–100	65–90	45–57	25–36	0.06–2.0	0.15–0.20	7.4–8.4	Moderate	High	Low.

TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Percentage less than 3 inches passing sieve—	
					Unified	AASHTO	No. 4 (4.7 mm)	No. 10 (2.0 mm)
		Inches	*Inches*					
Leson: LeB, LeC	D	>120	0–60	Clay	CH	A–7–6	98–100	90–100
			60–80	Shaly clay	CH	A–7–6	98–100	90–100
*Lufkin: Lr	D	0–12	0–9	Loam	ML or CL–ML	A–4	90–100	85–100
For Raino part, see Raino series.			9–53	Clay	CH	A–7–6	90–100	90–100
			53–65	Stratified clay, silty clay loam, sandy loam.	CL, CH, or SC	A–7–5 or A–7–6	70–100	70–100
Nahatche: Na	C	0–18	0–7	Clay loam	CL	A–6 or A–7–6	100	100
			7–13	Loam	CL	A–4 or A–6	100	100
			13–65	Clay loam	CL	A–6 or A–7–6	100	100
Pickton: PkC	A	>72	0–54	Loamy fine sand	SM, SM–SC, or SP–SM	A–2–4	100	95–100
			54–120	Sandy clay loam	CL, CL–ML, SC, or SM–SC	A–4 or A–6	100	95–100
Raino	D	12–36	0–35	Loam	CL, ML, SM, CL–ML, SC, or SM–SC	A–4	95–100	95–100
Mapped only with Annona and Lufkin series.			35–70	Clay	CL or CH	A–7–6	95–100	95–100
			70–90	Sandy clay loam	CL or CH	A–7–6	95–100	95–100
Wilson: WcB	D	0–12	0–5	Clay loam	CL or CL–ML	A–4 or A–6	95–100	85–100
			5–66	Clay	CL or CH	A–7–6	90–100	80–100
			66–82	Shale and clay	CL or CH	A–7–6	95–100	95–100
Wolfpen: WoC	A	50–60	0–27	Loamy fine sand	SM, SM–SC, or SP–SM	A–2–4	100	95–100
			27–100	Sandy clay loam	CL or SC	A–4 or A–6	100	95–100



significant to engineering—Continued

Percentage less than 3 inches passing sieve—Continued		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				In per hour	*In per in of soil*	*pH*			
90–100	90–100	60–90	40–60	<0.06	0.12–0.18	6.1–8.4	High	High	Low.
90–100	90–100	70–100	40–75	<0.06	0.12–0.18	7.4–8.4	High	High	Low.
85–100	80–85	<25	[1] NP–7	0.6–2.0	0.11–0.18	4.5–6.5	Low	Low	Moderate.
90–100	70–95	51–65	30–45	<0.06	0.14–0.18	4.5–7.8	High	High	Moderate.
55–100	44–90	45–86	25–55	<0.06	0.10–0.14	6.1–8.4	High	High	Moderate.
90–100	70–80	30–45	15–25	0.6–2.0	0.15–0.20	5.1–7.8	Moderate	High	Moderate.
85–95	60–75	28–40	8–20	0.6–2.0	0.15–0.20	5.1–7.8	Moderate	High	Moderate.
90–100	70–80	30–45	11–25	0.6–2.0	0.15–0.20	5.1–7.8	Moderate	High	Moderate.
85–100	10–25	<25	[1] NP–7	6.0–20.0	0.07–0.11	5.6–7.3	Low	Low	Low.
85–100	36–55	23–40	7–20	0.6–2.0	0.12–0.17	4.5–6.5	Low	Low	Moderate.
80–100	40–80	<30	[1] NP–10	0.6–2.0	0.11–0.20	4.5–6.5	Low	Moderate	Moderate.
80–100	55–90	46–74	24–45	<0.06	0.12–0.18	4.5–5.5	High	High	Moderate.
80–100	55–90	41–60	18–35	0.06–0.2	0.12–0.18	4.5–7.8	High	High	Moderate.
80–100	60–85	25–35	7–20	0.2–0.6	0.15–0.20	5.6–6.5	Low	Moderate	Low.
80–100	65–90	41–55	25–35	<0.06	0.15–0.20	5.6–8.4	High	High	Low.
90–100	70–90	41–55	25–35	<0.06	0.12–0.15	7.9–8.4	High	High	Low.
85–100	10–30	<25	[1] NP–7	6.0–20.0	0.07–0.11	5.6–7.3	Low	Low	Low.
85–100	36–55	25–40	8–20	0.6–2.0	0.12–0.17	4.5–6.5	Low	Low	Moderate.
75–95	30–60	<27	[1] NP–7	0.6–2.0	0.10–0.15	4.5–6.5	Low	Low	Moderate.
80–100	60–90	45–60	25–40	<0.06	0.16–0.18	4.5–6.5	High	High	High.
80–100	36–85	35–55	15–35	0.06–0.2	0.15–0.20	5.1–7.3	High	Moderate	Moderate.

