SOIL SURVEY OF

MAVERICK COUNTY, TEXAS

ELECTRONIC VERSION

This soil survey is an electronic version of the original printed copy, dated November 1977. It has been formatted for electronic delivery. Additional and updated information may be available from the Web Soil Survey. In Web Soil Survey, identify an Area of Interest (AOI) and navigate through the AOI Properties panel to learn what soil data is available.

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 1965-71. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. 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 Maverick Soil and Water Conservation District and the Chaparal 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 and ranches; 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 Maverick 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 areas 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, Removed" 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 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 the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites.

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, for industrial buildings, and for recreation areas in the sections "Recreation" and "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 how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Maverick 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 "Additional Facts About the County."

Cover: Typical area of Bracket-Rock outcrop association, hilly, characterized by rounded hills and a benched or stairstep appearance.

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SOIL SURVEY OF MAVERICK COUNTY, TEXAS

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IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION**

MAVERICK COUNTY is in the northwestern part of the Rio Grande Plain in Texas (fig. 1). The county has an area of 1,289 square miles, or 824,960 acres. The county seat is at Eagle Pass, the major town in the county. Smaller communities include Quemado, Normandy, and El Indio.

Raising beef cattle is the main enterprise in the county. About 92 percent of the acreage is rangeland. About 5 percent is in irrigated crops, pasture, and orchards. Forage sorghums, alfalfa, and small grain are the main crops. Grain sorghum, vegetables, and pecans are also grown.

Water for irrigation mainly comes from the Rio Grande by a network of canals. A small amount of irrigation water comes from deep wells in the eastern part of the county.

Wildlife is an important resource in the county. Many landowners lease their land for hunting, and this has been an important source of income to many.

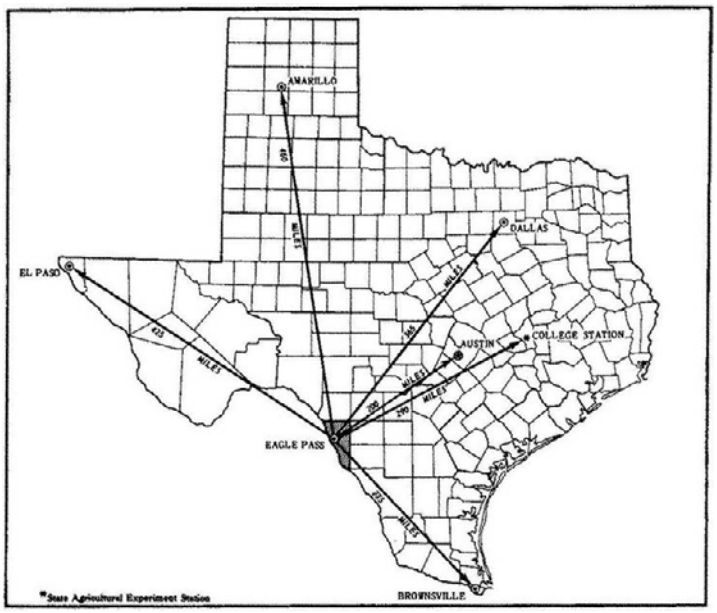

Figure 1.—Location of Maverick County in Texas.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Maverick County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and

many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

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

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

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soil 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, Elindio silty clay loam, 0 to 1 percent slopes, is one of several phases within the Elindio series.

After a guide for classifying and naming the soils had been worked out. The soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map 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 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. Two such kinds of mapping units are shown on the soil map of Maverick County: soil associations and undifferentiated groups.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly from one to another. Dant association, gently undulating, is an example of a soil association in Maverick County.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the 'soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Rio Grande and Zalla soils is an example.

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 its 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 studies 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 Maverick County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, drainage, and other characteristics that affect their management.

The soil associations in Maverick County are discussed in the following pages.

1. Copita-Pryor-Dant association

Nearly level to gently sloping and undulating, moderately deep and deep, sandy clay loams and clay loams

This association consists of moderately permeable to slowly permeable soils on broad, smooth upland plains. Slopes are mainly 1 to 3 percent but range from 0 to 5 percent.

This association makes up about 37 percent of the county. It is about 39 percent Capita soils, 23 percent Pryor soils, and 7 percent Dant soils. The remaining 31 percent is mainly Catarina, Darl, Elindio, Mavco, Maverick, Montell, Olmos, and Verick soils.

Copita soils are moderately deep. They have a surface layer of grayish-brown sandy clay loam about 12 inches thick. The next layer is sandy clay loam that is moderately permeable. The underlying material is cemented sandstone.

Pryor soils are deep. They have a surface layer of grayish-brown clay loam about 8 inches thick. The next layer is clay loam and clay that is slowly permeable. The underlying material is clayey shale.

Dant soils are deep. They have a surface layer of dark grayish-brown clay loam about 11 inches thick. Below this is clay that is slowly permeable.

Most of this association is used for range and wildlife habitat. The soils in this association are marginal for dryland farming, because rainfall is low and the evaporation rate is high. Most of the acreage is in large ranch units, and very little is cultivated. A small acreage is irrigated and is in perennial introduced grasses, grain sorghum, and small grain. Much of this association could be irrigated if an adequate water supply were available.

Wildlife in the association is mainly deer, javelina, dove, and quail. Scattered ranch ponds provide good fishing.

2. Elindio-Montell association

Nearly level to gently sloping, deep silty clay loams and clays

This association consists of moderately permeable to very slowly permeable soils in broad, smooth areas on uplands. Slopes are mainly less than 1 percent but range from 0 to 3 percent.

This association makes up about 26 percent of the county. It is about 40 percent Elindio soils and 40 percent Montell soils. The remaining 20 percent is mainly Copita, Dant, Darl, Mavco, Olmos, and Zapata soils.

Elindio soils have a surface layer of dark grayish-brown silty clay loam about 15 inches thick. The underlying material is clay loam that is moderately permeable.

Montell soils have a surface layer of gray clay that is about 28 inches thick. The underlying material is clay that is very slowly permeable.

Most of this association is used for range and wildlife habitat. The soils in this association are marginal for dryland farming, because rainfall is low and the evaporation rate is high. Most of the acreage is in large ranch units, and very little is cultivated. A small acreage is irrigated and is in such crops as perennial introduced grasses, grain sorghum, and small grain. A large part of this association could be irrigated if an adequate water supply were available.

Wildlife is generally plentiful in this association. The main kinds are deer, javelina, dove, and quail. Deer and some of the other species may be scarce in some of the broader, more open areas. Scattered ranch ponds provide very good fishing.

3. Jimenez-Olmos-Zapata association

Rolling to undulating, very shallow and shallow very gravelly loams and loams

This association consists of moderately permeable soils on broad, uneven to broken, old, high terraces and uplands. Slopes are mainly 1 to 8 percent but range to 12 percent.

This association makes up about 13 percent of the county. It is 43 percent Jimenez soils, 11 percent Olmos soils, and 11 percent Zapata soils. The remaining 35 percent is mainly Copita, Darl, Elindio, Mavco, Quemado, and Verick soils.

Jimenez soils are very shallow to shallow. They have a surface layer of dark grayish-brown very gravelly loam about 9 inches thick. The underlying material is strongly cemented caliche.

Olmos soils are very shallow to shallow. They have a surface layer of dark grayish-brown very gravelly loam about 11 inches thick. The underlying material is indurated caliche.

Zapata soils are very shallow. They have a surface layer of light brownish-gray loam about 8 inches thick. The underlying material is indurated caliche.

Most of this association is used for range and wildlife habitat. Areas of these soils are a source of caliche that is used for construction purposes, especially as base material for road construction. Many small, open-pit caliche mines are in these areas.

Wildlife is generally less plentiful in this association because good cover, food, and water are not available.

4. Catarina-Maverick association

Gently sloping and gently undulating to undulating, deep and moderately deep clays

This association consists of slowly permeable to very slowly permeable soils in broad, uneven areas on uplands. Slopes are mainly 0 to 3 percent but range from 0 to 5 percent.

This association makes up about 11 percent of the county. It is about 60 percent Catarina soils and 18 percent Maverick soils. The remaining 22 percent is mainly Brundage, Copita, Dant, Elindio, Mavco, Montell, Olmos, Pryor, and Verick soils.

Catarina soils are deep. They have a surface layer of grayish-brown clay about 22 inches thick. The underlying material is clay that is very slowly permeable.

Maverick soils are moderately deep. They have a surface layer of grayish-brown clay about 5 inches thick. The underlying material is clay that is slowly permeable.

Most of this association is used for range and wildlife habitat. A few small areas are irrigated and are in crops for grazing.

Wildlife in the association is mainly deer, javelina, dove, and quail. Scattered ranch ponds provide good fishing.

5. Brundage-Dant association

Nearly level to gently undulating, deep fine sandy loams and clay loams

This association consists of very slowly permeable to slowly permeable soils in narrow areas in upland drainageways. Slopes are mainly less than 1 percent but range from 0 to 3 percent.

This association makes up about 7 percent of the county. It is about 58 percent Brundage soils and 15 percent Dant soils. The remaining 27 percent is mainly Catarina, Elindio, Montell, and Pryor soils.

Brundage soils have a surface layer of light brownish-gray fine sandy loam about 3 inches thick. The underlying material is sandy clay loam that is very slowly permeable.

Dant soils have a surface layer of dark grayish-brown clay loam about 11 inches thick. The underlying material is clay that is slowly permeable.

Most of this association is used for range and wildlife habitat.

Wildlife is plentiful in this association. Scattered ranch ponds provide good fishing.

6. Lagloria-Laredo association

Nearly level to gently sloping, deep very fine sandy loams and silty clay loams

This association consists of moderately permeable soils on stream terraces. Slopes are mainly less than 1 percent but range from 0 to 3 percent.

This association makes up about 4 percent of the county. It is about 35 percent Lagloria soils and 19 percent Laredo soils. The remaining 46 percent is mainly Elindio, Montell, Reynosa, Rio Grande, and Zalla soils.

Lagloria soils have a surface layer of light brownish-gray very fine sandy loam about 18 inches thick. The underlying material is very fine sandy loam.

Laredo soils have a surface layer of dark grayish-brown silty clay loam about 18 inches thick. The underlying material is silty clay loam and silt loam.

Most of this association is used for irrigated crops or for pasture and hay. A few areas are in native vegetation. Some farmland has been abandoned because of salt buildup in the soils. The areas of native vegetation are mainly on the first terrace above the river channel.

Deer, quail, and dove are the main kinds of wildlife in the association. The deer are mostly in areas of native vegetation, and the quail and dove are in the open

cultivated areas when food is available. The Rio Grande and the main irrigation canals provide good fishing.

7. Brystal association

Gently undulating, deep fine sandy loams

This association consists of moderately permeable soils on uplands. Slopes are mainly about 2 percent but range from 0 to 3 percent.

This association makes up about 2 percent of the county. About 50 percent is Brystal soils. About 30 percent is soils that are very similar to Brystal soils but have sandstone within 60 inches of the surface. The remaining 20 percent is mainly Brundage, Copita, Darl, and Pryor soils, and a soil similar to Brystal soils except for a clayey layer about 10 inches below the surface.

The Brystal soils have a surface layer of reddish-brown fine sandy loam about 7 inches thick. The underlying material is sandy clay loam.

Most of the soils in this association are used for range and wildlife habitat. A small acreage is in irrigated crops and perennial introduced grasses.

Much of this association could be irrigated if an adequate water supply were available.

Wildlife is plentiful and includes such species as deer, javelina, dove, and quail.

Descriptions of the Soils

This section describes the soil series and mapping units in Maverick County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be 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 rock or other 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. Color terms are for dry soil unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described as representative for the series, these differences are stated in describing the mapping unit, or they are differences that 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 interpretive group in which the mapping unit has been placed.

The 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 at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.(1)

Brundage Series

The Brundage series consists of deep, nearly level, noncalcareous, loamy soils along small drainageways in narrow valleys. These soils formed in saline loamy sediment.

In a representative profile the surface layer is light brownish-gray, slightly acid fine sandy loam about 3 inches thick. The next layer extends to a depth of 38 inches. In sequence downward, it is 6 inches of grayish-brown, mildly alkaline sandy clay

loam; 15 inches of brown, calcareous sandy clay loam; and 14 inches of very pale brown, calcareous sandy clay loam that has a few lime masses. The underlying material, to a depth of 78 inches, is pale-yellow sandy clay loam that is faintly mottled.

Brundage soils are moderately well drained. Permeability is very slow. Runoff is slow. Available water capacity is low. The hazard of erosion is slight. Harmful salt affects some plants.

Most areas of these soils are used for range and wildlife habitat.

Representative profile of Brundage fine sandy loam in an area of Brundage association, nearly level, 2.3 miles east on U.S. Highway 277 from courthouse in Eagle Pass, 14.6 miles northeast on Texas Highway 57, 4.2 miles southwest on pipeline road, 150 feet west in area of range:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; slightly hard, very friable; common fine roots; 1/4 inch platy crust on surface; slightly acid; abrupt, smooth boundary.

B21t—3 to 9 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium and coarse, columnar structure parting to moderate, fine and medium, subangular blocky and angular blocky; thin light-gray (10YR 7/2) caps about 1 millimeter to 5 millimeters thick on columns; very hard, firm; few fine roots; very few fine pores and root channels; patchy clay films on ped surfaces; mildly alkaline; clear, wavy boundary.

B22t—9 to 24 inches, brown (10YR 5/3) sandy clay loam-dark brown (10YR 4/3) moist; weak, medium and coarse, columnar structure parting to moderate, fine and medium, subangular blocky; hard, firm; few fine roots; very few fine pores and old root channels; few patchy clay films on ped surfaces; few lumps 1 millimeter to 2 millimeters thick and few threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B3tca—24 to 38 inches, very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few fine roots; few fine and medium pores and root channels; about 3 percent, by volume, soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—38 to 78 inches, pale-yellow (2.5Y 7/4) sandy clay loam, light yellowish brown (2.5Y 6/4) moist; few, fine and medium, faint mottles of yellowish brown (10YR 5/4) and olive yellow (2.5Y 6/6); weak, fine and medium, subangular blocky structure; hard, friable; about 10 percent, by volume, soft masses of calcium carbonate as much as 1 centimeter in diameter; calcareous; moderately alkaline.

The solum ranges from 22 to 48 inches in thickness. The A horizon is brown, grayish-brown, pale-brown, very pale brown, light brownish-gray, or light-gray fine sandy loam or loam. It is medium acid to neutral in reaction. The Bt horizon is dark grayish-brown, grayish-brown, brown, light brownish-gray, light yellowish-brown, light-gray, or very pale brown sandy clay loam or clay loam. It is slightly acid to mildly alkaline in the upper part and is mildly alkaline or moderately alkaline in the lower part. It is high in content of exchangeable sodium and medium to high in salinity. The C horizon contains visible segregations of calcium carbonate or calcium sulfate in soft lumps and concretions that make up about 2 percent to as much as 20 percent, by volume, of the horizon. In some profiles are threads and small pockets of salts other than calcium carbonate or calcium sulfate.

BRA—Brundage association, nearly level. The soils in this association are in areas that are much greater in length than in width and average about 500 acres in size. Slopes are mainly concave, but in a few places they are convex. They average about 0.5 percent but range from 0 to 1 percent. These soils are transected by small meandering creeks that have narrow and shallow channels. They are occasionally flooded when these creeks overflow their banks after heavy, short-duration rains. The water remains on the soils for only a few hours after rainfall ceases. Bare, crusted areas are common between the channels.

This association is about 80 percent Brundage soils. The remaining 20 percent is mainly Copita, Dant, Montell, and Pryor soils. The Copita, Pryor, and Dant soils are slightly higher than Brundage soils and are on small knolls or along the outer edges of the association. Montell soils are slightly lower than Brundage soils. The soils in this association could have been separated in mapping, but because the present use and management are very similar, the separation was not justified.

Most areas of these soils are used for range and wildlife habitat. Hardland range site.

Brystal Series

The Brystal series consists of deep, gently undulating, noncalcareous, loamy soils on uplands. These soils formed in loamy materials interbedded with sandstone.

In a representative profile the surface layer is reddish-brown, neutral fine sandy loam about 7 inches thick. The next layer extends to a depth of 80 inches. In sequence downward, it is 11 inches of reddish-brown, friable sandy clay loam, 15 inches of yellowish-red, friable sandy clay loam, 29 inches of reddish-yellow sandy clay loam that is about 5 percent soft lime masses and concretions, and 18 inches of reddish-yellow sandy clay loam that is about 2 percent soft lime masses and concretions.

Brystal soils are well drained. They are moderately permeable. Runoff is slow to medium. Available water capacity is medium. The hazard of erosion is slight.

Almost all areas of these soils are used for range and wildlife habitat. A few small irrigated fields are planted to cotton, sorghum for grain and forage, and small grain.

Representative profile of a Brystal fine sandy loam in an area of Brystal soils, gently undulating, 16.5 miles west of LaPryor on Texas Highway 57, 0.35 miles west of Maverick-Zavala County line marker on Texas Highway 57, 200 feet north in area of range:

A1—0 to 7 inches, reddish-brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/3) moist; weak, fine, subangular blocky structure; slightly hard, very friable; many fine roots, fine pores, and old root channels; thin surface crust; neutral; clear, smooth boundary.

B1—7 to 12 inches, reddish-brown (5YR 4/4) sandy clay loam; dark reddish brown (5YR 3/4) moist; weak, medium, prismatic structure parting to weak, fine and medium, subangular blocky; hard, friable; common fine roots, fine pores, and old root channels; sand grains bridged with clay; neutral; gradual, smooth boundary.

B21t—12 to 18 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak, medium, prismatic structure parting to moderate, fine and medium, subangular blocky; very hard, friable; common fine roots, fine pores, and old root channels; few patchy clay films on surface of peds and in pores; few ironstone fragments 1 millimeter to 2 millimeters in diameter; neutral; gradual, wavy boundary.

B22t—18 to 25 inches, yellowish-red (5YR 4/6) sandy clay loam, yellowish red (5YR 3/6) moist; weak, medium, prismatic structure parting to moderate, fine and medium, subangular blocky; very hard, friable; few fine roots,

fine pores, and old root channels; few patchy clay films on surface of peds and in pores; few ironstone fragments 1 millimeter to 2 millimeters in diameter; neutral; gradual, wavy boundary.

B23t—25 to 33 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; few, fine, faint, red and reddish-brown mottles; weak and moderate, fine and medium, subangular blocky structure; hard, friable; few fine roots, fine pores, and old root channels; few patchy clay films on surface of peds and in pores; few soft masses of calcium carbonate; mildly alkaline; clear, wavy boundary.

B31tca—33 to 62 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) when moist; few, fine, faint, strong-brown and reddish-brown mottles; weak, fine, subangular blocky structure; few fine splotches of uncoated sand grains; slightly hard, very friable; few patchy clay films; few fine and medium pores; about 5 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B32tca—62 to 80 inches, reddish-yellow (7.5YR 7/6) sandy clay loam; reddish yellow (7.5YR 6/6) moist; few, fine, faint, reddish-brown and brown mottles; weak, fine, subangular blocky structure; few fine splotches of uncoated sand grains; about 2 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to 90 inches in thickness. Secondary lime is at a depth of about 20 to 35 inches. The A horizon is 6 to 15 inches thick. It is brown or reddish-brown fine sandy loam to loamy fine sand. It is neutral to mildly alkaline in reaction. The Bt horizon ranges from sandy loam to sandy clay loam. The upper part is brown, strong brown, reddish yellow, reddish brown, or yellowish red. The lower part is reddish yellow, yellowish red, strong brown, brownish yellow, pink, light brown, very pale brown, or light yellowish brown. The lower part of the Bt horizon is less clayey than the upper part, and uncoated sand grains are few to common. It has few to as much as 25 percent soft masses and concretions of visible calcium carbonate. The C horizon in places has weakly to moderately consolidated sandstone below a depth of 60 inches.