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

Dwellings without basements, as rated in table 7, 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 ease of excavation and to capacity to support load and resist settlement under load. Soil properties that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks. Properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential.

Sanitary landfills are areas for refuse disposals in dug trenches. The waste is spread in thin layers, com-

TABLE 7.—*Engineering*

[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 instructions for referring to other series that appear in the first column of this table. "Percs slowly" and some of the other "fair," and other

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills
*Annona: Ar For Raino part, see Raino	Severe: percs slowly; wetness	Severe: wetness	Severe: wet-	Severe: shrink-	Severe: wet-

interpretations

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," terms used to rate soils]

Degree and kind of limitation for—Continued			Suitability as source of—		Soil features affecting—	
Local roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Drainage for crops and pasture	Terraces and diversions
Severe: shrink-swell; low strength.	Slight	Moderate: low strength.	Poor: shrink-swell; low strength.	Fair: thin layer.	Percs slowly	Percs slowly.
Severe: low strength; shrink-swell.	Slight	Moderate: compressible; unstable fill.	Poor: low strength.	Poor: thin layer.	Slope	Slope; percs slowly.
Severe: low strength; shrink-swell.	Slight	Moderate: compressible; unstable fill.	Poor: low strength.	Poor: thin layer.	Slope	Slope; percs slowly.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: thin layer.	Not needed	Complex slope.
Severe: shrink-swell.	Slight	Moderate: unstable fill.	Poor: shrink-swell.	Fair: thin layer.	Not needed	Percs slowly.
Severe: shrink-swell; low strength.	Slight	Moderate: low strength; compressible.	Poor: shrink-swell; low strength.	Poor: too clayey.	Not needed	Percs slowly.
Severe: shrink-swell; low strength.	Slight	Moderate: low strength; compressible.	Poor: shrink-swell; low strength.	Poor: too clayey	Not needed	Slope.
Severe: shrink-swell; low strength.	Slight	Moderate: unstable fill.	Poor: shrink-swell; low strength.	Fair: thin layer.	Percs slowly	Percs slowly.
Severe: shrink-swell; floods.	Slight	Moderate: compressible.	Poor: shrink-swell; wetness.	Poor: wetness; too clayey.	Floods	Not needed.
Severe: shrink-swell.	Slight	Moderate: unstable fill.	Poor: shrink-swell.	Poor: too clayey.	Not needed	Slope; percs slowly.
Severe: floods	Moderate: seepage.	Moderate: compressible; piping.	Fair: low strength.	Fair: too clayey.	Floods	Not needed.
Severe: shrink-swell.	Slight	Moderate: compressible; shrink-swell.	Poor: shrink-swell.	Fair: too clayey.	Floods	Not needed.
Severe: low strength.	Moderate: seepage.	Moderate: unstable fill; low strength.	Poor: shrink-swell.	Fair: thin layer.	Not needed	Slope.
Severe: shrink-swell.	Slight	Moderate: unstable fill.	Poor: shrink-swell.	Poor: too clayey.	Percs slowly	Percs slowly.
Severe: shrink-swell; wetness.	Slight	Moderate: unstable fill; compressible.	Poor: shrink-swell.	Poor: thin layer.	Favorable	Slope.
Severe: floods; wetness; low strength.	Moderate: seepage.	Moderate: unstable fill.	Poor: low strength; wetness.	Fair: too clayey.	Floods	Not needed.
Slight	Severe: seepage	Moderate: piping.	Good	Poor: too sandy.	Not needed	Too sandy.
Moderate: low strength; wetness.	Slight	Moderate: unstable slopes; compressible.	Fair: low strength; shrink-swell.	Good	Percs slowly	Slope.

TABLE 7.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills
Wilson: WcB	Severe: percs slowly.	Slight	Severe: too clayey; wetness.	Severe: shrink-swell; low strength.	Severe: too clayey.
Wolfpen: WoC	Moderate: wetness.	Moderate: seepage.	Moderate: wetness.	Slight	Severe: wetness.
Woodtell:					
WtC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.
WtD	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.
WwC	Severe: percs slowly; large stones.	Moderate: slope; large stones.	Severe: large stones.	Severe: shrink-swell; large stones.	Severe: too clayey; large stones.

pacted, 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, 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 7 apply only to a depth of about 6 feet, and therefore limitations ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 to 15 feet. Nevertheless, every site should be investigated before it is selected.