BYB—Brystal soils, gently undulating. The soils in this mapping unit are in areas that are irregular in shape and are mainly less than 50 acres in size. Slopes are mainly convex. They average about 2 percent but they range from 0 to 3 percent.

This mapping unit is about 40 percent Brystal soils that have slopes of 1 to 3 percent and about 10 percent Brystal soils that have slopes of 0 to 1 percent. About 35 percent is soils that are similar to Brystal soils but have sandstone within 60 inches of the surface. About 10 percent is soils that are similar to Brystal soils but have a moderately slowly permeable, more clayey layer about 10 inches below the surface. The remaining 5 percent is mainly Copita and Darl soils. The soils that have sandstone within 60 inches of the surface, the Copita soils, and the Darl soils are mainly in the highest positions on the landscape. The soils that have more clayey layers below the surface are mainly in the lowest positions on the landscape. The soils in this mapping unit could have been separated in mapping, but because the present use and management are very similar, the separation could not be justified.

The soils in this mapping unit are used mostly for range. Sandy Loam range site.

Catarina Series

The Catarina series consists of deep, gently undulating, calcareous, clayey soils on uplands. These soils formed in saline clays and shaly clays.

In a representative profile the surface layer is grayish-brown clay about 22 inches thick. The next layer extends to a depth of 52 inches. The upper 14 inches is grayish-

brown, very firm clay that has a few lime masses, and the lower 16 inches is light yellowish-brown clay that has a few masses and threads of salt. The underlying material, to a depth of 78 inches, is pale-yellow clay that is about 5 percent lime masses and 5 percent gypsum crystals (fig. 2).

Figure 2.—Profile of a Catarina clay showing cracks throughout the profile.

Catarina soils are moderately well drained. They are very slowly permeable. Runoff is slow to medium. Available water capacity is low. The hazard of erosion is moderate. Salinity affects some plants.

Most areas of these soils are used for range and wildlife habitat. A few small areas are irrigated and are in Coastal bermudagrass or oats for grazing.

Representative profile of a Catarina clay in an area of Catarina association, gently undulating, 2.3 miles east on U.S. Highway 277 from courthouse in Eagle Pass, 14.6 miles northeast on Texas Highway 57, 8.5 miles southwest on pipeline road, 100 feet south in an area of range:

A11—0 to 12 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak, fine and medium, blocky and subangular blocky structure: extremely hard, very firm; few fine roots; few chert pebbles in

soil mass and on surface; calcareous; moderately alkaline; gradual, smooth boundary.

A12—12 to 22 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, blocky structure; extremely hard, very firm; few fine roots; few chert pebbles; intersecting slickensides; calcareous; moderately alkaline; saline; gradual, wavy boundary.

AC1—22 to :36 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 412) moist; moderate, fine and medium, blocky structure; extremely hard, very firm; few fine roots; intersecting slickensides; few calcium carbonate masses 1 millimeter to 2 millimeters in diameter; calcareous; moderately alkaline; saline; gradual, wavy boundary.

AC2ca—36 to 52 inches, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak, fine and medium, blocky structure; extremely hard, very firm; few fine roots; few narrow tongues filled with darker clay; few slickensides; few soft masses of calcium carbonate 1 millimeter to 5 millimeters in diameter; few small masses and threads of other neutral salts; calcareous; moderately alkaline; saline; diffuse, wavy boundary.

Ccacs—52 to 78 inches, pale-yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; weak, fine and medium, blocky structure; extremely hard, very firm; few fine pores; about 5 percent, by volume, soft masses of calcium carbonate and 5 percent, by volume, gypsum crystals; calcareous; moderately alkaline; saline.

Tbe solum ranges from 35 to 60 incbes or more in thickness. In places the content of exchangeable sodium is in excess of 15 percent in the upper 30 inches of the solum. Salinity is low or moderate in the A horizon and moderate or high in the AC and C horizons. When dry, the profile has cracks 1/2 inch to 2 inches wide and more than 12 inches long that extend to a depth of 24 to 40 inches. The A horizon is 15 to 24 inches in thickness. It ranges from grayish brown to pale olive. The AC horizon is light yellowish brown, grayish brown, or pale olive. The C horizon bas few to about 20 percent gypsum crystals. It is pale yellow, yellowish brown, or olive brown.

CAB—Catarina association, gently undulating. The soils of this association are in areas that are irregular in shape and more than 200 acres in size. Slopes are mainly convex. They average about 2 percent but range from 0 to 5 percent.

This association is about 40 percent Catarina soils that have slopes of 0 to 1 percent, 35 percent Catarina soils that have slopes of I to 3 percent, and 5 percent Catarina soils that have slopes of 3 to 5 percent. The remaining 20 percent is mainly Dant, Maverick, Montell, and Pryor soils. The Dant, Maverick, and Pryor soils are in the higher positions on the landscape. Maverick and Pryor soils are slightly higher than Dant soils in areas where they occur together. The Montell soils are in about the same positions or in slightly lower positions than Catarina soils. The soils in this association could have been separated in mapping, but because present use and management are similar, their separation could not be justified.

The salinity of these soils is low to medium in the surface layer and medium to high in the lower layers.

Most areas of these soils are used for range and wildlife habitat. A few small areas are irrigated and are in Coastal bermudagrass or oats for grazing. Saline Clay range site.

Copita Series

The Copita series consists of moderately deep, nearly level to gently sloping and gently undulating, calcareous, loamy soils on uplands. These soils formed in loamy sediment over sandstone.

In a representative profile the surface layer is grayish-brown sandy clay loam about 12 inches thick. The next layer extends to a depth of 30 inches. The upper part is 9 inches of brown, friable sandy clay loam, and the lower part is pale-brown, friable sandy clay loam. The next layer, about 5 inches thick, is very pale brown, sandy clay loam that is about 15 percent soft masses of calcium carbonate. The underlying material, at a depth of 60 inches, is light-gray sandstone that has small amounts of visible calcium carbonate.

Copita soils are well drained. Permeability is moderate. Runoff is slow to medium. Available water capacity is medium. The hazard of erosion is slight to moderate.

Nearly all areas of the Copita soils are used for range and wildlife habitat. A few areas are irrigated.

Representative profile of a Copita sandy clay loam in an area of Copita association, gently undulating, 2.3 miles east on U.S. Highway 277 from the courthouse in Eagle Pass, 12.2 miles northeast on Texas Highway 57, 1.75 miles north on Farm Road 3078, 100 feet west in an area of range:

A1—0 to 12 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; hard, friable; common fine roots; few fine pores and root channels; few fine calcium carbonate masses and threads; calcareous; moderately alkaline; clear, smooth boundary.

B21—12 to 21 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak, fine and medium, subangular blocky structure; hard, friable; few fine roots; few fine pores and root channels; few snail shell fragments; few films and threads and calcium carbonate masses 1 millimeter to 2 millimeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B22—21 to 30 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak, fine and medium, subangular blocky structure; hard, friable; very few fine roots; few fine pores and root channels; few snail shell fragments; about 2 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—30 to 35 inches, very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; weak, fine, subangular blocky structure; hard, friable; common fine and medium pores; 15 percent, by volume, calcium carbonate masses to as large as 15 millimeters in diameter; calcareous; moderately alkaline; abrupt, wavy boundary.

C—35 to 60 inches, light-gray (10YR 7/1) sandstone, gray (10YR 6/1) moist; few, fine and medium, distinct streaks and splotches of yellowish brown, strong brown and reddish brown, moderately cemented; seams and fractures with calcium carbonate.

The solum ranges from 20 to 40 inches in thickness over weakly to strongly cemented sandstone. The A horizon ranges from 6 to 16 inches in thickness. It is grayish brown, light brownish gray, brown, pale brown, or light olive brown. It is fine sandy loam or sandy clay loam in texture. The B horizon is brown, pale brown, very pale brown, light yellowish brown, or pale yellow. It is fine sandy loam, sandy clay loam, or clay loam. The lower part of the B horizon is 5 to 25 percent soft masses or concretions of visible carbonates. The C horizon is grayish, brownish, or yellowish, weakly cemented to strongly cemented sandstone that is commonly mottled.

CfB—Copita fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is in areas that are irregular in shape and are mostly more than 75 acres in size. Slopes are convex. They average about 1.5 percent but range from 1 to 3 percent.

The surface layer is brown fine sandy loam about 10 inches thick. The next layer, about 8 inches thick, is brown, friable sandy clay loam. The next layer, between depths of 18 and 30 inches, is pale-brown, friable sandy clay loam that is about 15 percent soft masses of lime. The underlying material is very pale brown sandstone.

Included with this soil in mapping are areas of Copita sandy clay loam, Mavco soils, and Verick soils. The Copita sandy clay loam and Mavco soils are in slightly lower areas than Verick soils. Verick soils are on small knolls or along outer areas of this Copita soil.

Most areas of this soil are irrigated and planted to oats, Coastal bermudagrass, and buffelgrass. The hazard of erosion is moderate.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed on irrigated land to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs. Terraces and contour farming are needed in places when using sprinkler irrigation.

The principal plants suitable for pasture and hay are improved bermudagrass and buffelgrass. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIe-1, irrigated; pasture and hayland group 8C.

CoA—Copita sandy clay loam, 0 to 1 percent slopes. This nearly level soil has plane to weakly convex slopes. Slopes average about 0.5 percent but range from 0 to 1 percent. Areas are irregular in shape and average about 50 acres in size.

The surface layer is about 12 inches of friable sandy clay loam that is light brownish gray in the upper part and grayish brown in the lower part. The next layer is about 26 inches of friable sandy clay loam that is pale brown in the upper 16 inches and very pale brown in the lower 10 inches. It has about 5 percent limy masses in the lower part. The underlying material is yellowish, weakly cemented sandstone that has pockets of sandy clay loam.

Included with this soil in mapping are areas of Mavco and Pryor soils, which are in slightly lower positions than this Copita soil.

Most areas of this soil are irrigated cropland. The major crops are grain sorghum, Coastal bermudagrass, and oats for grazing.

The hazard of erosion is slight.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed on irrigated land to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass and buffelgrass. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIs-3, irrigated; pasture and hayland group 8C.

CoB—Copita sandy clay loam, 1 to 3 percent slopes. This gently sloping soil has slopes that are mainly convex. They are about 1.5 percent but range from 1 to 3 percent. Soil areas are irregular in shape and average about 100 acres in size.

The surface layer is about 12 inches of friable sandy clay loam that is light brownish gray in the upper part and grayish brown in the lower part. The next layer is 25 inches of very pale brown, friable sandy clay loam that has a few limy masses in the upper 12 inches and about 5 percent limy masses in the lower 13 inches. The underlying material is yellowish, weakly cemented sandstone.

Included with this soil in mapping are areas of Mavco, Pryor, and Verick soils. Mavco and Pryor soils are in slightly lower positions than this Copita soil. Verick soils are on small knolls or on the outer edges of areas of this Copita soil.

Most areas of this soil are irrigated and are planted to sorghum grain, Coastal bermudagrass, and oats for grazing.

The hazard of erosion is moderate.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed on irrigated land to control soil and water losses and to minimize salt accumulation in the soil. Leaching of the soil may be needed where salt buildup occurs. Terraces and contour farming are needed in places when using sprinkler irrigation.

The principal plants suitable for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, blue panicum, and buffelgrass. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIe-1, irrigated; pasture and hayland group 8C.

CPB—Copita association, gently undulating. These soils are in areas that are irregular in shape and aver-age about 50 acres in size. Slopes are complex. They range from 0 to 3 percent but average about 1.5 percent.

This association is about 50 percent Copita sandy clay loam, 1 to 3 percent slopes, about 20 percent Copita sandy clay loam, 0 to 1 percent slopes, and about 10 percent Copita fine sandy loam that has slopes of 0 to 1 percent. The remaining 20 percent is mainly Mavco, Pryor, Verick, and Zapata soils. The Copita fine sandy loams are mostly on the higher elevations in the area, but they are slightly below the Verick and Zapata soils where these soils are present. The Mavco and Pryor soils are in positions similar to those of Copita sandy clay loams. The soils in this association could have been separated in mapping, but because present use and management are similar, the separation could not be justified.

A Copita sandy clay loam in this association has the profile described as representative of the Copita series. The hazard of erosion is slight.

Most areas of these soils are used for range and wildlife habitat. Gray Sandy Loam range site.

Dant Series

The Dant series consists of deep, gently undulating, loamy soils on uplands. These soils formed in calcareous clay.

In a representative profile the surface layer is dark grayish-brown clay loam about 11 inches thick. The next layer extends to a depth of 50 inches. The upper 30 inches is grayish-brown clay, and the lower 9 inches is light brownish-gray, very firm clay. The underlying material, to a depth of about 72 inches, is very pale brown clay that has small to moderate amounts of visible lime and gypsum.

Dant soils are well drained. They are slowly permeable. Runoff is slow to medium. Available water capacity is high. The hazard of erosion is moderate.

Nearly all areas of these soils are used for range and wildlife habitat. A few small areas are irrigated and are mainly in small grain and sorghum for grain and forage.

Representative profile of Dant clay loam in an area of Dant association, gently undulating, about 24 miles northeast of Eagle Pass, in an area of range 150 feet north of Texas Highway 57, 3.5 miles southwest of Maverick-Zavala County line:

A1—0 to 11 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine roots; 1/8- to 1/4-inch crust on surface

that is slightly lighter in color and more sandy; calcareous; moderately alkaline; clear, smooth boundary.

B21—11 to 19 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, blocky and subangular blocky structure; very hard, firm; many fine roots; few fine pores and old root channels; some ped surfaces have shiny faces; vertical cracks 1/4 to 5/16 inch wide; calcareous; moderately alkaline; gradual, wavy boundary.

B22—19 to 41 inches, grayish-brown (10YR 5/2) clay, dark grayish-brown (10YR 4/2) moist, slightly lighter colored than B21; weak prismatic structure parting to moderate, medium and coarse, blocky; extremely hard, very firm; few roots in upper part, which diminish with depth; roots are mainly between peds; few fine pores; some organic staining on ped faces; peds have shiny faces presumed to be pressure planes; vertical cracks 1/4 to 5/16 inch wide and 4 to 12 inches apart; few small slickensides in lower part; few threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—41 to 50 inches, light brownish-gray (10YR 6/2) clay, brown (10YR 5/2) moist; weak, blocky structure; very hard, very firm; very few fine roots and root channels; 2 percent, by volume, soft lumps of calcium carbonate as much as 1/4 inch in diameter; few narrow tongues filled with darker colored clay; calcareous; moderately alkaline; diffuse, wavy boundary.

Cca—50 to 72 inches, very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) moist; massive; very hard, very firm; many more visible quartz grains than in above horizons; few soft calcium carbonate concretions, especially in upper part, and few gypsum crystals; few streaks or narrow tongues filled with darker clay; calcareous; moderately alkaline.

The solum ranges from 24 to 60 inches in thickness. When dry, these soils have cracks 1/4 inch to 2 inches wide and more than 12 inches long that extend to a depth of 24 to 40 inches.

The A horizon is grayish brown, dark grayish brown, brown, or dark brown. It is clay loam, sandy clay loam, or clay. The B horizon is grayish brown, dark grayish brown, light brownish gray, or brown. It ranges from clay loam to clay in texture. The B22 horizon and B3ca horizons are lacking in some profiles. The C horizon is light yellowish brown, pale brown, very pale brown, light gray, or light brownish gray. It ranges from clay to sandy clay in texture. The C horizon has visible calcium carbonate concretions ranging from a few to 10 percent, by volume, and visible gypsum crystals ranging from a few to 20 percent, by volume.

DAB—Dant association, gently undulating. The soils in this association are in areas that are generally subrounded to irregular in shape and are about 75 to 150 acres in size. Slopes are convex. They range from 0 to 3 percent but are mainly 1 to 2 percent.

This association is about 50 percent Dant soils that have slopes of 1 to 3 percent and about 25 percent Dant soils that have slopes of 0 to 1 percent. The remaining 25 percent is Catarina, Copita, Elindio, Montell, and Pryor soils. The Catarina and Montell soils are on the lower positions on the landscape. The Copita and Pryor soils are on the higher positions on the landscape. Elindio soils are on slightly higher positions than Dant soils. The Dant soils could have been separated in mapping, but because use and management are similar, it was not justified.

These soils are used mostly for range. Clay Loam range site.

Darl Series

The Darl series consists of shallow, nearly level, calcareous, loamy soils on uplands. These soils formed in loamy materials over thick beds of caliche.

In a representative profile the surface layer is light brownish-gray clay loam about 9 inches thick. The next layer is about 7 inches of pale-brown, friable clay loam. The underlying material, to a depth of 50 inches, is pink caliche that is indurated in the upper 2 inches and weakly cemented below.

Darl soils are well drained. Permeability is moderate. Runoff is about medium. Available water capacity is low. The hazard of water is moderate.

Most areas of these soils are used for range or wildlife habitat.

Representative profile of Darl clay loam in an area of Darl association, nearly level, 12 miles north of Eagle Pass High School on U.S. Highway 277, 0.8 mile east on Farm Road 131, 250 feet north, in area of range, about 300 feet southeast of rifle range embankment:

A1—0 to 9 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky and granular structure; hard, friable; common fine roots, fine pores and old root channels; few worm casts; a 1/4-inch platy crust on surface; few calcium carbonate concretions as much as 2 millimeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B2—9 to 16 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak, fine, subangular and granular structure; hard, friable; common roots and fine pores; few worm casts; few calcium carbonate concretions as much as 4 millimeters in diameter; lower 2 inches is about 20 percent, by volume, hard caliche fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—16 to 18 inches, pinkish-white (7.5YR 8/2) caliche, pink (7.5YR 8/4) moist; indurated; weakly laminar in upper 1/2 inch; few solution channels filled with soil from above; calcareous; moderately alkaline; clear, wavy boundary.

C2ca—18 to 50 inches, pink (7.5YR 8/4) caliche; pink (7.5YR 7/4) moist; weakly cemented; calcareous; moderately alkaline.

The part of the solum above the indurated caliche layer ranges from 10 to 20 inches in thickness. Coarse fragments consist of a few to 20 percent angular caliche fragments and chert gravel. The A horizon is grayish brown, brown, light brownish gray, pale brown, light gray, and very pale brown. The B horizon is brown, pale brown, very pale brown, and light yellowish brown. Above the caliche layer it is loam or clay loam that is about 20 to 30 percent clay. The upper part of the C1cam horizon is laminar or massive. In some profiles the C1cam is fractured. The C2ca horizon ranges from weakly consolidated to strongly cemented caliche. The C2ca horizon is gravelly in some profiles.

DRA—Darl association, nearly level. The soils in this association are in areas that are irregular in shape and average about 40 acres in size. The slopes are convex and range from 0 to 3 percent.

This association is about 60 percent Darl soils that have slopes of 1 to 3 percent and about 20 percent Darl soils that have slopes of 0 to 1 percent. The remaining 20 percent is Elindio, Mavco, and Zapata soils. The Elindio and Mavco soils are in slightly lower positions than the Darl soils. The Zapata soils are in slightly higher positions than the Darl soils. The Darl soils could have been separated in mapping, but because use and management are similar, it was not justified.

Most areas of this association are used for range and wildlife habitat. The soils are a good source of caliche for construction purposes. Open-pit mines are in areas of this soil. Shallow range site.

Elindio Series

The Elindio series consists of deep, nearly level to gently sloping, loamy soils on uplands. These soils formed in calcareous alluvium.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 15 inches thick. The next layer extends to a depth of 39 inches. The upper 11 inches is brown, and the lower 13 inches is very pale brown, firm clay loam that is about 5 percent, by volume, soft masses of lime. The underlying material, to a depth of 72 inches, is very pale brown clay loam that is about 25 percent, by volume, soft masses of lime.