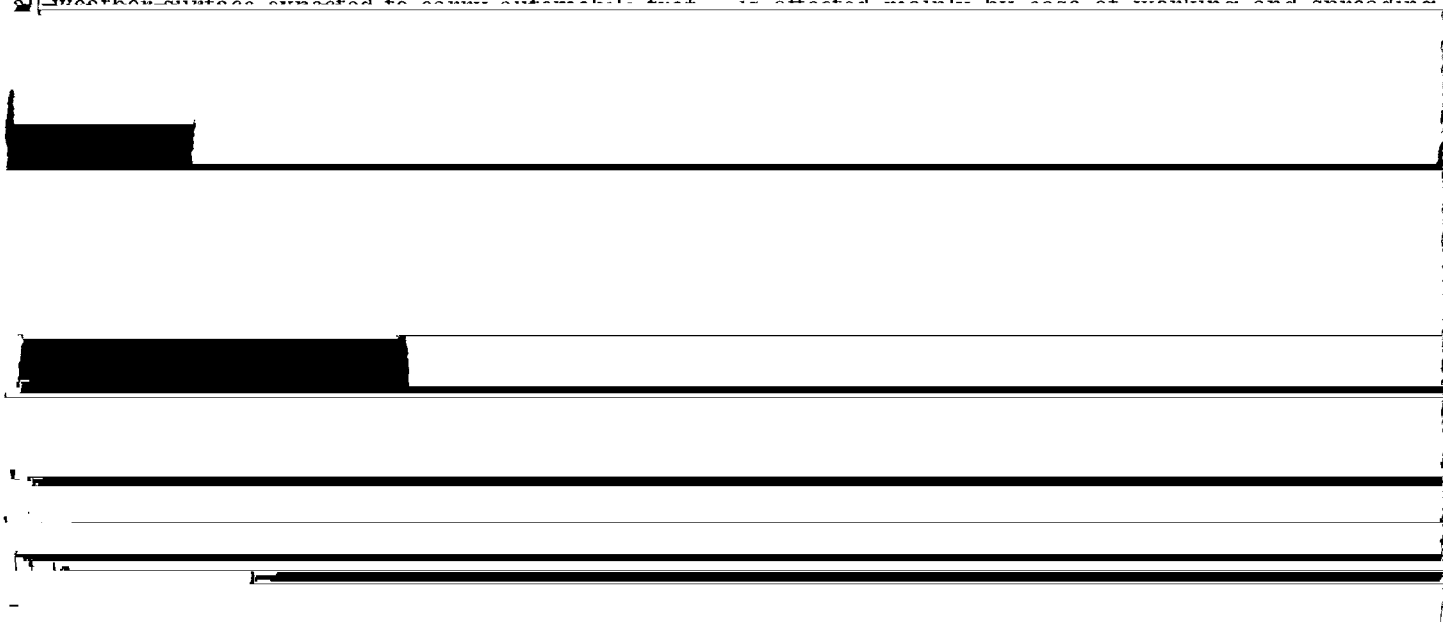
Local roads and streets, as rated in table 7, have an all-weather surface expected to carry automobile traf-

and depth to fractured or permeable bedrock or other permeable material.

Dikes, levees, and other embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among unfavorable factors.

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.

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



interpretations—Continued

Degree and kind of limitation for—Continued			Suitability as source of—		Soil features affecting—	
Local roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Drainage for crops and pasture	Terraces and diversions
Severe: shrink-swell; low	Slight	Moderate: unstable slopes;	Poor: shrink-swell; low	Poor: thin layer.	Percs slowly	Percs slowly.

TABLE 8.—*Soil*

[Tests performed by Texas Highway Department Testing Laboratory in accordance with standard

Soil name and location	Parent material	Texas report no.	Depth	Shrinkage [1]		
				Limit	Linear	Ratio
			Inches	*Percent*	*Percent*	
Crockett loam:	Shaly clay	71–29–R	0–9	23	4.7	1.61

test data

procedures of the American Association of State Highway and Transportation Officials (AASHTO) (*2*)]

Mechanical analysis [2]								Liquid limit	Plasticity index	Classification [3]	
Percentage passing sieve—					Percentage smaller than—						
3/8-in.	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHTO [4]	Unified [5]
								Percent			
------	------	------	100	95	76	19	13	33	10	A–4	CL
------	------	------	100	91	88	52	48	52	32	A–7–6	CH
------	------	------	100	86	83	44	35	57	36	A–7–6	CH
100	99	99	98	37	28	4	2	23	3	A–4	SM
100	98	97	96	63	59	46	42	46	23	A–7–6	CL
------	------	------	100	99	96	68	56	69	44	A–7–6	CH
------	------	------	100	99	95	63	55	80	54	A–7–6	CH
100	99	96	95	95	91	67	57	96	70	A–7–6	CH
------	------	------	100	84	67	14	9	24	5	A–4	CL–ML
------	------	------	100	91	83	48	41	51	34	A–7–6	CH
------	100	99	99	89	80	39	36	47	33	A–7–6	CL
------	100	99	99	77	60	9	6	21	3	A–4	ML
------	------	------	100	89	79	49	44	51	32	A–7–6	CH
------	100	99	99	76	64	30	26	41	25	A–7–6	CL
------	------	------	100	23	19	6	2	18	2	A–2–4	SM
------	------	------	100	40	37	30	27	35	19	A–6	SC
100	95	93	91	49	35	5	3	27	5	A–4	CL–ML
------	------	------	100	86	77	63	59	58	36	A–7–6	CH
------	------	100	98	68	59	29	24	41	24	A–7–6	CL

[3] Classification made by Soil Conservation Service.

[4] Based on AASHTO Designation M 145–49 (*2*).

[5] Based on Unified Soil Classification System (*3*).

Climate

Rainfall, temperature, and humidity have been important in the development of soils in the survey area. The climate is a uniform one, with warm temperatures and high humidity. Adequate rainfall favors plant

County and the eastern two-thirds of Rains County. The Wilcox group consists of mostly silty and sandy clay with local beds of silt, quartz sand, and lignite. The silty and sandy, noncalcareous clays formed soils such as Woodtell, Lufkin, and Annona. Wolfpen and Pickton soils formed in lentil sands derived mainly from the

TABLE 9.—*Classification of soil series*

Series	Family	Subgroup	Order
Annona	Fine, montmorillonitic, thermic	Vertic Paleudalfs	Alfisols.
Bazette	Fine, montmorillonitic, thermic	Udic Haplustalfs	Alfisols.
Bernaldo	Fine-loamy, siliceous, thermic	Glossic Paleudalfs	Alfisols.
Crockett	Fine, montmorillonitic, thermic	Udertic Paleustalfs	Alfisols.
Ellis	Fine, montmorillonitic, thermic	Vertic Ustochrepts	Inceptisols.
Ferris	Fine, montmorillonitic, thermic	Udorthentic Chromusterts	Vertisols.
Freestone	Fine-loamy, siliceous, thermic	Glossic Paleudalfs	Alfisols.

TABLE 10.—*Temperature and precipitation*

[Data from records kept at Sulphur Springs, 1949–71, eleva-

Month	Temperature [1]				Precipitation				
						Probability of receiving selected amounts during month			
	Average daily maximum	Average monthly highest maximum	Average daily minimum	Average monthly lowest minimum	Average total [1]	0 or trace	0.50 inch or more	1.00 inch or more	2.00 inches or more
	°F	°F	°F	°F	In	Pct	Pct	Pct	Pct
January	54.5	76.4	31.9	12.7	2.79	<1	95	88	63
February	58.2	76.7	35.1	19.9	3.49	<1	97	91	70
March	64.6	81.5	40.3	25.7	3.16	<1	99	94	75
April	74.7	86.1	50.7	37.0	5.54	<1	>99	97	88
May	81.9	91.4	59.4	45.8	5.27	<1	>99	98	88
June	89.3	97.0	67.0	58.1	3.46	5	93	85	67
July	94.3	101.3	70.5	62.4	3.23	<1	86	76	55
August	94.9	102.4	68.9	59.2	2.41	1	84	74	47
September	88.4	98.0	62.3	48.7	4.69	1	88	79	59
October	78.9	91.1	51.6	36.2	4.45	<1	90	90	59
November	66.3	82.4	40.1	24.5	3.09	<1	91	80	63
December	57.4	76.0	34.3	18.6	3.34	<1	96	91	71
Year	75.3	------	51.0	------	44.92	------	----	----	----

[1] Average length of record, 23 years.
[2] Average length of record, 16 years.

great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Hapludults (a typical Hapludult).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class

Canada bring sharp drops in temperature. Ordinarily, however, cold spells are of short duration. In a typical sequence the weather turns cold one day, reaches the lowest temperature on the second night, then warms up again on the third day. Although cloudiness is more prevalent in winter, the area continues to receive between 50 and 60 percent of the total possible sunshine during this season. Winds accompanying a vigorous cold front may be strong northerly, but these decrease rapidly after the frontal passage.