Elindio soils are well drained. Permeability is moderate. Runoff is slow to medium. Available water capacity is high. The hazard of erosion is slight to moderate.

Most areas of these soils are used for range and wildlife habitat. Some areas within the irrigation district are planted mainly to sorghum for grain and forage, small grain, and introduced grasses.

Representative profile of an Elindio silty clay loam in an area of Elindio association, nearly level, 9.9 miles northwest of high school in Eagle Pass on U.S. High-way 277 (this point is 1.1 mile southeast of junction of U.S. Highway 277 and Texas Highway 131), 0.4 mile east on old airport road, 100 feet north in an area of range:

A1—0 to 15 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky and granular structure; hard, friable; many fine roots, common fine pores and root channels; few worm casts; few snail shell fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B2—15 to 26 inches, brown (10YR 5/3) clay loam, dark brown (1OYR 4/3) moist; moderate, fine, sub-angular blocky structure; very hard, firm; common fine roots; few fine pores and root channels; few worm casts; few snail shell fragments; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—26 to 39 inches, very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few fine roots; few fine pores and root channels; few worm casts; about 5 percent, by volume, soft masses and films and threads of secondary calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—39 to 72 inches, very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; weak, fine, subangular blocky structure; very hard, firm; many fine and medium pores; few krotovinas; about 25 percent, by volume, soft masses of secondary calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 22 to 40 inches in thickness. Calcium carbonate equivalent ranges from about 10 to 25 percent in the A horizon and from about 25 to 40 percent in the B and C horizons. The A horizon is very dark grayish brown, dark grayish brown, grayish brown, brown, or dark brown. It ranges from 9 to 20 inches in thickness. It is silty clay loam or clay loam in texture. The B horizon is grayish brown, brown, pale brown, yellowish brown, or light yellowish brown. It ranges from clay loam to clay that has a clay content of 30 to 45 percent. An estimated 10 to 20 percent of the clay is carbonate clay. The C horizon is light brownish gray, pale brown, light yellowish brown, light olive brown, light yellowish brown, very pale brown, or pale yellow. Visible secondary calcium carbonate in the form of soft masses and concretions ranges from about 2 to 30 percent, by volume, in the lower part of the B horizon and from about 5 to 35 percent, by volume, in the C horizon.

EdA—Elindio silty clay loam, 0 to 1 percent slopes. This nearly level soil is in areas that are irregular in shape and are mainly about 75 acres in size. Slopes are plane to convex. They are mainly less than 0.5 percent but range from 0 to 1 percent.

The surface layer is about 16 inches of friable silty clay loam. The upper 5 inches is dark grayish brown, and the lower 11 inches is grayish brown. The next layer is 12 inches of brown, firm silty clay loam. The next layer, between depths of 28 and 36 inches, is pale-brown, firm silty clay loam. The underlying material is very pale brown silty clay loam that is about 10 percent limy masses.

Included with this soil in mapping are areas of Copita, Dant, and Montell soils. The Copita soils are on small knolls or along the outer edges of areas of this Elindio soil. The Dant and Montell soils are in slightly lower areas.

Most areas of this soil are cultivated. Runoff is slow, and the hazard of erosion is slight.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit I-1, irrigated; pasture and hayland group 7C.

EdB—Elindio silty clay loam, 1 to 3 percent slopes. This gently sloping soil is in areas that are longer than they are wide and follow the slope contours above the drainageways. Slopes are convex. They are mainly less than 1.5 percent but range from 1 to 3 percent. Soil areas are mainly about 75 acres in size.

The surface layer is 11 inches of dark grayish-brown silty clay loam. The next layer is 12 inches of brown, firm silty clay loam. Below this laver, between depths of 23 and 35 inches, is light yellowish-brown, firm silty clay loam. The underlying material is very pale brown silty clay loam that is about 10 percent limy masses.

Included with this soil in mapping are areas of Copita and Mavco soils as well as areas of Elindio silty clay loam, 0 to 1 percent slopes. The Copita soils occur as browner spots, mainly on slightly higher positions. The Mavco soils occur as light-colored spots, mainly on slightly higher positions. A few areas where slopes are 3 to 5 percent are also included.

Most areas of this soil are cultivated. Runoff is about medium, and the hazard of erosion is moderate.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control. and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIe-4, irrigated; pasture and hayland group 7C.

EnA—Elindio silty clay loam. 0 to 1 percent slopes, saline. This nearly level soil is in areas that are subrounded to irregular in shape and are mainly about 25 to 50 acres in size. Slopes are plane to convex. They are mainly less than 0.5 percent but range from 0 to 1 percent.

The surface layer is dark grayish-brown silty clay loam about 20 inches thick and contains a few threads of salt crystals in the mass and on the surface. The next layer is 20 inches of firm silty clay loam that has few to common threads of salt crystals. It is brown in the upper 12 inches and pale brown in the lower 8 inches. The underlying material is very pale brown silty clay loam that has common threads of salt crystals and about 10 percent, by volume, soft masses of lime.

Included with this soil in mapping are areas of Elindio silty clay loam, 0 to 1 percent slopes, and Elindio silty clay loam, 1 to 3 percent slopes. Also included are areas of Dant and Montell soils. The Dant and Montell soils are more clayey and are mainly in slightly lower positions.

The salinity of this soil is mainly a result of excessive use of irrigation water in the past and seepage from earthen ditches. A temporary water table is in much of the area of this soil. The water table fluctuates and is within 2 feet of the surface in some spots during peak use of irrigation water. Salinity of the soil ranges mainly from low to high in the upper 2 feet of the soil and from medium to high between depths of 2 and 4 feet. In many places, even though the salinity in the upper 2 feet is mainly low, the salinity in the upper 1 inch to 4 inches of the soil is high or very high. Germination is affected by the salinity of the upper few inches of the soil.

Because the yields on this soil are lower than those on nonsaline Elindio soils, much of the acreage of this soil is idle or has been sprigged to Coastal bermudagrass, a salt-tolerant grass.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs. The hazard of erosion is slight.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIs-1, irrigated; pasture and hayland group 7F.

EnB—Elindio silty clay loam, 1 to 3 percent slopes, saline. This gently sloping soil is in areas that are longer than they are wide and mainly follow the con-tour of slopes above the drainageways. Slopes are con-vex. They are mainly less than 1.5 percent but range from 1 to 3 percent. Areas are mainly about 20 to 40 acres in size.

The surface layer is about 12 inches of grayish-brown silty clay loam and has a few threads of salt crystals in the mass and on the surface. The next layer is 10 inches of light yellowish-brown, firm silty clay loam that has a few threads and pockets of salt crystals. The next layer, between depths of 22 and 36 inches, is very pale brown silty clay loam that contains about 2 percent soft masses of calcium carbonate and a few salt threads and salt pockets as much as 2 millimeters in diameter. The underlying material is very pale brown silty clay loam that has a few threads and pockets of salt crystals and about 10 percent, by volume, soft masses of lime.

Included with this soil in mapping are areas of Elindio silty clay loam, 1 to 3 percent slopes, and areas of Elindio silty clay loam, 0 to 1 percent slopes, saline. Also included are small areas of soils that have slopes of 3 to 5 percent.

The salinity of this soil is mainly a result of excessive use of irrigation water in the past and seepage from earthen ditches. A temporary water table is in small areas of this soil. The water table fluctuates and is within about 2 feet of the surface in some spots during peak use of irrigation water. Salinity of the soil ranges mainly from low to high in the upper 2 feet and from medium to high between depths of 2 and 4 feet. In

many places, even though the salinity in the upper 2 feet is mainly low, the salinity in the upper 1 inch to 4 inches of soil is high or very high. Germination is affected by the salinity of the upper few inches.

Because yields on this soil are lower than those on nonsaline Elindio soils, much of this soil is idle or has been sprigged to Coastal bermudagrass, a salt-tolerant grass.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where a salt buildup occurs. The hazard of erosion is moderate.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIIe-1, irrigated; pasture and hayland group 7F.

EOA—Elindio association, nearly level. This soil is in areas that are irregular in shape and are mainly about 500 acres in size. Slopes are plane to convex. They are mainly less than 1 percent but range from 0 to 3 percent.

This association is about 30 percent Elindio silty clay loam, 0 to 1 percent slopes, 20 percent Elindio clay loam that has slopes of 0 to 1 percent, 20 percent Elindio silty clay loam, 1 to 3 percent slopes, 10 percent Elindio clay loam that has slopes of 1 to 3 percent, and about 20 percent Copita, Dant, Darl, Mavco, and Montell and other soils. The Copita, Darl, and Mavco soils are in slightly higher positions than the Elindio soils. Darl soils mostly occupy the highest positions on the landscape. The Dant and Montell soils occupy slightly lower positions than the Elindio soils. The Elindio soils could have been separated in mapping, but because use and management are similar, it was not justified.

An Elindio soil in this association has the profile de-scribed as representative of the Elindio series. Most areas of these soils are used for range and wildlife habitat. The hazard of erosion is slight. Clay Loam range site.

Jimenez Series

The Jimenez series consists of very shallow to shallow, rolling, calcareous, very gravelly, loamy soils on old, high terraces. These soils formed in beds of gravelly caliche.

In a representative profile the surface layer is dark grayish-brown, very gravelly loam about 9 inches thick. This surface layer rests abruptly on thick beds of caliche containing gravel.

Jimenez soils are excessively drained. Permeability is moderate. Runoff is medium. Available water capacity is very low. The hazard of erosion is severe.

All areas of these soils are used for range and wildlife habitat. Caliche is mined for construction purposes, and there are several open-pit mines.

Representative profile of a Jimenez very gravelly loam in an area of Jimenez association, rolling, 5.5 miles north of post office in Quemado on U.S. Highway 277, 100 feet east in an area of range adjacent to caliche pit:

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; about 70 percent, by volume, waterworn quartzite, chert, limestone, and basalt pebbles, mostly less than 6 centimeters in diameter; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—9 to 18 inches, white (10YR 8/2) strongly cemented caliche that is about 40 percent embedded gravel; smooth and finely etched on the upper surface; upper 1/2 inch is finely laminated and has a hardness of 3 (Mohs scale) when dry; diffuse, irregular boundary.

C2—18 to 60 inches, white (10YR 8/2), weekly cemented, massive caliche, about 50 percent embedded gravel.

The A horizon ranges from 7 to 20 inches in thickness. It is dark grayish brown or dark brown. It ranges from very gravelly loam to very gravelly clay loam in texture. This horizon is 50 percent to more than 80 percent mixed gravel. The C1cam horizon ranges from 8 to 15 inches in thickness. In places the C1cam horizon is fractured. Fragments are 1/2 inch to 3 inches thick and 6 to 12 inches wide. Their upper surfaces are smooth but etched, and their lower sides are rather knobby. As much as 10 percent soil material may occur around the fragments. The C horizon is about 5 percent to as much as 80 percent embedded gravel. The soil surface is covered by mixed gravel that ranges from about 5 to 80 percent but normally is about 20 to 30 percent.

JZD—Jimenez association, rolling. The soils in this association are in areas that are mainly several hundred acres or more in size and are irregular in shape. Slopes are convex. They range from 1 to 12 percent but are dominantly 10 percent.

This association is about 50 percent Jimenez very gravelly loam, 25 percent Jimenez very gravelly clay loam, and 25 percent other soils. The other soils are mainly Maverick, Olmos, Quemado, and Zapata soils. The Maverick soils are in the lower positions on the landscape on the foot slopes of the steeper hills. The Olmos, Quemado, and Zapata soils are mainly on the caps of a few hills. The Jimenez soils could have been separated in mapping, but because use and management are similar, it was not justified. Most areas of these soils are used for range and wildlife habitat. Gravelly Ridge range site.

Lagloria Series

The Lagloria series consists of deep, nearly level to gently sloping, loamy soils on stream terraces. These soils formed in calcareous alluvium.

In a representative profile the surface layer is light brownish-gray very fine sandy loam about 18 inches thick. The next layer is about 26 inches of pale-brown, very friable very fine sandy loam. The underlying material, to a depth of 80 inches, is very pale brown very fine sandy loam that has thin strata of loam, silt loam, and silty clay loam.

Lagloria soils are well drained. Permeability is moderate. Available water capacity is high. Runoff is slow to medium. The hazard of erosion is slight to moderate.

Most areas of these soils are in irrigated crops. Alfalfa, forage for grain and sorghum, and introduced perennial grasses are the main crops. A small acreage is used for cotton, vegetables, and pecans.

Representative profile of Lagloria very fine sandy loam, 0 to 1 percent slopes, 2.6 miles north on U.S. Highway 277 from junction of U.S. Highway 277 and Rigley Road in Quemado, 800 feet west in cultivated field:

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; few fine roots; few very fine mica flakes; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

A1—7 to 18 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky and granular structure; slightly hard, very friable; few fine roots; few very fine

mica flakes; few worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B2—18 to 44 inches, pale-brown (10YR 6/3) very fine sandy loam; brown (10YR 5/3) moist; weak, fine, subangular blocky and granular structure; slightly hard, very friable; few fine 'roots; few very fine mica flakes; few threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C1—44 to 56 inches, very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive: slightly hard, very friable; thin strata of loam, silt loam, and silty clay loam of same color and of darker color; calcareous; moderately alkaline; gradual, wavy boundary.

C2—56 to 80 inches, very pale brown (10YR 7/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; thin strata of loam, silt loam, and silty clay loam of same color and of darker color; calcareous; moderately alkaline.

The solum ranges from 40 to 54 inches in thickness. The A horizon ranges from 12 to 20 inches in thickness. It is light brownish gray or pale brown. The B2 horizon ranges from 25 to 40 inches in thickness. It is pale brown or very pale brown very fine sandy loam to silt loam. The C horizon is weakly stratified.

LgA—Lagloria very fine sandy loam, 0 to 1 percent slopes. This nearly level soil is on stream terraces along the Rio Grande. Areas range from about 25 to 500 acres in size. Slopes range from 0 to 1 percent but average about 0.5 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Lagloria very fine sandy loam, 1 to 3 percent slopes, on narrow breaks to small drainageways. Also included are areas of Laredo, Reynosa, and Rio Grande soils. The Laredo and Reynosa soils are mainly in slightly lower positions than the Rio Grande soils. The Rio Grande soils are in positions nearest the Rio Grande.

Runoff is slow, and the hazard of erosion is slight. In places, salt that has accumulated in the soil inhibits plant growth.

The cropping system should include crops that protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass, johnsongrass, and buffelgrass. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important, Capability unit I-2, irrigated; pasture and hayland group 2A.

LgB—Lagloria very fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on stream terraces along the Rio Grande. Areas of this soil are mostly long and narrow, paralleling the drainageways. Size of the areas ranges from about 10 to 50 acres. Slopes range from 1 to 3 percent but are dominantly 1 to 2 percent.

The surface layer is light brownish-gray very fine sandy loam about 14 inches thick. The next layer, about 32 inches thick, is pale-brown, very friable very fine sandy loam. The underlying material is very pale brown very fine sandy loam that has thin strata of slightly darker material.

Included with this soil in mapping are areas of Lagloria very fine sandy loam, 0 to 1 percent slopes, and areas of Rio Grande soils. The Rio Grande soils are in areas nearest the Rio Grande. Also included are a few areas where slopes are greater than 3 percent.

Surface runoff is medium, and the hazard of erosion is moderate. In places, salt that has accumulated in the soil inhibits plant growth.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass, johnsongrass, and buffelgrass. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Proper timing and methods of harvesting hay are important. Capability unit IIe-2, irrigated; pasture and hayland group 2A.

Laredo Series

The Laredo series consists of deep, nearly level to gently sloping, loamy soils on terraces. These soils formed in calcareous alluvium.

In a representative profile the surface layer is 18 inches of dark grayish-brown, friable silty clay loam. The next layer is 18 inches of friable silty clay loam. It is grayish brown in the upper 10 inches and pale brown in the lower 8 inches. The underlying material, to a depth of 60 inches, is very pale brown silt loam that has thin strata of silty clay loam.

Laredo soils are well drained. Permeability is moderate. Runoff is slow to medium. Available water capacity is high. The hazard of erosion is slight to moderate.

Most areas of these soils are in irrigated crops. Alfalfa, sorghum for grain and forage, and introduced perennial grasses are the main crops. A small acreage is also used for cotton and vegetables.

Representative profile of Laredo silty clay loam, 0 to 1 percent slopes, 3.1 miles north of Quemado on U.S. Highway 277, east 0.15 mile along inside farm road, 100 feet south in cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; hard, friable; few fine pores and root channels; upper 1/4 inch is rusty and lighter colored; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—7 to 18 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, subangular blocky structure and some moderate, fine, angular blocky structure; hard, friable; common fine roots; many fine pores and root channels; few earthworm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B21—18 to 28 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, subangular blocky structure and some moderate, fine, granular structure; hard, friable; few earthworm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B22—28 to 36 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; weak, fine and medium, subangular blocky structure; hard, friable; many fine pores and old root channels; few earthworm casts; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—36 to 48 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; thin strata of grayish brown silty clay loam and silt loam; massive; hard, friable; few threads and concretions of calcium carbonate 1 millimeter in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

C2—48 to 60 inches, very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; massive; thin strata of grayish-brown silty clay loam and silt loam; very few threads of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 34 to 50 inches in thickness. The A horizon ranges from 14 to 28 inches in thickness. It is dark grayish brown or brown. The B2 horizon is grayish brown, brown, or pale brown. The C horizon is light brownish gray or very pale brown. Strata consist of thin lenses of slightly contrasting texture and slightly darker materials. Fine quartz, limestone, sandstone, and igneous pebbles; snail fragments; and mica flakes are throughout the profile in many places.

LrA—Laredo silty clay loam, 0 to 1 percent slopes. This soil is along the Rio Grande on terraces that are about 30 to 40 feet above the river channel. The soil areas are much greater in length than in width and average about 100 acres in size. Slopes are mainly plane to concave. They range from 0 to 1 percent but average about 0.5 percent.

This soil has profile described as representative for the Laredo series.

Included with this soil in mapping are small areas of Lagloria and Reynosa soils. Lagloria soils are on slightly higher elevations than Reynosa soils, either on small knolls or along the outer edges of the areas mapped as this soil. Reynosa soils are in positions similar to those of Laredo soils but are light colored. Runoff is slow, and the hazard of erosion is slight. In places, salt that has accumulated in the soil inhibits plant growth. Most areas of this soil are in cultivation and are irrigated.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed on irrigated land to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit I-3, irrigated; pasture and hayland group 7C.

LrB—Laredo silty clay loam, 1 to 3 percent slopes. This gently sloping soil is in long, narrow areas. Most areas are less than 50 acres in size. Slopes rarely exceed 2 percent, but they range from 1 to 3 percent.

The surface layer is dark grayish-brown silty clay loam about 17 inches thick. The next layer is about 20 inches of friable silty clay loam. It is grayish brown in the upper 9 inches and brown in the lower 11 inches. The underlying material is very pale brown silt loam that has a few lime concretions.

Included with this soil in mapping are areas of Lagloria and Reynosa soils, which are mainly along the outer edges of areas mapped as this soil. Runoff is medium, and the hazard of erosion is moderate. In places, salt that has accumulated in the soil inhibits plant growth.

Most areas of this soil are in irrigated cropland. The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices.

Use of proper timing and methods of harvesting hay is important. Capability unit IIe-3, irrigated; pasture and hayland group 7C.

Mavco Series

The Mavco series consists of deep, gently sloping and gently undulating soils on terraces and uplands. These soils formed in calcareous, loamy materials.