Daytime temperatures are quite warm in summer, particularly in August. Summer nights are not un-

data for Hopkins and Rains Counties

tion 495 feet. > equals more than; < equals less than]

Precipitation—Continued									
Probability of receiving selected amounts during month—Continued				Average number of days with—[2]			Snow, sleet		
3.00 inches or more	4.00 inches or more	5.00 inches or more	6.00 inches or more	0.10 inch or more	0.50 inch or more	1.00 inch or more	Average total [1]	Maximum monthly [1]	Greatest depth [2]
Pct	*Pct*	*Pct*	*Pct*				*In*	*In*	*In*
45	30	20	14	4	2	1	1.3	9.8	9
50	35	24	15	6	3	1	.2	1.5	2
54	35	20	13	5	3	1	.5	8.8	8
71	55	42	31	7	4	2	0	0	0
71	61	43	32	6	4	2	0	0	0
50	37	25	19	5	3	1	0	0	0
42	28	20	12	4	2	1	0	0	0
34	22	14	9	4	2	1	0	0	0
39	29	19	11	5	3	2	0	0	0
42	25	20	12	5	2	1	0	0	0
47	36	25	21	5	2	1	(3)	(3)	0
55	40	25	18	6	3	1	.3	3.3	3
----	----	----	----	62	33	15	2.3	9.8	----

[3] Trace, an amount too small to measure.

as it falls and is an unimportant source of moisture. More troublesome than snowfall are the occasional ice storms which do considerable damage to trees, shrubs, and utility lines, and make travel hazardous. These occur during brief periods in January and February.

The growing season (freeze-free period) in Hopkins and Rains Counties averages 238 days. The average date of the last freeze in the spring is March 23, while the average date of the first freeze in the fall is November 16.

Average annual relative humidity is about 83 percent at 6:00 a.m., Central Standard Time; 56 percent at noon; and 55 percent at 6:00 p.m. Seasonal averages vary only slightly. The area receives about 67 percent of the total possible sunshine annually. Mean annual lake evaporation is estimated to be 52 to 54 inches.

(4) Baldwin, Mark, Kellogg, Charles E., and Thorp, James. 1938. Soil classification. U.S. Dep. Agric. Yearb., pp. 970–1001 illus.

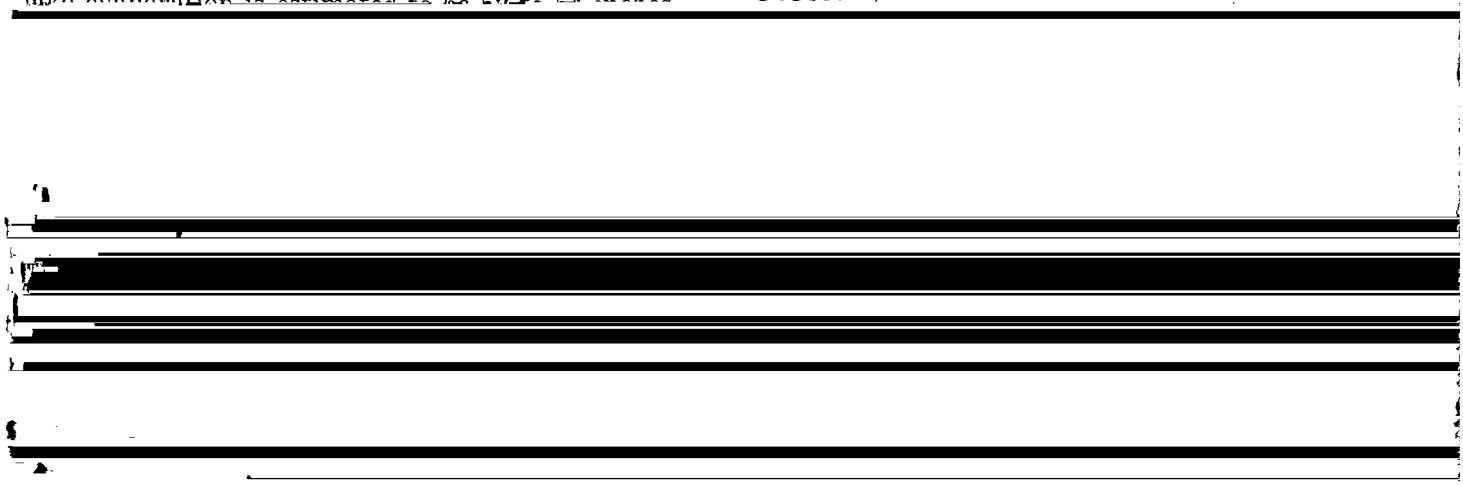
(5) Plummer, F. B. 1932. Genozoic systems in Texas. Sellards, E. H., Adkins, W. S., and Plummer, F. B. The geology of Texas: vol. 1, Stratigraphy. Univ. Texas, Bull. 3232, 1007 pp., illus.

(6) Simonson, Roy W. 1962. Soil classification in the United States. Soil Science 137: 1027–1034, illus.

(7) United States Department of Agriculture. 1960. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. [Supplements issued in March 1967 and in September 1968]

(8) _____ 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

Glossary



Violent wind or hailstorms may accompany the thunderstorms of late spring and early summer, but these are infrequent. Seven tornadoes are known to

AC soil. A soil that has an A horizon and a C horizon but no B horizon. Commonly such soils are immature, as those developing from alluvium or those on steep, rocky slopes.

the term "amendment" is used most commonly for material other than fertilizer that is added to soil.

Aspect (forestry). The direction toward which a slope faces. Synonym: Exposure.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture ca-

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

Fine-textured soils. *Moderately fine textured:* Clay loam, sandy clay loam, silty clay loam; *Fine-textured:* sandy clay, silty clay, and clay. Roughly, soil that contains 35 percent or more of clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless pro-

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Hue. One of the three variables of color. The dominant spectral (rainbow) color; it is related to the dominant wavelength of the light. See Munsell notation.

Humid climate. A climate with enough precipitation to support

source of insect infestation are removed so as to improve the quality and vigor of the stand. Thinning is an improvement cutting made in immature stands.

Increasers. Species in the climax vegetation that increase in relative amount as the more desirable plants are reduced by close grazing; increasers commonly are shorter than decreasers, and some are less palatable to livestock.

Increment (forestry). The increase in diameter, basal area, height, volume, quality, or value of individual trees or stands during a stated period.

Indicator plants (ecology). Plants that give reliable information concerning present condition and past history of an area as to soil, alkalinity, salinity, climate, depth to water table, overgrazing, fire, and the use to which the area is best adapted.

Inherited soil characteristic. Any characteristic of a soil that results directly from the nature of the material from which it formed, as contrasted to characteristics that are wholly or partly the result of soil-forming processes acting on parent material. For example, some soils are red because the parent material was red, but the color of most red soils is the result of the soil-forming processes.

Infiltration. The downward entry of water into the immedi-

tails, rushes, or other water-tolerant plants. Includes fresh-water and salt-water marshes.

Mature soil. Any soils with well-developed soil horizons having characteristics produced by the natural processes of soil formation and in near equilibrium with its present environment.

Meadow. A field in which biennial or perennial crops are grown for hay.

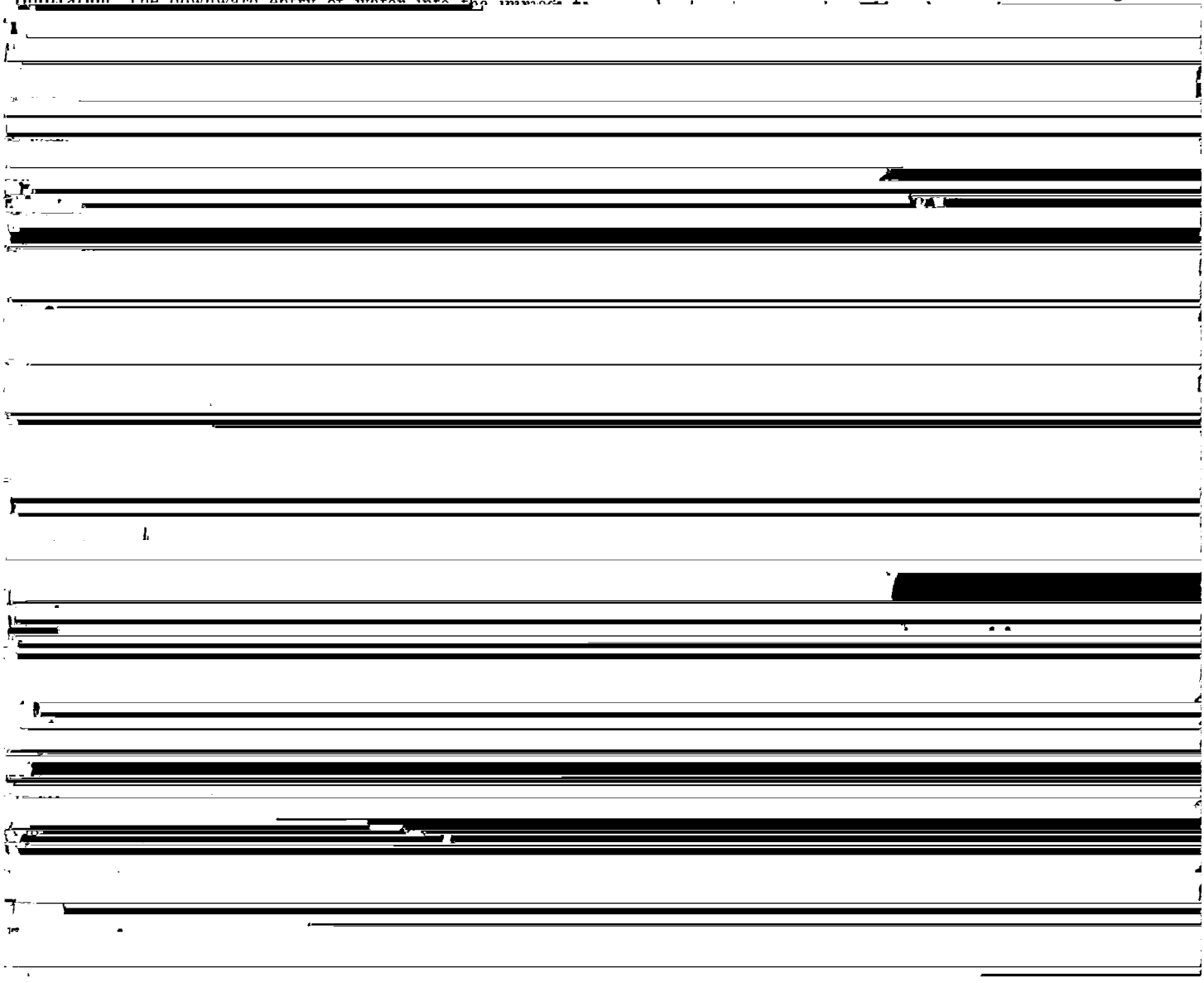
Mechanical analysis (soils). The percentage of the various sizes of individual mineral particles, or separates, in the soil. Also, a laboratory method of determining soil texture.