In a representative profile the surface layer is light brownish-gray and grayish-brown, friable loam about 12 inches thick. The next layer, about 34 inches thick, is very pale brown clay loam that has about 10 percent soft masses of lime in the upper 17 inches and 25 percent in the lower 17 inches. Below this, to a depth of 70 inches, is very pale brown clay loam.

Mavco soils are well drained. Permeability is moderate. Runoff is slow to medium. Available water capacity is high. The hazard of erosion is moderate.

Most areas of these soils are used for range and wildlife habitat. A few small areas are irrigated and are planted to grain sorghum, oats, and introduced grasses.

Representative profile of a Mavco loam in an area of Mavco association, gently undulating, 9.9 miles northwest of the high school in Eagle Pass on U.S. Highway 277, 0.6 mile east on old airport road, 0.3 mile south, 200 feet west in an area of range:

A11—0 to 1 inch, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, platy structure and weak, fine, subangular blocky structure; slightly hard, very friable; few fine roots; few fine animal tunnels; few snail shell fragments; calcareous; moderately alkaline; abrupt, smooth boundary.

A12—1 to 12 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, subangular blocky and granular structure; hard, friable; many fine roots; many fine pores and root channels; few fine animal tunnels; few worm casts; few snail shell fragments; few fine limestone fragments as much as 1/4 inch in diameter; 22 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, smooth boundary.

B21tca—12 to 29 inches, very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; moderate, fine and medium, subangular blocky structure; hard, friable; patchy clay films on peds; many fine roots; many fine pores and root channels; few fine animal tunnels; few worm casts; few snail shell fragments; about 10 percent, by volume, soft masses and concretions of calcium carbonate masses as much as 1/2 inch in diameter; few siliceous pebbles; about 35 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear, irregular boundary.

B22tca—29 to 46 inches, very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; weak, fine and medium, subangular blocky structure; hard, friable; patchy clay films on peds and in pores and root channels; very few fine roots; very few animal and root tunnels filled with slightly darker soil; about 25 percent, by volume, soft masses of calcium carbonate; about 51 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear, wavy boundary.

B3tca—46 to 70 inches, very pale brown (10YR 7/4) clay loam; light yellowish brown (10YR 6/4) moist; weak, fine and medium, subangular blocky structure; hard, friable; patchy clay films on peds, in pores, and in root channels; very few roots; few krotovinas; about 15 percent, by volume, soft masses of calcium carbonate; about 55 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Calcium carbonate equivalent averages about 40 to 60 percent in the lower part of the Bt horizon. The color of the A horizon is dark grayish brown, brown, grayish brown, light brownish gray, or pale brown. It is 1 to 22 inches thick. Texture of the A horizon is loam or clay loam. The B2t horizon is brown, pale brown, light yellowish brown, or very pale brown. The upper part of the B2t horizon ranges from clay loam to clay. It has a clay content of 35 to 45 percent. An estimated 10 to 25 percent of the clay is carbonate clay. The B3t horizon is pale brown, very pale brown, light yellowish brown, or pale yellow. Visible calcium carbonate in the form of soft masses and hard concretions or fragments ranges from about 15 to 50 percent, by volume.

MaB—Mavco loam, 1 to 3 percent slopes. This gently sloping soil is in areas that are irregular in shape and average about 50 acres in size. Slopes are generally convex. They are mainly less than 1.5 percent but range from 1 to 3 percent.

The surface layer is brown loam about 6 inches thick. The next layer is about 4 inches of pale-brown, friable loam. The next 18 inches is light yellowish-brown, friable clay loam. The underlying material is very pale brown clay loam that is about 25 percent, by volume, lime masses.

Included with this soil in mapping are small areas of Elindio and Copita soils. The Elindio soils are in slightly lower positions than the Copita soils. The Copita soils are slightly sandier spots on the higher elevations.

Most areas of this soil are irrigated cropland. The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs. Terraces and contour farming are needed in places when using sprinkler irrigation.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIe-4, irrigated; pasture and hayland group 7C.

MCB—Mavco association, gently undulating. These soils are in areas that are irregular in shape and average about 200 acres in size. Slopes are mainly convex. They are commonly less than 1.5 percent but range from 1 to 3 percent.

This association is about 30 percent Mavco loam that has slopes of 0 to 1 percent, 20 percent Mavco loam, 1 to 3 percent slopes, 20 percent Mavco clay loam that has slopes of 0 to 1 percent, 10 percent Mavco clay loam that has slopes of 1 to 3 percent, and 20 percent other soils. The other soils are mainly Darl, Copita, Elindio, and Zapata soils. The Darl, Copita, and Zapata soils are in the higher positions on the landscape, and Elindio soils are in the lower positions. The soils in this association could have been separated in mapping, but because use and management are similar, it was not justified.

This Mavco soil has the profile described as representative for the series.

Most areas of these soils are used for range and wildlife habitat. Clay Loam range site.

Maverick Series

The Maverick series consists of moderately deep, gently sloping and undulating, calcareous, saline, clayey soils on uplands. These soils formed in marine shale and clay.

In a representative profile the surface layer is grayish-brown clay 5 inches thick. The next layer is 16 inches of light olive-brown, very firm clay that has a few soft masses and a few threads of neutral salts. The next layer is 5 inches of pale-yellow

clay that is about 10 percent soft masses of lime and has a few threads of other salts. It has a few yellow and brownish-yellow mottles. The underlying material, to a depth of 72 inches, is pale-yellow shale.

Maverick soils are very slowly permeable. Runoff is rapid. The hazard of erosion is moderate. Available water capacity is medium. These soils are well drained.

Nearly all areas of these soils are used for range and wildlife habitat. Small areas are irrigated and planted to grain sorghum, oats, and Coastal bermudagrass for grazing.

Representative profile of a Maverick clay in an area of Maverick association, undulating, 2.3 miles east on U.S. Highway 277 from the courthouse in Eagle Pass, 3.9 miles northeast on Texas Highway 57, 50 feet south from right-of-way in an area of range:

A1—0 to 5 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, fine and medium, subangular blocky structure parting to moderate, fine and very fine, angular blocky; very hard, firm; common fine roots; few fine pores and root channels; few worm casts; few waterworn quartzite pebbles in soil mass and on surface; calcareous; moderately alkaline; clear, wavy boundary.

B2—5 to 21 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate, fine and medium, angular blocky structure; extremely hard, very firm; common fine roots; few fine pores and root channels; few streaks and pockets of grayish-brown clay; shiny pressure faces on peds; few calcium carbonate masses; few threads of neutral salts; calcareous; moderately alkaline; clear, wavy boundary.

B2ca—21 to 26 inches, pale-yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; weak, angular blocky structure; about 10 percent visible soft masses, films, and threads of calcium carbonate and other salts; few yellow and brownish-yellow mottles; calcareous; moderately alkaline; abrupt, wavy boundary.

C—26 to 72 inches, pale-yellow (2.5Y 7/4) shale, light yellowish brown (2.5Y 6/4) moist; moderate, fine and medium, platy structure parting to moderate, fine and medium, blocky; few brownish yellow mottles; few pockets and threads of calcium carbonate and other salts; few seams of gypsum crystals about 1/2 inch in diameter; calcareous; moderately alkaline.

The solum ranges from 20 to 30 inches in thickness. The electrical conductivity ranges from about 4 to 14 millimhos, and it generally increases with depth. Reaction is moderately alkaline to strongly alkaline. The A and B2 horizons range from clay to clay loam. The A horizon is grayish brown, light brownish gray, olive gray, light olive gray, pale brown, brown, light yellowish brown, yellowish brown, light olive brown, olive gray, light olive gray, or pale olive. It is 2 to 10 inches thick. The B2 horizon is very pale brown, yellowish brown, light olive brown, light yellowish brown, pale yellow, or pale olive. The B2ca horizon has 1 percent to about 10 percent, by volume, visible carbonates. The calcium carbonate equivalent generally is less than 15 percent, but if it is more than 15 percent, the horizon is less than 6 inches thick. The C horizon is shale or shaly clay that has evident bedding planes. It has few to common beds of gypsum and layers containing a considerable amount of calcium carbonate.

MdB—Maverick clay, 1 to 3 percent slopes. This gently sloping soil is in small, rounded or subrounded areas on knolls within broader areas of deeper irrigated soils. These areas average 10 acres in size but range from 3 to 20 acres. Slopes are mainly 1 to 2 percent but range from 1 to 3 percent.

The surface layer is grayish-brown clay about 6 inches thick. The next layer is about 14 inches of light olive-brown, very firm clay that has a few soft masses of lime and a few threads of other salts. The next layer is about 5 inches of pale-yellow clay that has about 10 percent soft masses of lime and threads of other salts. Beneath this layer, to a depth of 60 inches, is pale-yellow shale.

Included with this soil in mapping are areas of Catarina, Pryor, and Verick soils. The Catarina and Pryor soils are deeper pockets that are mainly along the outer edge of areas of this Maverick soil. The Verick soils are mainly in the higher positions of the areas and are underlain by sandstone.

Most areas of this soil are used for range and wildlife habitat, but some small areas are included in the larger, irrigated fields of other soils.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass and some introduced blue-stems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay are important. Capability unit IVe-1, irrigated; pasture and hayland group 7F.

MKC—Maverick association, undulating. These soils are in areas that average about 100 acres but range from 20 to 500 acres. Slopes are mainly convex. They average about 3 percent but range from 1 to 5 percent. The areas are generally greater in length than in width, but in places they are subrounded.

This association is about 65 percent Maverick soils, 15 percent Verick soils, and 10 percent Catarina soils. The remaining 10 percent is mainly Copita, Jimenez, and Pryor soils. The Verick soils are in positions similar to those of Maverick soils, but Verick soils are underlain by sandstone and have a sandier surface. The Catarina soils occur as deeper pockets in or along the lower edges of areas of this association. Copita soils are commonly in small areas close to the Verick soils. The Pryor soils are commonly along the lower edges between the Maverick and Catarina soils. Jimenez soils occur as gravelly knolls in the area. The soils in this association could have been separated in mapping, but because use and management are similar, it was not justified.

A Maverick soil in this association has the profile described as representative for the series.

Most areas of this soil are used for range and wildlife habitat. Rolling Hardland range site.

Mercedes Series

The Mercedes series consists of deep, nearly level, clayey soils in depressional areas on stream terraces. These soils formed in calcareous clayey alluvium several feet thick.

In a representative profile the surface layer is gray to light-gray very firm clay about 46 inches thick. The underlying material is light-gray, very firm clay to a depth of 60 inches.

Runoff is very slow. Permeability is very slow. Water enters the soil rapidly when dry and cracked, but water movement into the soil is very slow when the soil is wet and the cracks are closed. Available water capacity is high. The hazard of erosion is slight.

Most areas of these soils are used for range and wildlife habitat.

Representative profile of Mercedes clay in an area of Mercedes association, depressional, 12 miles north of Eagle Pass on U.S. Highway 277, 2.6 miles northeast on Texas Highway 131, 200 feet east of right-of-way:

A11—0 to 5 inches, gray (10YR 6/1) clay, gray (10YR 5/1) moist; weak, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; many fine roots; few snail shell fragments; few worm tunnels; calcareous; moderately alkaline; gradual, wavy boundary.

A12—5 to 25 inches, gray (10YR 6/1) clay, gray (10YR 5/1) moist; moderate, fine and medium, angular blocky structure; extremely hard, very firm, very sticky and plastic; many fine roots; few yellowish stains; shiny ped faces; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

A13—25 to 46 inches, light-gray (10YR 7/1) clay, gray (10YR 6/1) moist; moderate, fine and medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few organic stains, few yellowish stains; few very fine concretions of calcium carbonate; few fine roots; shiny ped faces; calcareous; moderately alkaline; gradual, wavy boundary.

AC—46 to 60 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; weak, fine and medium, angular blocky structure; extremely hard, very firm, very sticky and plastic; few yellowish stains; few very fine concretions of calcium carbonate; calcareous; strongly alkaline.

The solum ranges from about 40 to 60 inches in thickness. Intersecting slickensides begin at a depth of 12 to 30 inches. More than 15 percent exchangeable sodium is within 30 inches of the surface. Salinity generally increases with depth, and it ranges from none to moderate. The A horizon is gray or light gray. The AC horizon is light gray, grayish brown, or light brownish gray. The C horizon is gray or pale brown. Accumulations of calcium carbonate range from a very few concretions to a few to common soft masses.

MNA—Mercedes association, depressional. These nearly level soils are in depressional areas and in narrow drainageways. The depressional areas are commonly 2 to 5 feet lower than surrounding soils. They are 20 to 400 acres in size and are subrounded to oblong in shape. The areas in drainageways are 4 to 10 feet lower than the surrounding areas and are 50 to 400 acres in size. These areas are narrow and long. They generally do not exceed 500 feet in width, but in places they are as much as 1,200 feet. The soils in this association receive extra water from surrounding areas, and because of inadequate surface drainage and very slow permeability, they pond water for periods of 1 to 4 weeks after heavy rains. The ponding of water along narrow drainageways is intermittent. Slopes are mainly concave. They are commonly less than 0.5 percent but range from 0 to 1 percent.

This association is 40 percent Mercedes soils in subrounded to oblong depressional areas, 40 percent Mercedes soils along narrow drainageways, 10 percent Montell clay, and 10 percent soils that are similar to Mercedes soils but are darker in color. The Montell soils are mainly in slightly higher positions along the outer edges of the association. The soil that is similar to Mercedes soils but is darker in color is in depressional areas. The soils in this association could have been separated in mapping, but because use and management are similar, it was not justified.

Most areas of this association are used for range or wildlife habitat. Clay Flat range site.

Montell Series

The Montell series consists of deep, nearly level, clayey soils on broad, smooth uplands. These soils formed in calcareous clayey alluvium.

In a representative profile the surface layer is gray clay about 28 inches thick. The next layer is 16 inches of grayish-brown, very firm clay. The underlying material, to a depth of 80 inches, is very pale brown clay that is about 5 percent visible lime and gypsum.

Runoff is very slow. Permeability is very slow. Water enters these soils rapidly when they are dry and cracked. When the soils are wet, however, the cracks close and movement of water into the soil is very slow. Available water capacity is high. The hazard of erosion is slight.

Nearly all areas of these soils are used for range and wildlife habitat. A few small areas are planted to crops of sorghum for grain and forage, small grain, alfalfa, and Coastal bermudagrass.

Representative profile of Montell clay in an area of Montell association, nearly level, 12 miles northwest of Eagle Pass High School on U.S. Highway 277, 1.6 miles north on Texas Highway 131, northeast through gate and 0.5 mile on small ranch road, 100 feet south in an area of range:

A11—0 to 12 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine and medium, angular blocky structure; extremely hard, very firm, very sticky, and very plastic; common fine roots; few fine pores and root channels; few snail shell fragments; few calcium carbonate concretions as much as 1 millimeter in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

A12—12 to 28 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky, and very plastic; few fine roots, few fine pores and root channels; shiny pressure faces on peds; intersecting slickensides in lower part; few snail fragments; few calcium carbonate concretions as much as 1 millimeter in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

AC—28 to 44 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores and root channels; shiny pressure faces on many peds; intersecting slickensides; few tongues of gray clay; few pockets of pale-brown clay; few calcium carbonate masses as much as 1/2 inch in diameter; few threads and films of calcium carbonates; calcareous; moderately alkaline; gradual, wavy boundary.

C1cacs—44 to 62 inches, very pale brown (10YR 7/3) clay, pale brown (1OYR 6/3) moist; massive; extremely hard, very firm, very sticky, and very plastic; few fine roots and root channels; about 5 percent, by volume, soft masses of calcium carbonate as much as 1/4 inch in diameter; few films and threads of calcium carbonate; few threads and small pockets of neutral salts; few narrow tongues and streaks of gray and grayish-brown clay; calcareous; moderately alkaline; diffuse, wavy boundary.

C2cacs—62 to 80 inches, very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; massive; extremely hard, very firm, very sticky and very plastic; large pockets of soft chalk; few small pockets and threads of neutral salts; calcareous; moderately alkaline.

The solum ranges from 36 to 54 inches in thickness. Microdepressions range from 5 to 8 feet in diameter and 3 to 12 inches in depth. Cracks range from 0.4 inch

to 4 inches in width and are more than 20 inches deep. Exchangeable sodium, within 30 inches of the surface, ranges from 15 percent to more than 40 percent in some horizons. Intersecting slickensides begin at a depth of about 20 to 30 inches below the surface. The A horizon is non-saline to moderately saline, and the AC and C horizons have moderate to strong salinity. The A horizon is gray or dark gray. It is darker in microdepressions. The AC horizon is grayish brown, light brownish gray, pale brown, or brown. The accumulation of calcium carbonate ranges from few to about 3 percent, by volume. The C horizon is pale brown or very pale brown. Gypsum crystals range from few to about 30 percent. Calcium carbonate ranges from 2 to 15 percent.

MoA—Montell clay, 0 to 1 percent slopes. This soil is in nearly level areas. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are irregular in shape. They are mainly less than 100 acres in size, but a few areas are larger.

The surface layer is gray clay about 28 inches thick. The next layer is grayish-brown very firm clay about 8 inches thick. The next layer is 6 inches of pale-brown very firm clay. The underlying material is very pale brown clay that has a few films and threads of lime and other salts.

Included with this soil in mapping are areas of Elindio and Laredo soils that are slightly higher than this Montell soil.

Most areas of this soil are used for irrigated crops. The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and other methods of harvesting hay is important. Capability unit IIIs-1, irrigated; pasture and hayland group 7A.

MTA—Montell association, nearly level. These soils are in broad, smooth areas that are irregular in shape. Areas are mainly larger than 100 acres in size, but many areas are more than 1,000 acres. Slopes range from 0 to 1 percent but are mainly less than 0.5 percent.

This association is about 70 percent Montell soils that have slopes of 0 to 1 percent, 10 percent Montell soils that have slopes of 1 to 3 percent, 10 percent Catarina soils, and 10 percent other soils, mainly Elindio soils. The Montell soils that have slopes of 1 to 3 percent are along the small drainageways. The Catarina soils are in similar or slightly higher positions than the Montell soils. The Elindio soils are in higher positions than Montell soils or are along the outer edges of areas of the association. The soils in this association could have been separated in mapping, but because use and management are similar, it was not justified.

A Montell soil in this association has the profile described as representative for the series. Most areas of this association are used for range or wildlife habitat. Clay Flat range site.

Olmos Series

The Olmos series consists of shallow to very shallow, undulating, calcareous, gravelly, loamy soils on up-lands. These soils formed in outwash sediment from limestone.

In a representative profile the surface layer is dark grayish-brown, friable very gravelly loam about 11 inches thick. It is 50 percent caliche fragments in the upper 5

inches and 80 percent caliche fragments in the lower 6 inches. This surface layer rests abruptly on thick beds of caliche that is indurated and laminar in the upper part.

Olmos soils are well drained. They are moderately permeable above the caliche layer. Runoff is medium. Available water capacity is very low. The hazard of erosion is severe.

All areas of these soils are used for range and wildlife habitat. These soils are a good source of caliche for construction purposes. Several open-pit mines are in these areas.

Representative profile of an Olmos very gravelly loam in an area of Olmos association, undulating, 1.2 miles south of the Maverick-Kinney County line on Texas Highway 131, across road from caliche pit. This point is 16.5 miles north of junction of Texas Highway 131 and U.S. Highway 277, 12 miles north of Eagle Pass High School:

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure; hard, friable; many fine roots; about 50 percent, by weight, indurated caliche and limestone fragments, mostly less than 1 centimeter in diameter but as much as 7 centimeters; about 20 percent of surface is covered with same type of fragments; calcareous; moderately alkaline; clear, wavy boundary.

A12—5 to 11 inches, dark grayish-brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure; hard, friable; many fine roots; about 80 percent caliche fragments that are indurated and laminar in their upper 1/4 to 1/2 inch and slightly knobby or nodular on their lower sides; calcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—11 to 15 inches, indurated white (10YR 8/2) caliche that has hardness of more than 3 on Mohs scale and is laminar in the upper 14 inch; calcareous; moderately alkaline; gradual, wavy boundary.

C—15 to 72 inches, whitish caliche; weakly cemented; 2 to 3 percent mixed gravel in upper part, increasing to 25 to 30 percent at 72-inch depth; pebbles are mainly 1/2 inch to 3 inches in diameter and include limestone, igneous rock, chert, and quartzite.

The solum ranges from 7 to 20 inches in thickness over indurated caliche. This range is common within horizontal distances of less than 20 feet. Caliche fragments and chert gravel cover less than 5 percent to as much as 75 percent of the surface. The A horizon is very dark grayish brown, grayish brown, brown, and dark brown. It ranges from loam to clay loam in texture. It is 35 to 80 percent caliche fragments. Some profiles have a few limestone and chert fragments. Most of the fragments are in the A12 horizon, and many of these fragments are indurated and laminar in their upper part and slightly to moderately knobby or nodular on their lower sides. The C horizon consists of beds of caliche that are indurated and laminar in the upper 1/4 to 1/2 inch but become softer with depth. The Ccam horizon is weakly cemented to strongly cemented and has a few to 75 percent pebbles of rounded chert and other gravel in some profiles.

OMC—Olmos association, undulating. The soils in this association are in areas that are irregular in shape and range from about 10 acres to several hundred acres in size. Slopes are convex. They are mainly 2 to 5 percent but range from 1 to 8 percent.

This association is about 50 percent Olmos gravelly or very gravelly loam, 25 percent Olmos gravelly or very gravelly loam, 10 percent Zapata soils, 5 percent Jimenez soils, 5 percent Darl soils, and 5 percent other soils. The Zapata and Darl

soils are mainly on foot slopes, but the Zapata soils are also on the caps of hills. The Jimenez soils are in positions similar to those of the Olmos soils but have much gravel of mixed origin. These soils could have been separated in mapping, but because use and management are similar, separation was not justified.

These soils are used for range and wildlife habitat. Some areas of these soils are also used as a source of caliche for construction purposes. Shallow Ridge range site.

Pryor Series

The Pryor series consists of deep, nearly level to gently sloping and undulating soils on uplands. These soils formed in calcareous, loamy and clayey material over shale.

In a representative profile the surface layer is grayish-brown clay loam about 8 inches thick. The next layer extends to a depth of 42 inches. In sequence downward, it is 10 inches of pale-brown, firm clay loam; 12 inches of light yellowish-brown firm clay; and 12 inches of light yellowish-brown firm clay loam. The underlying material, to a depth of 72 inches, is pale-yellow clayey shale that has a few soft masses of calcium carbonate and a few gypsum crystals.

Pryor soils are well drained. Permeability is very slow. Runoff is medium. Available water capacity is medium. Soil salinity affects the available water capacity. The hazard of erosion is slight to moderate.

Almost all areas of these soils are used for range and wildlife habitat. A few areas are in small grain, grain sorghum, and introduced grasses.

Representative profile of a Pryor clay loam in an area of Pryor association, undulating, 2.3 miles east of courthouse in Eagle Pass on U.S. Highway 277, 14.6 miles northeast on Texas Highway 57, 5.2 miles south-west on pipeline road to metal gate, 3.5 miles west by southwest on pipeline road, 100 feet south in an area of range:

A1—0 to 8 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak, medium, platy structure in upper 1 inch, weak, fine and medium, subangular blocky structure below; very hard, friable; many fine roots; many fine pores and root channels; few chert pebbles in soil mass and on surface; about 15 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear, smooth boundary.

B21ca—8 to 18 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate, fine and medium, subangular blocky structure; very hard, firm; common fine roots; few fine pores and root channels; few films and threads of calcium carbonate; about 25 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, smooth boundary.

B22ca—18 to 30 inches, light yellowish-brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate, fine and medium, subangular blocky and angular blocky structure; very hard, firm; few roots; few fine pores and root channels; few soft masses and few films and threads of calcium carbonate; about 30 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—30 to 42 inches, light yellowish-brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; moderate, fine and medium, angular blocky structure; very hard, firm; few roots; few fine pores; about 5 percent soft masses of calcium carbonate; about 30 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear, wavy boundary.

C—42 to 72 inches, pale-yellow (2.5Y 7/4) clayey shale, light yellowish brown (2.5Y 6/4) moist; moderate, thin, medium, platy structure parting to moderate, fine and medium, blocky; extremely hard, very firm; few soft

masses of calcium carbonate; few gypsum crystals; about 19 percent calcium carbonate equivalent; calcareous; moderately alkaline.

Depth to shaly material ranges from 40 to 60 inches. Salinity ranges from low to moderate in the upper 24 inches and from moderate to high below. The A horizon is grayish-brown, brown, or light olive-brown clay loam or clay. It is 5 to 20 inches thick. The B2 horizon is pale brown, brown, yellowish-brown, light olive-brown, light yellowish-brown, or pale-yellow clay loam or clay that is 15 to 45 percent clay. The B3 horizon is light gray, light yellowish brown, olive yellow, brownish yellow, or pale yellow. It is 5 percent to about 15 percent visible masses and concretions of calcium carbonate. The C horizon is light gray, light olive gray, pale olive, or pale yellow.

PrA—Pryor clay loam, 0 to 1 percent slopes. This nearly level soil is in areas that are irregular in shape and average about 100 acres in size. Slopes are plane to weakly convex. They are mainly about 0.5 to 0.8 percent but range from 0 to 1 percent.

The surface layer is grayish-brown clay loam about 14 inches thick. The next layer is 16 inches of brown, firm clay. The next layer is 13 inches of light yellowish-brown very firm clay that has about 5 percent limy masses and a few shale fragments. The underlying material is clayey shale and some sandstone material.

Included with this soil in mapping are areas of Copita and Maverick soils that are slightly higher than this Pryor soil.

Most areas of this soil are irrigated. The main crops are grain sorghum, small grain, and introduced perennial grasses.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation water system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs. The hazard of water erosion is slight.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIs-2, irrigated; pasture and hayland group 7C.

PrB—Pryor clay loam, 1 to 3 percent slopes. This gently sloping soil is in areas that are irregular in shape and average about 125 acres in size. Slopes are convex. They average about 1.5 percent but range from 1 to 3 percent.

The surface layer is grayish-brown clay loam about 6 inches thick. The next layer is 4 inches of brown, friable clay loam. The next layer is 18 inches of light yellowish-brown, firm clay loam. Below this layer is 22 inches of light yellowish-brown, firm clay that has about 5 percent limy masses. The underlying material is pale-yellow, clayey shale.

Included with this soil in mapping are areas of Copita and Maverick soils that are slightly higher than this Pryor soil.

Most areas of this soil are irrigated. The main crops are grain sorghum, small grain, and introduced perennial grasses.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs. Terraces and contour farming are needed in places when using sprinkler irrigation. The hazard of water erosion is moderate.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit IIIe-2, irrigated; pasture and hayland group 7C.

PYC—Pryor association, undulating. The soils in this association are in areas that are subrounded in shape and average about 400 acres in size. Slopes are mainly about 2 percent but range from 0 to 5 percent.

This association is about 35 percent Pryor clay loam, 1 to 3 percent slopes, 10 percent Pryor clay loam, 0 to 1 percent slopes, 5 percent Pryor clay loam that has slopes of 3 to 5 percent, 15 percent Pryor clay that has slopes of 1 to 3 percent, 5 percent Pryor clay that has slopes of 0 to 1 percent, 5 percent Pryor clay that has slopes of 3 to 5 percent, 10 percent Catarina soils, 10 percent Maverick soils, and 5 percent other soils. The Catarina soils occupy the lower positions, and the Maverick soils occupy the higher positions. The soils in this association could have been separated in mapping, but because use and management are similar, separation was not justified.

A Pryor soil in this association has the profile described as representative for the series.

The hazard of water erosion is moderate. Most areas of this soil are used for range and wildlife habitat. Clay Loam range site.

Quemado Series

The Quemado series consists of shallow, undulating, very gravelly and loamy soils on old, high terraces. These soils formed in calcareous, gravelly alluvium.

In a representative profile the surface layer is brown, neutral very gravelly loam about 6 inches thick. The next layer is about 8 inches of reddish-brown very gravelly sandy clay loam. The underlying material, to a depth of 60 inches, is caliche that is strongly cemented in the upper 6 inches and weakly cemented below.

Quemado soils are well drained. Permeability is moderate. Runoff is medium. Available water capacity is very low. The hazard of erosion is moderate.

All areas of these soils are used for range and wildlife habitat. Quemado soils have been mined for caliche for construction purposes. Several open pit mines are in areas of these soils.

Representative profile of a Quemado very gravelly loam in an area of Quemado association, undulating, 7.2 miles north of Quemado, Texas, on U.S. Highway 277; 100 feet west from highway right-of-way:

A1—0 to 6 inches, brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, sub-angular blocky structure; hard, friable; many fine roots; about 50 percent, by volume, chert, quartz, and igneous pebbles, mainly less than 2 inches in diameter; neutral; clear, wavy boundary.

B2t—6 to 14 inches, reddish-brown (5YR 4/3) very gravelly sandy clay loam, dark reddish brown (5YR 3/3) moist; moderate, fine, subangular and angular blocky structure; many fine roots; about 80 percent chert, quartz, and igneous pebbles, mainly less than 2 inches in diameter; neutral; abrupt, wavy boundary.

C1cam—14 to 20 inches, pinkish-white (7.5YR 8/2) strongly cemented caliche, finely laminated and indurated in the upper part; few chert and igneous pebbles; diffuse, irregular boundary.

C2ca—20 to 60 inches, pinkish-white (7.5YR 8/2) weakly cemented caliche; massive; about 50 percent, by volume, embedded pebbles.

The solum ranges from 10 to 20 inches in thickness. It is neutral to mildly alkaline. The A horizon is dark brown, brown, or reddish brown. It is gravelly or very gravelly loam to gravelly or very gravelly sandy loam that is 40 to 80 percent gravel. About 30 to 95 percent of the surface is covered with gravel. The Bt horizon is brown or reddish brown. It is gravelly or very gravelly sandy clay loam, sandy loam, or loam that is 40 to 80 percent gravel. The C horizon is moderately cemented or strongly cemented in the upper part and becomes softer with depth.

QMC—Quemado association, undulating. The soils in this association are in areas that are irregular in shape and range from about 10 acres to several hundred acres in size. Slopes are convex and are mainly 1 to 3 percent, but range from 1 to 8 percent.

This association is about 45 percent Quemado gravelly or very gravelly loam, 20 percent Quemado gravelly or very gravelly sandy loam, 10 percent soils that are similar to Quemado soils but are slightly deeper to caliche, 10 percent Jimenez soils, 5 percent Olmos soils, 5 percent Zapata soils, and 5 percent other soils. The soils that are similar to Quemado soils but are slightly deeper to caliche occur as pockets that are in slightly lower positions than this Quemado soil. Jimenez, Olmos, and Zapata soils commonly are on side slopes or foot slopes. The soils in this association could have been separated in mapping, but because their use and management are similar, separation was not justified.

These soils are used for range and wildlife habitat. Some areas are used as a source of caliche for construction purposes. Gravelly Ridge range site.

Reynosa Series

The Reynosa series consists of deep, nearly level, loamy soils on old stream terraces. These soils formed in calcareous sediment.

In a representative profile the surface layer is 15 inches of grayish-brown silty clay loam. The next layer is 13 inches of light brownish-gray, friable silty clay loam. The next layer is 16 inches of pale-brown, friable silty clay loam that has a few films and threads of calcium carbonate. The underlying material, to a depth of 78 inches, is very pale brown silt loam that has thin lenses and small pockets of silty clay loam (fig. 3).

Reynosa soils are well drained. Permeability is moderate. Available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Most areas of these soils are in irrigated vegetables, small grain, sorghum for grain and forage, and introduced grasses.

Representative profile of a Reynosa silty clay loam, 0 to 1 percent slopes, 1.9 miles north on U.S. Highway 277 from Eagle Pass High School, 0.6 mile west on Farm Road 1589, 300 feet south in cultivated field:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; very hard, friable; common fine roots; few fine pores; thin surface crust of slightly lighter color; few very fine mica flakes; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—7 to 15 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4 2) moist; weak, fine, subangular and angular blocky structure; very hard, friable; common fine roots; few fine pores; few worm casts; few very fine mica flakes; calcareous; moderately alkaline; gradual, smooth boundary.

B21—15 to 28 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayisb brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure and some fine, granular structure; very hard, friable; few fine roots; few fine pores; few worm casts; few very fine mica flakes; few films

and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B22—28 to 44 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak, fine and medium, subangular blocky structure: very hard, friable, few fine roots; few fine pores; few worm casts; few very fine mica flakes; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C—44 to 78 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; hard, friable; thin lenses and small pockets of silty clay loam; calcareous; moderately alkaline.

Figure 3.—Profile of Reynosa silty clay loam. Plant roots have penetrated this soil to a depth of more than 50 inches.

The solum ranges from 40 to 60 inches in thickness. The A horizon is grayish brown, brown, or light brownish gray. Tbe B horizon is grayish-brown, brown, light brownish-gray, or pale-brown silty clay loam or silt loam. The C horizon is light brownish gray, pale brown, or very pale brown. Strata consist of thin lenses of slightly contrasting texture and slightly darker buried soils. Visible films, threads, soft masses, and concretions of secondary calcium carbonate range from scarcely evident to about 2 percent, by volume.

ReA—Reynosa silty clay loam, 0 to 1 percent slopes. The soil in this mapping unit is in nearly level, irregularly shaped or long and narrow areas that parallel the Rio Grande. Most areas of this soil are less than 50 acres in size. Slopes are mainly less than 0.5 percent.

Included with this soil in mapping are small areas of Lagloria and Laredo soils. The Lagloria soils are on slightly higher elevations than the Laredo soils.

Most areas of this soil are in cultivation, and a wide variety of crops are grown. Among the major crops are irrigated vegetables, alfalfa, small grain, sorghum for grain and forage, and introduced grasses. Pecans are also irrigated.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs.

The principal plants suitable for pasture and hay are improved bermudagrass, kleingrass, and introduced bluestems. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit I-3, irrigated; pasture and hayland group 7C.

Rio Grande Series

The Rio Grande series consists of deep, nearly level to gently sloping soils on bottom lands. These soils formed in calcareous, stratified, loamy sediment.

In a representative profile the surface layer is pale-brown very fine sandy loam about 10 inches thick. The next layer extends to a depth of 66 inches. In sequence downward, it is 10 inches of light brownish-gray very friable loam that has a few thin strata or darker colored silt loam and lighter colored very fine sandy loam; 3G inches of pale-brown, very friable loam that has a few thin strata of silt loam and very fine sandy loam; and 10 inches of light brownish-gray, friable silty clay loam that has a few strata of brown loam. Below this, to a depth of 80 inches, is very pale brown, very friable loam that has a few thin strata of slightly darker silt loam.

Rio Grande soils are well drained. Permeability is moderate. Runoff is slow. Available water capacity is high. Infrequent flooding occurs but is brief. The hazards of erosion and soil blowing are slight to severe.

Most areas of these soils are used for range and wildlife habitat. A few areas have been cleared and are irrigated. Alfalfa and introduced grasses are the main crops.

Representative profile of Rio Grande very fine sandy loam, 2.8 miles southeast on U.S. Highway 277 from junction of U.S. Highway 277 and Farm Road 1590 (this junction is 1/4, mile south of Normandy), 0.4 mile southwest on county road, 0.25 miles northwest, 0.8 mile west in an area of cultivated land:

A1—0 to 10 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak, fine and very fine, subangular blocky structure; soft, very friable; common fine roots; few worm casts; few very fine mica flakes; calcareous; moderately alkaline; abrupt, smooth boundary.

C1—10 to 20 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; common fine roots; few worm casts; few very fine mica flakes; few bedding planes and few thin strata of slightly darker colored silt loam and slightly lighter colored very fine sandy loam; calcareous; moderately alkaline; clear, smooth boundary.

C2—20 to 56 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; few roots; few mica flakes; few bedding planes and few thin strata of silt loam and very fine sandy loam; calcareous; moderately alkaline; abrupt, smooth boundary.

C3—56 to 66 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few mica flakes; few

bedding planes and few thin strata of slightly more brown loam; calcareous; moderately alkaline; abrupt, smooth boundary.

C4—66 to 80 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few bedding planes and few thin strata of slightly darker silt loam; calcareous; moderately alkaline.

The A horizon ranges from about 6 to 10 inches in thickness. The A and C horizons are light brownish gray, pale brown, or very pale brown very fine sandy loam to silt loam. The C horizon has thin strata of silty clay loam, very fine sandy loam, and silt.

Rg—Rio Grande very fine sandy loam. The soil in this mapping unit is in nearly level areas on the flood plain of the Rio Grande. Slopes range from 0 to 1 percent but are mainly less than 0.5 percent. The soil areas are irregular in shape and average about 250 acres in size. This soil is flooded about once every 5 to 20 years, and floods commonly last less than 1 week.

This soil has the profile described as representative for the series. Included with this soil in mapping were areas of a soil that is similar to Rio Grande soils but is more sandy below the surface layer. Also included were areas of Zalla soils on small knolls.

Most areas of this soil are cultivated and irrigated.

The cropping system should include crops that protect the soil during the growing period and furnish sufficient residue to protect the soil between growing periods. A conservation irrigation system and irrigation water management are needed to control soil and water losses and to minimize accumulation of salt in the soil. Leaching of the soil may be needed where salt buildup occurs. The hazards of water erosion and soil blowing are slight.

The principal plants suitable for pasture and hay are improved bermudagrass, johnsongrass, blue panicum, and buffelgrass. Proper management of pasture includes fertilization, weed control, and rotation grazing and other suitable grazing practices. Use of proper timing and methods of harvesting hay is important. Capability unit I-2, irrigated; pasture and hayland group 2A.

Rz—Rio Grande and Zalla soils. These soils formed in recent alluvium deposited along the flood plain of the Rio Grande. Areas are in narrow bands, commonly less than 1/4 mile wide, on low terraces that are about 5 to 20 feet above the river channel. Broader areas are along some bends in the river. These soils are nearly level to gently sloping, and they are commonly very moundy. Slopes range from 0 to 3 percent but are mainly less than 2 percent. Areas of these soils are locally called vegas (fig. 4).

This mapping unit is about 48 percent Rio Grande soils and about 32 percent Zalla soils. The remaining 20 percent is soils that are similar to Rio Grande or Zalla soils but are more silty or clayey.

The Rio Grande soils have a surface layer of pale-brown very fine sandy loam about 9 inches thick. The underlying material, to a depth of 60 inches, is pale-brown loam that has thin strata of pale-brown very fine sandy loam and light brownish-gray silt loam.

The Zalla soils have a surface layer of light brownish-gray very fine sandy loam about 4 inches thick. The underlying material, to a depth of 60 inches, is pale-brown loamy fine sand that has a thin strata of fine sandy loam and silt loam.

Where channels are evident and sloughing has begun, the hazard of water erosion is severe. In the Zalla soils the hazard of soil blowing is moderate. These soils are subject to flooding and sedimentation, usually about once every 5 to 20 years, and the floods usually last less than 1 week. Most areas of these soils are used for range. Vega range site.

Figure 4.—Area of Rio Grande and Zalla soils. The moundy condition is typical of these soils. The Zalla soils are mainly on the mounds, and the Rio Grande soils are mainly between the mounds. The area was recently burned over.

Verick Series

The Verick series consists of shallow, gently sloping to sloping and undulating, loamy soils on uplands. The soils formed in interbedded calcareous sandstone material.