Mechanical stability (soils). Resistance of soil to breakdown by mechanical forces, such as tillage or abrasion from wind-borne soil particles; strength of coherence; mechanical strength.

Medium-textured soil. Soil of very fine sandy loam, loam, silt loam, or silt texture.

Mellow soil. A porous, soft, granular soil that is easily worked without becoming compacted.

Merchantable forest. Refers to the trees or part of the stand that can be marketed under given economic conditions. Merchantable length refers to the marketable length of a



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.

Neutral soil. In practice, a soil having a pH value between 6.6 and 7.3. Strictly speaking, a soil that has a pH value of 7.0

Nitrogen fixation (soils). The taking in of free nitrogen from the air by organisms in the soil

stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plantation (forestry). An area artificially reforested by planting young trees or by seeding.

Plastic (soil consistence). Capable of being deformed without

Reforestation. The natural or artificial restocking of an area with forest trees. Commonly, the term "reforestation" refers to artificial restocking.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layers, are similar in differentiating characteristics and in arrangement in the profile.

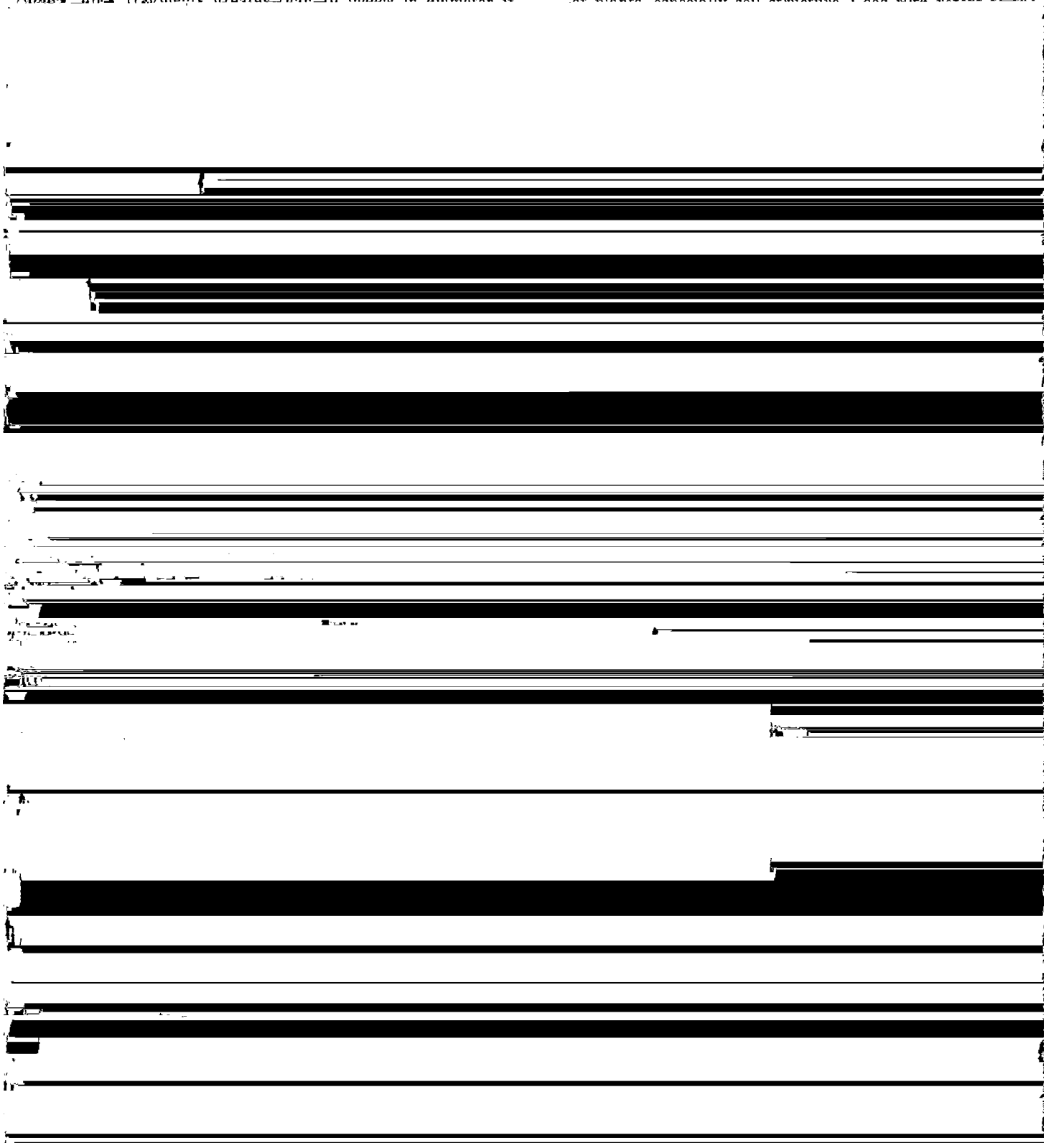
The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stones. Rock fragments greater than 10 inches in diameter if