In a representative profile the surface layer is brown, very friable fine sandy loam about 6 inches thick. The next layer is 9 inches of pale-brown, friable sandy clay loam. The underlying material to a depth of 50 inches, is weakly cemented, calcareous sandstone that contains a small amount of visible lime.

Verick soils are well drained. They are moderately permeable. Runoff is rapid. Available water capacity is very low. The hazard of erosion is moderate to severe.

Most areas of these soils are used for range or wildlife habitat. A few small areas are planted to grass or oats for grazing.

Representative profile of a Verick fine sandy loam in an area of Verick association, undulating, 3.35 miles northwest of El Indio and Farm Road 1021, 1.7 miles northeast through ranch gate to stock pens, 0.7 mile south across main canal and along power line, 210 feet west in an area of range:

A1—0 to 6 inches, brown (I0YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable; common fine roots and old root channels; common fine and medium pores; few weathered sandstone and snail shell fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B2t—6 to 15 inches, pale-brown (I0YR 6/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate, fine and medium, subangular blocky structure; hard, friable; few patchy clay films on peds and in pare channels; common fine roots and old root channels; few threads and fine concretions of calcium carbonate; few sandstone fragments that increase with depth; calcareous; moderately alkaline; abrupt, wavy boundary.

C—15 to 50 inches, light yellowish-brown (2.5Y 6/4) weakly cemented sandstone, light olive brown (2.5Y 5141 moist; platy, with plates 1/4 inch to 1 inch in diameter that have patchy coatings of calcium carbonate; a few roots enter fractures in upper part; calcareous; moderately alkaline.

The solum ranges from 12 to 20 inches in thickness. The A horizon is grayish brown, brown, pale-brown, light yellowish-brown, or light olive-brown fine sandy loam or sandy clay loam. The Bt horizon is grayish-brown, pale-brown, yellowish-brown, or light yellowish-brown fine sandy loam or sandy clay loam. Sandstone fragments typically make up about 3 to 10 percent, by volume, of this horizon. The C horizon is platy sandstone that is weakly consolidated or cemented.

VKC—Verick association, undulating. The soils in this association are in areas that are mainly irregular in shape and average about 50 acres in size. Slopes are convex. They average about 3 percent but range from 1 to 5 percent.

This association is about 65 percent Verick soils, 15 percent Maverick soils, 10 percent Copita soils, 5 percent Zapata soils, and 5 percent other soils. The Maverick soils are in positions similar to those of Verick soils. The Copita soils are in slightly lower positions, either in deeper pockets or on the lower slopes. The Zapata soils are in the higher positions on the landscape. The soils in this association could have been separated in mapping, but because use and management are similar, separation was not justified.

A Verick soil in this association has the profile described as representative for the series.

The hazard of water erosion is moderate. Most areas of these soils are used for range or wildlife habitat. Gray Sandy Loam range site.

VzD—Verick and Zapata soils, 1 to 8 percent slopes. The soils in this mapping unit are in small areas that are 5 to 30 acres in size. They are mainly on rounded or semirounded knolls and are gently sloping to sloping. Slopes are mostly less than 5 percent.

This mapping unit is about 44 percent Verick soils and 28 percent Zapata soils. The remaining 28 percent is mainly Jimenez and Olmos soils. Individual areas may be mostly Verick, Zapata, Jimenez, or Olmos soils and less than 15 percent other soils. The Zapata soils are mainly on the highest parts of the landscape. Verick soils are also on the higher parts of the landscape, but they are below the Zapata soils. The Jimenez and Olmos soils are on side slopes below the Verick and Zapata soils.

The Verick soils have a surface layer of grayish-brown very friable fine sandy loam about 8 inches thick. The next layer is pale-brown, friable sandy clay loam that is about 7 inches thick. The underlying material is calcareous sandstone that contains a small amount of visible lime.

The Zapata soils have a surface layer of grayish-brown loam, about 7 inches thick, that is about 15 percent caliche fragments. The surface layer rests abruptly on thick beds of caliche that is indurated and laminar in the upper few inches and weakly cemented below.

The hazard of water erosion is severe.

Almost all areas of these soils are used for range and wildlife habitat. A few of the smaller areas are included in areas of irrigated soils. Shallow Ridge range site.

Zalla Series

The Zalla series consists of deep, nearly level to gently sloping, calcareous, loamy soils on bottom lands. These soils formed in sandy alluvial sediment that has been reworked by wind.

In a representative profile the surface layer is about 4 inches of light brownish-gray very fine sandy loam. The underlying material, to a depth of 60 inches, is pale-

brown, loose loamy fine sand that has thin strata and lenses of fine sandy loam and silt loam.

Zalla soils are somewhat excessively drained. Permeability is moderately rapid. Runoff is slow. Available water capacity is low. Infrequent floods occur but are brief. The hazard of soil blowing is moderate, and the hazard of erosion is severe where sloughing has occurred.

Most areas of these soils are used for range and wildlife habitat. These soils in Maverick County are mapped only in an undifferentiated group with Rio Grande soils.

Representative profile of a Zalla very fine sandy loam in an area of Rio Grande and Zalla soils adjacent to the Rio Grande, about 5 miles south of Quemado:

A1—0 to 4 inches, light brownish-gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak, fine, subangular blocky structure; soft, very friable; common fine roots; few very fine mica flakes; calcareous; moderately alkaline; abrupt, wavy boundary.

C—4 to 60 inches, pale-brown (10YR f/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose; few strata and lenses of fine sandy loam and silt loam; bedding planes evident; few very fine mica flakes; calcareous; moderately alkaline.

The A horizon ranges from about 2 to 10 inches in thickness. It is very fine sandy loam, silt loam, and loamy fine sand in texture. The C horizon is loamy fine sand that has few to common strata of fine sandy loam and silt loam. It ranges from grayish brown or light brownish gray to pale brown or very pale brown.

Zapata Series

The Zapata series consists of very shallow, gently sloping to sloping and undulating, calcareous, loamy soils on uplands. These soils formed in loamy material over thick beds of caliche.

In a representative profile the surface layer is light brownish-gray loam about 8 inches thick. The surface layer rests abruptly on thick beds of indurated caliche in which the upper few inches is broken into plates that have soil material between them. Beneath this hard platy layer, the caliche becomes less indurated.

Zapata soils are well drained. They are moderately permeable. Runoff is medium. Available water capacity is very low. The hazard of erosion is severe.

All areas of these soils are used for range and wildlife habitat.

This soil is a good source of caliche. There are several open-pit mines.

Representative profile of Zapata loam in an area of Zapata association, undulating, about 10 miles north of Eagle Pass on U.S. Highway 277 to main irrigation canal that crosses under highway, continue about 0.25 mile north on highway, 200 feet east in an area of range:

A1—0 to 8 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky and granular structure; hard, friable; few fine and very fine pores; few fine roots; few worm casts; estimated 20 percent, by volume, of soil mass is caliche and limestone fragments mostly less than 1 centimeter in diameter, but some to 7 centimeters in diameter; about 10 percent of ground surface covered with same type of fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—8 to 12 inches, indurated whitish caliche; about 90 percent of mass is caliche fragments less than 12 inches across and 3 inches thick; upper surface of fragments is smooth, lower surface is knobby or nodular; fragments are laminated in upper 1/2 inch; some overlapping of

fragments occurs; soil material is around, under, and between these fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

C—12 to 60 inches, white (10YR 8/2) massive caliche that becomes nodular at a depth below 20 inches, very pale brown (10YR 7/3) moist; calcareous; moderately alkaline.

The solum ranges from about 3 to 10 inches in thickness. It has few to about 25 percent chert gravel and angular caliche fragments 1 to 8 inches long. It is brown, light brownish-gray, or grayish-brown loam to clay loam. The Ccam horizon is 2 to 4 inches thick. It has soil material between fractures in places. The C horizon ranges from strongly cemented to weakly cemented in the upper part and becomes softer with depth.

ZPC—Zapata association, undulating. The soils in this association are in areas that are irregular in shape and range from about 25 acres to several hundred acres in size. Slopes are convex. They range from 1 to 8 percent but are mainly 2 to 5 percent.

This association is about 45 percent Zapata loam, 20 percent Zapata clay loam, 15 percent Darl soils, 5 percent Jimenez soils, 5 percent Olmos soils, and 10 percent other soils. The Darl soils are in slightly lower positions than Zapata soils. The Jimenez and Olmos soils are in slightly higher positions, and the Zapata soils are on the caps of rolling hills. The soils in this association could have been separated in mapping, but because use and management are similar, it was not justified.

These soils are used for range and wildlife habitat. Shallow Ridge range site.

Use and Management of the Soils

This section explains the system of capability classification used by the Soil Conservation Service, discusses the use and management of the soils for crops and gives predicted yields, describes the use and management of the soils for pasture and hay, groups the soils according to kinds and amounts of forage they can produce if used for range, describes use of the soils for wildlife and recreation, and discusses engineering use of the soils.

Management for Crops, Pasture, and Hay

GERALD M. DARBY, field specialist in agronomy, Soil Conservation Service, helped to prepare this section.

About 40,000 acres in Maverick County is used for irrigated crops, pasture, and hay. Dryland farming is not considered to be economical, because rainfall is low. A few acres is used for dryland farming during the winter months. The major irrigated crops are small grain, forage sorghum, grain sorghum, alfalfa, a few truck crops, and pecans. The major irrigated pasture and hay crop is Coastal bermudagrass.

General management applicable to the soils in Maverick County is briefly described in the following paragraphs.

Irrigated crops.—About 25,000 acres of cropland in the county is irrigated with water from the Rio Grande. The irrigation water is distributed to the fields and applied mainly by surface gravity flow. Large areas of nearly level soils are suited to irrigation farming.

The major irrigated crops are alfalfa (fig. 5), for-age sorghum, small grain, grain sorghum, and a few truck crops. The alfalfa is mainly harvested and pelletized for feed. In addition to these crops, about 2,000 acres is used for irrigated pecans (fig. 6).

Because of the high cost of producing these irrigated crops, good farming management is especially important. The conservation cropping system needs to include application of fertilizer, management of crop residue for maintenance of soil

tilth, control of weeds and insects, and other good farming practices. Irrigation water should be applied in the required amounts and evenly distributed to all parts of the field, and it should be applied when the crop needs it. These objectives can be achieved by proper design of the system. In many cases it is necessary to use earthmoving equipment to level or grade the land so that water can be applied evenly.

Figure 5.—Thick, even stand of irrigated alfalfa on Rio Grande very fine sandy loam.

Figure 6.—Established pecan orchard on a Reynosa silty clay loam.

Infrequent flooding for short periods may occur on the Brundage, Mercedes, Rio Grande, and Zalla soils. The construction of the Amistad Dam and Reservoir has reduced the hazard of major flooding in areas adjacent to the Rio Grande and has made irrigation feasible on several thousand acres of land along the river.

Saline spots commonly occur in several areas of irrigated soils that are not mapped as saline phases. A symbol on the soil map indicates the presence of a saline spot.

Irrigated pasture and hayland.—Approximately 16,000 acres in Maverick County is used for pasture and hay. This acreage is in perennial grasses and does not include land on which annual crops are used for livestock forage. Among the practices that need to be considered in the management of soils for pasture or hay are the use of suitable plants, fertilizing, rotation grazing, and weed control. Management of irrigation water is very important.

Many high-producing grasses are suitable for use in irrigated pastures. Coastal bermudagrass is the most versatile of these. It has a wide range of adaptation. Among the other suitable grasses are Kleberg bluestem, medio bluestem, gordo bluestem, Bell rhodesgrass, Kleingrass 75 (fig. 7), johnsongrass, and weeping lovegrass.

Figure 7.—Irrigated Kleingrass 75 on Elindio silty clay loam, 0 to 1 percent slopes.

On pastureland only one grass should be planted in a field. Mixtures of different grasses are undesirable because they are difficult to manage. Differences in palatability of plants cause animals to overgraze some and to undergraze others, which results in inefficient use of the stand.

Application of fertilizer is essential for economical production of irrigated pasture and hay. It should be applied according to needs as indicated by analysis of the soil, but some general rules can be followed. The soils generally need nitrogen and phosphorus. Potassium is adequate in most cases. Perennial grasses remove nitrogen and phosphoric acid in a ratio of 4 to 1. Therefore, the total application made throughout the year should average about 4 pounds of nitrogen for each pound of phosphoric acid applied. All of the phosphorus can be applied at one time, but the nitrogen needs to be applied in two to six applications, depending on the amount needed. The amount of nitrogen to be applied annually depends on the availability of

water and on the desired level of forage production. In fertilizing alfalfa, phosphorus normally is the only amendment that is necessary.

It is important to have irrigated fields arranged so that grazing can he rotated and coordinated with the irrigation schedule. Most soils need to dry for a few days after irrigation before animals are returned. Grazing on wet soils causes deterioration of soil structure.

Once grass is established on irrigated land, weeds are normally not a concern if the grass is properly harvested and fertilized. A vigorous stand of grass crowds out weeds. Where weeds are a concern, they can be controlled by mowing or by spraying with a hormone-type herbicide. The latter method is usually more effective than mowing and does not damage the grass.

High production from irrigated pasture and hayland requires a large amount of water. To produce 10 tons of Coastal bermudagrass hay per acre, 30 acre-inches of water or more may he needed. The fertility level has a bearing on the efficiency of water use; the higher the fertility level, the lower the requirement for water. Generally, 5 inches of water is needed for each ton of hay produced, and this water can come from rainfall or irrigation. This requirement also applies to forage for grazing, but it refers to dry forage and not to tons of green herbage. The irrigation water should be applied evenly to all parts of the field at the time of production.

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 when they are farmed, and the way the soils 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 horticultural crops or other crops that require 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 for range 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 through VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be up to 4 subclasses. The subclasses are indicated by adding a small letter, e, w, s, or c, to the class numeral, for example IIe. The letter "e" shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; "w" means 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" indicates 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 or no limitations. Class V can contain, at the most, only subclasses w, s, and c, be-cause 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, and have generally similar productivity and other response to management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIs-1.

The classes in the capability system and the sub-classes and units in Maverick County are described in the list that follows:

Class I. Soils that have few limitations that restrict their use (no subclasses).
- Unit I-1, irrigated. Deep, nearly level, moderately permeable silty clay loams on up-lands.
- Unit I-2, irrigated. Deep, nearly level, moderately permeable very fine sandy loams on bottom lands and stream terraces.
- Unit I-3, irrigated. Deep, nearly level, moderately permeable silty clay loams on stream terraces.

Class II. Soils that have moderate limitations that re-duce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils that are subject to moderate erosion if they are not protected.
- Unit IIe-1, irrigated. Moderately deep, gently sloping, moderately permeable fine sandy loams and sandy clay loams on uplands.
- Unit IIe-2, irrigated. Deep, gently sloping, moderately permeable very fine sandy loams on stream terraces.
- Unit IIe-3, irrigated. Deep, gently sloping, moderately permeable silty clay loams on terraces.
- Unit IIe-4, irrigated. Deep, gently sloping, moderately permeable loams and silty clay loams on terraces and uplands.

Subclass IIs. Soils that have moderate limitations because of soil properties.
- Unit IIs-1, irrigated. Deep, nearly level, moderately permeable, saline silty clay loams on uplands.
- Unit IIs-2, irrigated. Deep, nearly level, slowly permeable clay loams on uplands.
- Unit IIs-3, irrigated. Moderately deep, nearly level, moderately permeable sandy clay loams on uplands.

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

Subclass IIIe. Soils that are subject to severe erosion if they are not protected.
- Unit IIIe-1, irrigated. Deep, gently sloping, moderately permeable, saline silty clay loams on uplands.
- Unit IIIe-2, irrigated. Deep, gently sloping, slowly permeable clay loams on uplands.

Subclass IIIs. Soils that have severe limitations because of soil properties.
- Unit IIIs-1, irrigated. Deep, nearly level, very slowly permeable clays on uplands.

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

Subclass IVe. Soils that are subject to very severe erosion if they are not protected.
- Unit IVe-1, irrigated. Moderately deep, gently sloping, slowly permeable clays on uplands.

Pasture and hayland groups

Soils are grouped in this section according to their suitability to specific plants, their productive potential, and their treatment needs. The groups are described briefly in the following paragraphs.

Pasture and Hayland Group 2A. —Deep, moderately permeable very fine sandy loams on stream terraces and bottom lands. These soils have high available water capacity.

Pasture and Hayland Group 7A.—Deep, very slowly permeable clays on uplands. These soils have high available water capacity.

Pasture and Hayland Group 7C.—Deep, moderately to slowly permeable loams, clay loams, and silty clay loams on uplands and terraces. These soils have medium to high available water capacity.

Pasture and Hayland Group 7F.—Deep to moderately deep, saline silty clay loams and clays on uplands. These soils are moderately to slowly permeable and have medium available water capacity.

Pasture and Hayland Group 8C.—Moderately deep, moderately permeable sandy clay loams on uplands. These soils have a medium available water capacity.

Predicted yields

Table 2 lists predicted yields of the principal irrigated crops grown in the county. Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included because their acreage is small or because reliable data on yields are not available. The predictions are based on estimates made by farmers, plant and soil scientists, and others who have knowledge of yields in the county and on research data. The predicted yields are average yields per acre that can be expected by good commercial farmers at the level of management that tends to produce the highest economic returns.

Not included in this table are soils that are used only as range or recreation.

The predicted yields given in table 2 can be expected if the following management practices are used:

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems, or both, are installed.
3. Crop residue is managed to maintain soil tilth.
4. Minimum but timely tillage is used.
5. Insect, disease, and weed control measures are consistently used.
6. Fertilizer is applied according to crop needs as indicated by soil tests.
7. Suitable crop varieties are used at recommended seeding rates.
8. Irrigation water of suitable quality is used.
9. Applications of irrigation water are timed to meet the need of the crop.
10. Irrigation systems are properly designed and efficiently used.

Range

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About 92 percent of Maverick County is in native range. The range is used mainly for raising cattle. Both stocker steer and cow-calf types of operations are conducted.

There are 40 ranches in the county, and these range in size from about 2,500 acres to about 200,000 acres.

The northern part of the county is a level to gently sloping plain. The soils in this area are clays that produce mainly short grasses. Mesquite has invaded areas of these soils. The central and southern parts of the county are characterized by ridges and drainageways in these areas. These soils are sandy loams and clay loams that produce a number of grasses and many shrubs. Shallow and gravelly soils on ridges and hills along the Rio Grande produce good browse, such as that provided by guajillo, grasses, and forbs.

It has been reported that as late as 1890 the area north of Eagle Pass was extensively covered by grasses. Today, this area is covered by many undesirable woody plants (fig. 8)

Figure 8.—Invasion of brush on soil in southern part of Maverick County. Rolling Hardland and Gray Sandy Loam range sites dominate the area. The soils are mainly in the Maverick and Capita series.

Range sites and condition classes

Different kinds of soil differ 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. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community; it reproduces itself and does not change as long as the environment remains unchanged. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to

75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep rangeland in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. The problem is recognizing 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 rangeland that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of the range sites

In the following pages the range sites of Maverick County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition.

CLAY FLAT RANGE SITE

The soils of this site are mainly deep, nearly level clays. There are some depressional areas and other low areas that receive extra moisture from runoff. These soils crack when dry. Water enters the cracks rapidly until they are filled, and then the water enters the soils very slowly. The available water capacity is high. Movement of air, water, and roots in these soils is slow.

The climax plant community consists of short and mid grasses and a few scattered woody plants. The approximate composition, by weight, of the climax (potential) plant community is 25 percent pink pappusgrass; 20 percent curly mesquite; 10 percent pinhole bluestem and two-flower trichloris; 10 percent plains bristlegrass; 10 percent tobosa; 5 percent plains lovegrass; 5 percent white tridens; 5 percent Arizona cottontop; 5 percent fall witchgrass; and 5 percent bundleflower and other herbs.

This site produces about 3,500 pounds of air-dry herbage per acre in favorable years and 1,500 pounds or less per acre in unfavorable years. Most of the plants produce forage used by cattle. Only a few species provide forage used by deer.

Under continued heavy grazing by cattle, pink pappusgrass, plains bristlegrass, white tridens, and Arizona cottontop decrease in the plant community. Such plants as curly mesquite and tobosa increase. If over-grazing is prolonged, red grama, three-awn, mesquite, annual weeds, and annual grasses make up a substantial part of the annual production, and total production is greatly reduced.

This site is quite difficult to successfully reseed, because the soil is clayey. Brush can be managed by chemical means. The range is improved mainly by use of proper grazing management.

CLAY LOAM RANGE SITE

The soils of this site are deep, nearly level to undulating loams, clay loams, and silty clay loams (fig. 9). Permeability is slow to moderate, and available water capacity is medium to high. Movement of air, water, and roots in these soils is good.

Figure 9.—Area of Clay Loam range site in Mavco association, gently undulating.

The climax plant community is an open grassland that has mesquite trees or shrubs in places. The approximate composition, by weight, of the climax (potential) plant community is 25 percent Arizona cottontop, 20 percent curly mesquite, 10 percent perennial three-awn, 10 percent plains bristlegrass, 10 percent plains lovegrass, 10 percent pink pappusgrass, 10 percent pinhole bluestems, and 5 percent orange zexmenia and other forbs.

This site produces about 3,500 pounds of air-dry herbage per acre in favorable years and 1,800 pounds or less per acre in unfavorable years. About 95 percent of this production is from plants that provide forage for cattle.

If this site has deteriorated, mesquite, other mixed brush, red grama, purple three-awn, ragweed, annual weeds, and annual grasses make up a substantial part of the annual production. The vegetation can usually be improved by brush management and by reseeding.

GRAVELLY RIDGE RANGE SITE

The soils of this site are shallow to very shallow, undulating to rolling very gravelly loams (fig. 10). Permeability is moderate above the caliche. Available water capacity is very low. Movement of air, water, and roots in these soils is limited by shallow or very shallow depth to caliche.

The climax plant community is mid and short grasses interspersed with low-growing shrubs. Guajillo and blackbrush are the dominant woody plants. The approximate composition, by weight, of the climax (potential) plant community is 25 percent pinhole bluestems, 20 percent guajillo, 15 percent tanglehead, 10 percent Arizona cottontop, 5 percent bushsunflower and other forbs, 5 percent kidneywood and other shrubs, 5 percent hooded windmillgrass, 5 percent slim tridens, 5 percent Texas bristlegrass, and 5 percent lovegrass tridens.

This site produces about 2,000 pounds of air-dry herbage per acre in favorable years and 1,000 pounds or less per acre in unfavorable years. Approximately 60 percent of this production is from plants that provide forage for cattle. Many plants provide forage for deer.

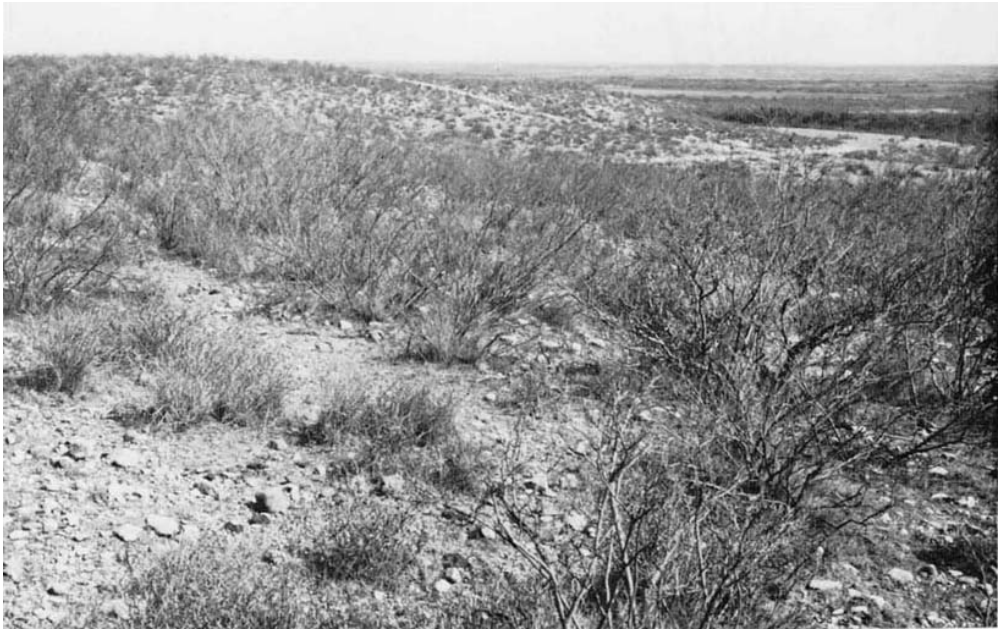

Figure 10.—Area of Gravelly Ridge range site in Jimenez association, rolling.

Under continued heavy grazing by cattle, pinhole bluestem and tanglehead decrease in the plant community. Such plants as slim tridens and Texas bristlegrass increase. If this site has deteriorated, ceniza, hairy tridens, red grama, blackbrush, annual weeds, and annual grasses make up a substantial part of the annual production.

GRAY SANDY LOAM RANGE SITE

The soils of this site are shallow to moderately deep, gently undulating to undulating fine sandy loams and sandy clay loams. These soils are underlain by sand-stone. Permeability is moderate, and available water capacity is very low to medium. Movement of air, water, and roots in these soils is fair to good.

The climax plant community is an open grassland and scattered mesquite and other shrubs. The site supports some climax forbs and legumes. The approximate composition, by weight, of the climax (potential) plant community is 20 percent plains bristlegrass, 15 percent hooded windmillgrass, 15 percent trichloris and tanglehead, 10 percent pink pappusgrass, 10 percent Arizona cottontop, 5 percent forbs including legumes, 5 percent shrubs, 5 percent fall witchgrass, 5 percent perennial three-awn, 5 percent curly mesquite, and 5 percent slim tridens.

This site produces approximately 3,000 pounds of air-dry herbage per acre in favorable years and 1,800 pounds or less per acre in unfavorable years. About 90 percent of this production is from plants that provide forage for cattle.

If this site has deteriorated, woody plants such as blackbrush, mesquite, cactus, red grama, annual forbs, and grasses make up a substantial part of the annual production. This site can be reseeded and woody plants can be managed by mechanical and chemical methods.

HARDLAND RANGE SITE

The soils of this site are deep, nearly level fine sandy loams (fig. 11). Below the surface layer of fine sandy loam is dense sandy clay loam that is very slowly permeable. The available water capacity is low. Movement of air, water, and roots in these soils is slow.

Figure 11.—Area of Hardland range site in Brundage association, nearly level.

The climax plant community is open stands of mid and short grasses. Distribution of species varies because of small variations in surface drainage. The approximate composition, by weight, of the climax (potential) plant community is 20 percent two-flower trichloris, 15 percent bristlegrass, 15 percent pink pappusgrass, 15 percent Arizona cottontop, 10 percent hooded windmillgrass, 10 percent curly mesquite, 10 percent pinhole bluestems, and 5 percent ruellia and other forbs.

The site produces approximately 3,000 pounds of air-dry herbage per acre in favorable years and 1,500 pounds per acre in unfavorable years. Most of the species provide forage for cattle.

Under continued heavy cattle grazing, two-flower trichloris, Arizona cottontop, and pinhole bluestems decrease in the plant community and such plants as hooded windmillgrass and Texas bristlegrass increase. If overgrazing is prolonged, red grama, whorled drop-seed, mesquite, dwarfed screwbean, annual weeds, and annual grasses make up a substantial part of the annual production.

ROLLING HARDLAND RANGE SITE

The soils of this site are moderately deep, undulating clays. Permeability is slow, and available water capacity is medium. Streaks and pockets of gypsum and other salts are in the subsoil. Movement of air, water, and roots in the soil is slow. The salinity and clay content causes the soil to be droughty.

The climax plant community is an open grassland that has scattered low brush such as blackbrush. The approximate composition, by weight, of the climax (potential) plant community is 30 percent pink pappusgrass, 15 percent curly mesquite, 15 percent tobosa, 15 percent plains bristlegrass, 10 percent Texas bristlegrass, 5 percent bundleflower and other forbs, 5 percent shrubs, and 5 percent plains lovegrass.

This site produces approximately 2,100 pounds of air-dry herbage per acre in years that have favorable growing conditions and 1,0 (10 pounds per acre) in years

that have poor growing conditions. About 95 percent of this production is from plants that provide forage for cattle.

If this site has deteriorated, whorled dropseed, red grama, Texas varilla, silverleaf nightshade, mesquite, allthorn goatbush, annual weeds, and annual grasses make up a substantial part of the annual production. In this condition total production is greatly reduced.

SALINE CLAY RANGE SITE

The soils in this site are deep, gently undulating, saline clays. Permeability is very slow. The amount of water available to plants is low because of the salinity of the soil. Movement of air, water, and roots in these soils is slow.

The climax vegetation is salt-tolerant, shallow-rooted grasses and a few shrubs and forbs. The approximate composition, by weight, of the climax (potential) plant community is 30 percent two-flower trichloris, 15 percent curly mesquite, 10 percent Texas bristlegrass, 10 percent tobosa, 10 percent white tridens, 10 percent pink pappusgrass, 10 percent alkali sacaton, 3 percent armed saltbush, guayacan and other shrubs, and 2 percent velvet bundleflower and other forbs. Texas varilla is in patches where salinity is high.

This site produces approximately 2,500 pounds of air-dry herbage per acre in favorable years and 1,500 pounds or less per acre in unfavorable years. About 95 percent of this production is from plants that provide forage for cattle.

Under continued heavy cattle grazing, two-flower trichloris and alkali sacaton decrease in the plant community. Such plants as curly mesquite and tobosa increase. If overgrazing is prolonged, whorled dropseed, red grama, Texas varilla, mesquite, annual weeds, and annual grasses make up a substantial part of the annual production, and total production is greatly reduced.

SANDY LOAM RANGE SITE

The soils in this site are deep, gently undulating fine sandy loams. Permeability is moderate. Available water capacity is medium. Movement of air, water, and roots in these soils is good.

The climax plant community is an open grassland. The site is dominated by mid grasses, but it supports some climax forbs and woody plants. The approximate composition, by weight, of the climax (potential) plant community is 30 percent tanglehead, 20 percent Arizona cottontop, 10 percent hairy grama, 10 percent hooded windmillgrass, 10 percent pink pappusgrass, 10 percent plains bristlegrass, 5 percent forbs such as bushsunflower, and 5 percent guayacan and other shrubs.

This site produces approximately 3,500 pounds of air-dry herbage per acre in favorable years and 2,000 pounds per acre in unfavorable years. About 90 percent of this production is from plants that provide forage for cattle.

If heavy grazing is prolonged, red grama, red lovegrass, mesquite, pricklypear, annual weeds, and annual grasses make up a substantial part of the annual production, and total production is greatly reduced. Brush can be controlled on this site by chemical or mechanical means, and reseeding ran be done successively.

SHALLOW RANGE SITE

The soils of this site are shallow and are underlain by caliche. Permeability is moderate. Available water capacity is low. Movement of air, water, and roots in these soils is limited because of shallow depth.

The climax plant community is open stands of mid grasses, some climax forbs, and a scattering of woody plants. The approximate composition, by weight, of the climax (potential) plant community is 15 percent slim tridens, 15 percent side-oats grama, 15 percent pinhole bluestems, 10 percent fall witchgrass, 10 percent curly mesquite, 10 percent Arizona cottontop, 5 percent orange zexmenia and other forbs,

5 percent guajillo and other shrubs, 5 percent bristlegrass, 5 percent lovegrass tridens, and 5 percent pink pappusgrass.

This site produces approximately 2,500 pounds of air-dry herbage per acre in favorable years and 1,000 pounds per acre in unfavorable years. About 90 percent of this production is from plants that provide forage for cattle.

If overgrazing is prolonged, recd grama, gray coldenia, annual weeds, and annual grasses make up a substantial part of the annual production, and total production is greatly reduced. This site can be successively reseeded, and woody plants can be managed by mechanical means.

SHALLOW RIDGE RANGE SITE

The soils of this site are shallow to very shallow, undulating loams, fine sandy loams, or very gravelly loams over sandstone or caliche. Permeability is medium. Available water capacity is very low. Movement of air, water, and roots in these soils is limited because of soil depth.

The climax plant community is an open stand of grass and scattered woody shrubs and perennial forbs. The approximate composition, by weight, of the climax (potential) plant community is 15 percent side-oats grama, 10 percent guajillo shrubby dalea, Texas kidneywood, and other shrubs, 10 percent fall witchgrass, 10 percent slim tridens, 10 percent Arizona cottontop, 10 percent pink pappusgrass, 10 percent bristlegrass, 10 percent pinhole bluestems, 5 percent orange zexmenia and other forbs, 5 percent hairy tridens, and 5 percent sand dropseed.

The site produces approximately 2,000 pounds of herbage per acre in favorable years and 1,000 pounds per acre in unfavorable years. About 90 percent of this production is from plants that provide forage for cattle.

If this site has deteriorated, hairy grama, three-awn, ceniza, annual weeds, and annual grasses make up a substantial part of the annual production, and total production is greatly reduced. Creosotebush increases on this site if it deteriorates.

VEGA RANGE SITE

The soils of this site are deep loams or very fine sandy loams that are nearly level to gently sloping. Permeability is moderate to moderately rapid, and available water capacity is low to high. Movement of air, water, and roots in these soils is good.

The climax plant community is not fully known, but evidence indicates that it is open, tall grasses and scattered large willow trees. The approximate composition, by weight, of the climax (potential) plant community is 35 percent common reed, 25 percent big sacaton; 10 percent white tridens, 10 percent southwestern bristlegrass, 10 percent black willow, 5 percent spiny aster, and 5 percent forbs.

This site produces approximately 5,500 pounds of air-dry herbage per acre in years with favorable growing conditions and 3,000 pounds per acre in years with poor growing conditions. About 85 percent of this production is from plants that provide forage for cattle.

Fires and continued heavy grazing cause big sacaton and common reed to decrease. Introduced plants such as giantreed and bermudagrass increase rapidly (fig. 12). Because of overflow of streams, many other species may show up temporarily. Saltcedar, devilweed aster, and annuals will be dominant on some areas.

Figure 12.—Area of Vega range site on Rio Grande and Zalla soils. Giantreed and bermudagrass dominate the area. Bermudagrass increases in the open areas.

Wildlife

The main kinds of wildlife in Maverick County are white-tailed deer, turkey, javelina, bobwhite quail, scaled (blue) quail, mourning dove, white-winged dove, cottontail rabbit, jackrabbit, and numerous kinds of nongame birds. Also present are raccoon, fox, ringtail cats, skunk, opposum, beaver, nutria, and other furbearing animals. The predators commonly found are coyote, bobcat, and a few mountain lions.

Intermittent lakes, ponds, streams, and grainfields attract ducks and a few geese during migration. Sandhill cranes are also attracted to grainfields. Most of the ponds in the county are stocked with channel catfish, black bass, and sunfish, and they provide excellent fishing. The Rio Grande and the main irrigation canal also provide good fishing.

Fish and wildlife resources are of great economic importance to landowners in this county. Realizing the value of food and cover for wildlife, many landowners who have planned brush control on their land have endeavored to leave a part of the brush for wildlife use. Straight strips, circular or semicircular strips, and offset strips have been used as patterns for brush control.

Soils directly influence the kinds and amounts of vegetation and the amounts of water available, and in this way they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are (1) thickness of soil useful to crops, (2) surface texture, (3) available water capacity to a depth of 40 inches, (4) wetness, (5) salinity or alkalinity within a depth of 20 inches, (6) flood hazard, (7) slope, and (8) permeability of the soil to air and water.

In table 3 the soils of this survey area are rated for their suitability for producing six elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability of the soils for various elements. A rating of *good* means the element of wildlife habitat is easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory results are expected when the soil is used for the prescribed purpose. A rating of *fair* means the element

of wildlife habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention may be required for satisfactory results. A rating of *poor* means the element of wildlife and limitations for the designated use are rather severe. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means the elements of wildlife habitat are very severe and that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

The ratings for elements of wildlife habitat take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account present use of soils or present distribution of wildlife and people. For this reason, selection of a site for development as a habitat for wildlife requires inspection at the site.

The elements of wildlife habitat rated in table 3 are briefly described in the following paragraphs.

Grain and seed crops.—These crops are annual grain-producing plants, such as corn, sorghum, small grain, and sunflower.

Grasses and legumes.—This group consists of domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Examples of grasses are kleingrass and panicgrass; examples of legumes are alfalfa and white clover.

Wild herbaceous upland plants.—This group consists of native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. On rangeland, typical plants are bluestem, panicum, bristlegrass, bushsunflower, bundleflower, and orange zexmenia.

Shrubs.—These plants produce buds, twigs, bark, or foliage that is used as food by wildlife, or that provide cover and shade for some wildlife species. Typical plants are mesquite, catclaw, whitebrush, blackbrush, guajillo, guayacon, desert yaupon, vine ephedra, and Texas kidneywood.

Wetland food and cover plants.—This group consists of annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples are smartweed, wild millet, spikerush and other rushes, sedges, burreed, sourdock, and cattails. Submerged and floating aquatics are not included in this category.

Shallow water areas.—These areas are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submersed aquatics.

Table 3 also rates soils according to their suitability as habitat for the kinds of wildlife in the county. These ratings are related to ratings made for the elements of wildlife habitat. For example, soils rated very poor for shallow water developments are rated very poor for wetland wildlife.

Open-land wildlife consists of birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, sandhill cranes, Harris hawks, cottontail rabbits, and foxes are typical examples of open-land wildlife.

Rangeland wildlife consists of birds and mammals that normally live in brushy areas of small trees and shrubs. Deer, turkey, javelina, raccoon, and coyote are typical examples of rangeland wildlife.

Wetland wildlife consists of birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, heron, beaver, and nutria are typical examples of wetland wildlife.

Recreation

Many areas of Maverick County have medium to high potential for the development of various types of recreational facilities. There is a need for new recreational facilities in the county. There is also a need for access to many areas that could be used for recreation, such as the Rio Grande and the main irrigation canal. Hunting and fishing areas are the most important sources of recreation in the county, and a considerable amount of income is derived from hunting and fishing leases.

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 4 the soils of Maverick County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

In table 4 the limitations of the soils are rated slight, moderate, or severe for specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A rating of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A rating of *moderate* means that limitations can be overcome or modified by planning, by design, or by special maintenance. A rating of *severe* means that costly soil reclamation, special design, or intensive maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive 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 rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have slopes of stoniness that greatly increases cost of leveling sites or of building access roads.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering Uses of the Soils

CLAUDE THOMPSON JR., agricultural engineer, Soil Conservation Service, assisted in the preparation of this section.

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 commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the 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. 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 soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil 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 7, and it also can be used to make other useful maps.

This information, however, does not eliminate 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 greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many mapped areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms 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 soil classification system, used by SCS engineers, the Department of Defense, and others,(2) and the AASHTO system, adopted by the American Association of State Highway and Transportation officials.(3)

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. 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 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 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. The AASHTO classification for tested soils is shown in table 7; the estimated classification is given in table 5 for all soils mapped in the survey area.

Engineering properties of the soils

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for representative soil profiles, by layers sufficiently different to have different significance for soil engineering. 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 soil in other counties. Following are explanations of some of the columns in table 5.