Thin layer. Inadequate thickness of suitable soil.

Thinning (forestry). A cutting made in immature stands after the sapling stage for the purpose of increasing the rate of growth of the trees left standing.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the



GUIDE TO MAPPING UNITS

For a full description of 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 or other land use interpretative group, read the introduction to the section it is in for general information about its management. Blank spaces signify that the soil was not placed in a particular grouping.

Map symbol	Mapping unit	Described on page	Capability unit	Pasture and hayland group	Range site
			Symbol		Name
Ar	Annona-Raino complex	6	IIIw-2	8A	Claypan Savannah
BaC	Bazette clay loam, 3 to 5 percent slopes	8	IVe-1	8B	Claypan Prairie
BaD	Bazette clay loam, 5 to 12 percent slopes	8	VIe-1	8B	Claypan Prairie
BeB	Bernaldo fine sandy loam, 1 to 3 percent slopes	9	IIe-1	8C	Sandy Loam
CrA	Crockett loam, 0 to 1 percent slopes	9	IIIs-1	8A	Claypan Prairie
CrB	Crockett loam, 1 to 3 percent slopes	9	IIIe-1	8A	Claypan Prairie
CrC	Crockett loam, 3 to 5 percent slopes	10	IVe-1	8A	Claypan Prairie
CrC2	Crockett loam, 2 to 5 percent slopes, eroded	10	IVe-1	8A	Claypan Prairie
EsD	Ellis clay, 5 to 12 percent slopes	11	VIe-2	7B	Eroded Blackland
FeD2	Ferris clay, 5 to 12 percent slopes, eroded	11	VIe-2	7B	Eroded Blackland
FrB	Freestone fine sandy loam, 1 to 3 percent slopes	12	IIe-2	8C	Sandy Loam
Gw	Gladewater clay	13	Vw-2	1B	Clayey Bottomland
HeC2	Heiden clay, 3 to 5 percent slopes, eroded	15	IIIe-3	7A	Blackland
Ho	Hopco silty clay loam	15	Vw-1	2A	Loamy Bottomland
Ka	Kaufman clay	16	Vw-2	1A	Clayey Bottomland
KnD	Kirvin gravelly fine sandy loam, 3 to 8 percent slopes	16	IVe-2	8C	Sandy Loam
KvD	Kirvin soils, 3 to 8 percent slopes	17	VIe-3	8C	Sandy Loam
LeB	Leson clay, 1 to 3 percent slopes	17	IIe-3	7A	Blackland
LeC	Leson clay, 3 to 5 percent slopes	18	IIIe-3	7A	Blackland
Lr	Lufkin-Raino complex	18	IIIw-2	8E	Claypan Savannah
Na	Nahatche soils	19	Vw-1	--	Loamy Bottomland
PkC	Pickton loamy fine sand, 1 to 5 percent slopes	20	IIIs-3	9B	Deep Sand
WcB	Wilson clay loam, 0 to 2 percent slopes	21	IIIw-1	7H	Claypan Prairie
WoC	Wolfpen loamy fine sand, 1 to 5 percent slopes	22	IIIs-2	9A	Sandy
WtC	Woodtell loam, 2 to 5 percent slopes	24	IIIe-2	8A	Claypan Savannah
WtD	Woodtell loam, 5 to 12 percent slopes	24	VIe-1	8B	Claypan Savannah
WwC	Woodtell stony loam, 1 to 5 percent slopes	25	VIIs-1	--	Claypan Savannah

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