Hydrologic soil groups give the runoff potential from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long duration storms occurring after prior wetting and opportunity for swelling, and without the protective effects of vegetation. The major soil groups are given in the following paragraphs:

Group A (low runoff potential) consists of soils that have high infiltration rates even when thoroughly wetted. These are chiefly deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission in that water readily passes through them.

Group B soils have moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately deep to deep, moderately well drained to well drained soils that have moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C soils have slow infiltration rates when thoroughly wetted. These are chiefly soils that have a layer that impedes downward movement of water or soils that have moderately fine to fine texture. These soils have a slow rate of water transmission.

Group D (high runoff potential) soils have very slow infiltration rates when thoroughly wetted. These are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have 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.

Depth to bedrock is distance from the surface to the soil to the upper surface to the rock layer.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters 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 USDA textural classification are defined in the Glossary of this soil survey.

The data on percentage passing sieves in table 7 show a range in percentage of soil materials passing 5 different sieve sizes. This information is useful in helping to determine suitability of the soil as a source of material for construction purposes. Because the estimates are for modal soils, considerable variation in the grain size of any specified soil should be anticipated.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is in-creased from a dry state, the material changes from a semisolid to a plastic state. If the

moisture content is further increased, the material changes from a plastic state to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid state to 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 moisture 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 is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete.

Shrink-swell potential is 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. 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 (fig. 13), 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.

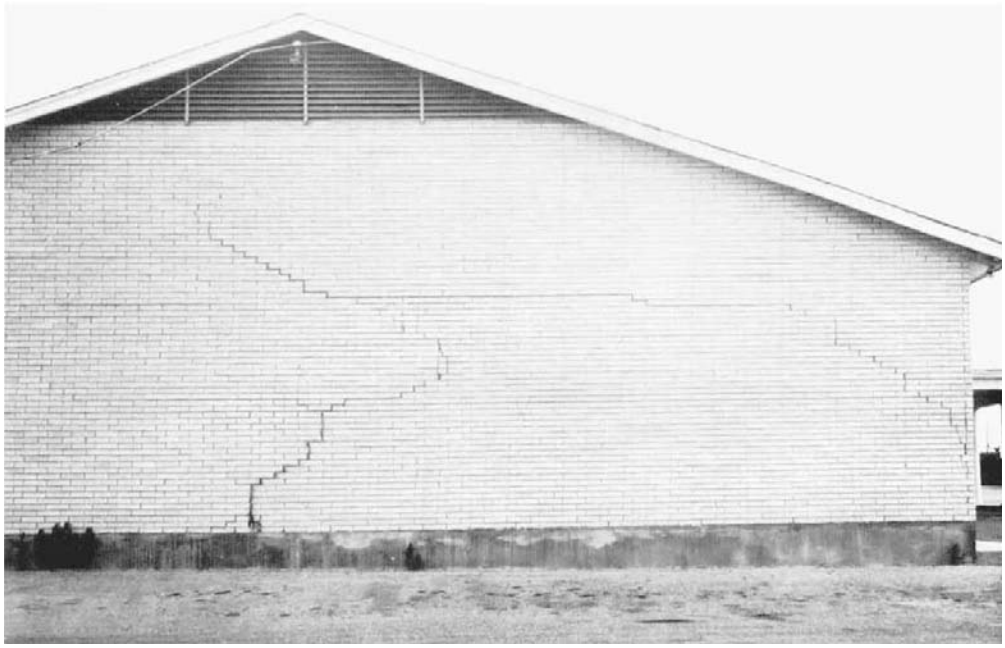

Figure 13.—Crack in a building caused by shrinking and swelling of the soil. The soil is in the Maverick series.

Corrosivity, as used in table 5, 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 mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of the soils

The estimated interpretations in table 6 are based on the 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 Maverick County. In table 6, ratings are used to summarize the limitation or suitability of the soils for all listed purposes other than for drainage of crops and pasture, irrigation, and grassed waterways. For these particular uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. Slight means that soil properties are generally favorable for the rated use or, in other words, that 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 that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, 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 from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption or 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 is a soil property that affects difficulty of layout and construction and also the risk of soil 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 the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, 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 amounts of stones, if any, that influence the case 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, such as 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 slopes,

absence of rock outcrop or big stones, and freedom from flooding or a high water table.

Dwellings without basements, 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.

Sanitary landfill is a method of disposing of refuse in dug trenches. The 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, 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 if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 6, have an all-weather surface 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 also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

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.

Embankments, dikes, and levees 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 factors that are unfavorable.

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.

Sand and gravel deposits are in a few areas of the Rio Grande and Zalla soils adjacent to the Rio Grande. These areas do not occur in a definite pattern and cannot be located in survey data. The deposits contain an excessive amount of fine material.

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 to plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suit-

ability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

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 rate of water movement; depth to the water table; slope, 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; soil texture; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer; amount of water held available to plants; and need for drainage, or depth to water table or bedrock (figs. 14 and 15).

Figure 14.—Irrigated area of Reynosa silty clay loam, 0 to 1 percent slopes. This soil requires little additional leveling to achieve suitable water distribution.

Figure 15.—Concrete-lined irrigation ditches are commonly needed to carry water across permeable soils. The soil is Rio Grande very fine sandy loam.

Grassed waterways are constructed to carry excess runoff water through irrigated cropland, pasture, or hayland to a safe outlet without erosion or damage to structures needed to irrigate, manage, or protect the soil and crops. The factors considered in selecting soils for grassed waterways are those features that affect establishment, growth, and maintenance of plants and ease of construction of the waterway, such as texture and thickness of soil layers, steepness of slope, and susceptibility to erosion or siltation.

Engineering test data

Table 7 contains engineering test data for some of the major soil series in Maverick County. These tests were made to help evaluate the soils for engineering purposes.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Linear shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when ovendry.

The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Formation and Classification of the Soils

This section discusses the factors of soil formation and briefly describes important processes in the development of soil horizons. In addition, the system of classifying soils is discussed and each soil series represented in the county is placed in the major categories of that system.

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 such 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 the 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 required for the development of distinct horizons.

Climate

Precipitation, temperature, humidity, evaporation, and wind have all been important in the development of the soils in Maverick County. The vet climate of past geologic ages has influenced the deposition of parent materials. The present climate, characterized by low rainfall, hot summers, and mild winters, has a striking effect on soil development. It influences the kind and density of vegetation, and therefore the organic-matter content of the soils; the leaching of soluble material from the soils; and the activity of micro-organisms in the soil. Low rainfall limits the vegetation to

grasses, shrubs, and small trees, except in some areas along streambeds. Free lime occurs throughout the profiles of most of the soils because not enough water passes through them to each out the lime, but some of the soils have a layer of calcium carbonate accumulation. Almost all of the precipitation in the county is in the form of rain. At times rain falls in torrents and removes soil material almost as fast as it forms, especially on the sparsely covered steeper slopes.

During the hot summers and mild winters, microbial decomposition is almost continuous, and the residue from plants and animals breaks down almost as fast as it accumulates. For this reason the organic-matter content of most soils in the county remains below 2 percent.

Living organisms

Plants, animals, insects, bacteria, and fungi are important in the formation of the soils. Native vegetation of the mixed prairie type has contributed a large amount of organic matter to the soil. Organic matter is on the soil in the form of decaying leaves and stems. It is throughout the solum in the form of fine, fibrous, decomposed roots that have left a network of tubes and pores that hasten the passage of air and water through the soil and provide food for bacteria, actino-mycetes, and fungi.

Plant roots may take calcium, potassium, phosphorus, or other elements from the lower layers of the soils and redeposit these elements on the soil surface when the plants die. Burrowing animals also mix soil horizons as they build homes or gather food.

Earthworms mix the soil material and increase the movement of air, water, and plant roots through it. Despite the low rainfall in this county, and the periods when the entire solum is dry, some soils have an abundance of earthworm casts.

The influence of man on soil formation should not be ignored. Man has permitted the range to be severely overgrazed. This overgrazing has removed many kinds of grasses from the range and has encouraged other, less nutritious grasses to take their place. Much of the range now has sparse vegetation, which allows large amounts of rainfall to run off and carry soil with it. In addition, the sparse vegetation permits the soil temperature to rise in summer, and the heat kills many of the microbes in the soil.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the chemical and mineralogical composition of the soil.

The parent material in Maverick County has been derived mainly from chalky limestone, caliche, marl, sandstone, shale, clay, loamy to clayey outwash or old alluvium, and recent alluvium.

Darl, Jimenez, Olmnos, Quemado, and Zapata soils formed in parent material derived from chalky limestone, caliche, and marl. During the weathering process, some of the calcium carbonate in the soils wont into solution, was redeposited, and formed an enriched layer of calcium carbonate beneath the solum.

Brystal, Copita, and Verick soils formed in parent material derived from sandstone of different geologic ages. The weathering process has produced significant differences in the morphology of these soils even though they formed in the same parent material.

Soils such as Catarina, Dant, Maverick, and Pryor soils formed in parent material derived from shale and clay. Brundage, Elindio, Mavco, Mercedes, and Montell soils formed in loamy to clayey outwash or old alluvium that was transported by water and redeposited at its present location.

Lagloria, Laredo, Reynosa, Rio Grande, and Zalla soils formed in recent alluvium along the Rio Grande. These are deep soils that exhibit varying degrees of maturity.

Movement of calcium carbonate downward in the profile is evident in the Laredo soils, but much stratification still exists in Rio Grande and Zalla soils.

Much of the parent material in the county contains varying amounts of gypsum and other neutral salts. This causes many of the soils that formed in this material to be saline to some degree. Brundage, Catarina, Dant, Maverick, Montell, and Pryor soils contain a significant amount of salt derived from the parent material.

Topography

Topography affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. The topography of Maverick County ranges from nearly level to rolling. The drainage pattern is distinctly expressed in most of the county, except in the north-central part, which is a nearly level and featureless plain.

Gently sloping and gently undulating Mavco soils are deeper and have more distinct horizons than Darl and Zapata soils on the upper slopes or caps of the low hills. They are different because the soils in lower positions receive additional water and are subject to less runoff and erosion.

On the rolling hills, where the soils such as Jimenez soils are underlain at a shallow to very shallow depth by strongly cemented or indurated caliche, geological erosion occurs almost as fast as the soils form. These soils have been forming about as long as many of the less sloping soils in valley positions, but they are shallower.

Time

A long time is required for the formation of distinct horizons. The differences in the length of time that parent material has been in place are generally reflected in the degree of development of the soil profile.

The soils in Maverick County range from young to old. The young soils have very little horizon development, and the old soils have well-expressed horizons. Rio Grande soils are an example of young soils that have little horizon development. These soils have a calcareous A horizon about 10 inches thick over a calcareous C horizon that has bedding planes and stratification. Brystal soils are an example of older soils that have more distinct horizon development. Brystal soils have a darkened, noncalcareous A horizon over a thick Bt horizon that contains illuvial clay and is noncalcareous in the upper part and contains soft masses of calcium carbonate and is calcareous in the lower part.

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 to 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 range; 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. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.(4)

The current system of classification has six categories. Beginning with 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 or measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Maverick County are placed in 3 categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

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

The 6 orders recognized in Maverick County are Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols have a light-colored surface layer that is low in organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent.

Aridisols have a light-colored surface layer that is low in organic matter and has inadequate moisture for a crop to mature without irrigation in most years.

Entisols have little or no evidence of development of pedogenic horizons.

Inceptisols have a light-colored surface layer that is low in organic matter, but they lack a clay-enriched B horizon.

Mollisols have a dark-colored surface layer that is high in organic matter, and they have a base saturation of more than 50 percent.

Vertisols are clayey soils that have deep, wide cracks part of the year in most years.

SUBORDER: Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu*, meaning water or wet, and *ent*, from Entisol).

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots or movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. 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 Haplaquents (*Hapl*, meaning simple horizons, *aqu* or wetness or water, and *ent*, from Entisols).

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 also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range 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 Haplaquents (a typical Haplaquent).

FAMILY: Soil families are separated within a sub-group 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, reactions, 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 names for texture, mineralogy, and so on, that are used as family differentiae. An example is the coarse-loamy, siliceous, acid, thermic family of Typic Haplaquents.

Additional Facts About the County

Maverick County was created by separation from Bexar in 1856. It was organized in 1871, and Eagle Pass became the county seat. The population of the county in 1930 was 6,120. Since that time, the population has increased several thousand because of the opening and settlement of the irrigated areas around Quemado, Normandy, and El Indio. In 1960 the population had grown to 14,508, and in 1970 the population was 18,093. About 15,374 people reside in Eagle Pass.

Relief and Drainage

The relief of Maverick County ranges from nearly level to rolling. Large areas in the north-central part of the county and scattered areas throughout the rest of the county are nearly level. A narrow band of rolling soils along the breaks parallel the flood plain of the Rio Grande. Scattered areas of rolling soils are also in the southern part of the county. Between these areas of nearly level soils and rolling soils are large areas of undulating soils. The elevation in the county ranges from about 540 feet in the southern part to 960 feet in the northern part.

The drainage in the county is about equally divided between that to the Rio Grande in the west and that to the Nueces River in the east. Drainage to the Rio Grande is by way of Tequesquite, Los Moras, Canon Grande, Quemado, Elm, Rosita, Saus, Cuevas, Indio, Cuervo, Tovar, Barrego, San Ambrosia, and Rosita San Juan Creeks. Drainage to the Nueces River is by way of Chaparrosa, Palo Blanco, Mula, Chacon, Picosa, Crooked Fifteen Mile, and Comanche Creeks.

Most of the irrigation water comes from the Rio Grande by canal. The communities of Eagle Pass, Quemado, Normandy, and El Indio depend on the Rio Grande for their domestic supply of water. A few irrigation wells have been drilled into the Carrizo Sand aquifer in the extreme eastern part of the county. On most of the ranches in the county, water for livestock is obtained from ponds (earth reservoirs) that catch and hold runoff water. Well water is available in only a few areas. Most of the wells are in the Carrizo Sand aquifer along the eastern edge of the county, but a few are in the gravel beds along the Rio Grande. The vast central part of the county depends mainly on pond water. The well water available is commonly too saline even for livestock.

Climate

By ROBERT B. HORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

Maverick County has a subtropical steppe climate characterized by low humidity in summer. Winters are mild, and summers are hot. More than three-fourths of the average annual precipitation is in the months of April to October. Rainfall is most often associated with thunderstorm activity. Heavy downpours may occur at any time, but they are most common late in spring and early in fall. The small amount of precipitation from November to March is usually in the form of light, steady rain. Total precipitation varies greatly from month to month and from year to year. The aver-age total annual rainfall for the period 1939-68 was 19.52 inches, but records since 1850 show annual totals ranging from 44.36 inches in 1900 to only 6.01 inches in 1956. The warm season (freeze-free period) at Eagle Pass averages 285 days. The average dates of the last occurrence of 32° F or below in spring and the first occurrence of 32° or below in fall are February 21 and December 3, respectively. Prevailing winds are south-easterly during the entire year. The evaporation rate is

high in this relatively dry climate. It is about 78 inches annually from a free-water source.

Table 9 gives a summary of the climate in Maverick County.

Winters are mild and dry. The average daily maxi-mum temperature in the coldest month, January, is 64.3°. The temperature drops to 32° or below about 1 night in 4 in winter. Sunshine is limited to about 55 percent of the possible total. Mornings are often cloudy, but afternoons are sunny. Cold periods in winter are ushered in by strong, dry, often dusty, northerly and northwesterly winds that may cause sudden drops in temperature, but these winds last for only a day or two. The lowest temperature on record at Eagle Pass was 7° on February 12, 1899.

Summer has consistently high temperatures, but low afternoon humidity and a steady southeasterly breeze alleviate the discomfort commonly associated with high temperatures. Evaporative air conditioners are effective about 85 percent of the time during July and August. June and July are relatively dry months. On rare occasions, weak tropical depressions move inland along the Rio Grande or through northern Mexico. They deposit large amounts of precipitation in the Eagle Pass area, usually late in August or early in September. The average daily relative humidity is about 56 percent in summer. Sunshine averages about 75 percent of the possible total. The highest temperature on record was 115°. This temperature has been recorded several times, most recently on July 25, 1944.

Spring and fall are very pleasant seasons in Maverick County. Generally, days are mild and nights are cool. There may be a few hot days in May and September. Early morning cloudiness is more prevalent in spring.

Industries

Industries in the county include one cotton gin at El Indio and two cattle feedlots. Each of the feedlots has a capacity of about 25,000 cattle (fig. 16). One is near Normandy, and the other is between Eagle Pass and El Indio. A spinach packing shed is on the southern edge of Eagle Pass. Other industries are a hydro electric plant that operates in conjunction with the gravity irrigation system; three garment manufacturing plants; two oil and natural gas fields; a fluorspar processing plant; and the mining of sand, caliche, and gravel used in construction. Much coal has been mined from beds underlying areas of the county, and much remains, but none is mined at present.

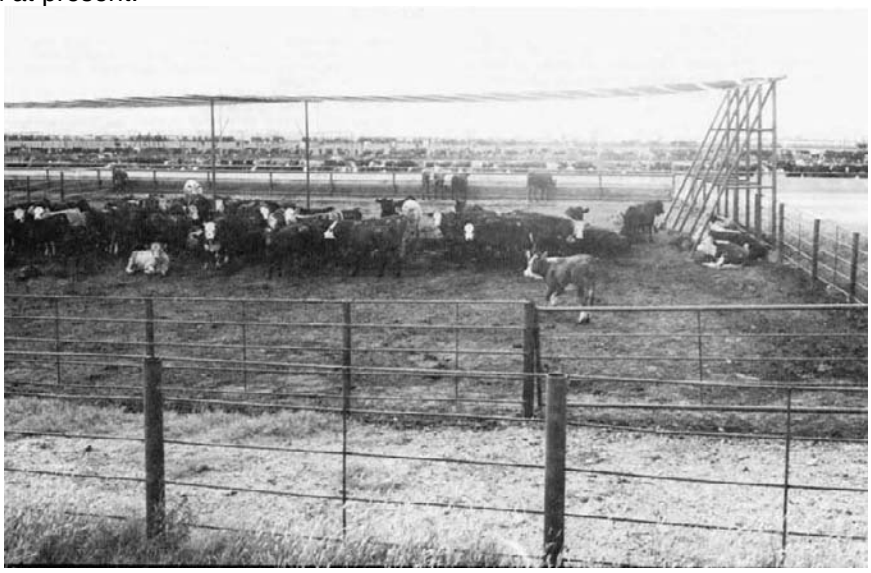

Figure 16.—Cattle feedlot in an area of Laredo silty clay loam, 0 to 1 percent slopes.

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(3) American Association of State Highway (and Transportation) Officials. 1961. Standard Specifications for Highway Materials and Methods of Sampling and Testing. Ed. 8, 2 v., illus.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

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.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with 'which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent 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.—W hen 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.

Cutbanks cave. Walls of cuts not stable.
Depth to rock. Bedrock too close to surface.
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 back surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.
Droughty. Soil holds enough water for plants during dry periods.
Erodes easily. Water erodes soil easily.
Excess lime. Carbonates restrict plant growth.
Excess salt. Soluble salts restrict plant growth.
Fast intake. Water infiltrates rapidly.
Favorable. Features of soil favorable.
Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical conditions of the soil are favorable.
Floods. Soil temporarily flooded by stream overflow, runoff or high tides.
Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.
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 0 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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

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

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Low strength. Inadequate strength to support the load.

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.

Not needed. Practice not applicable.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Peres slowly. Water moves through the soil too slowly.

Piping. Water can form tunnels or pipelike cavities in the soil.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

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:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8

Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rooting depth. Soil thin over layer that restricts roots.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

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.

Seepage. Water moves through the soil too fast.

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.

Shrink-swell. Soil expands significantly when wet and shrinks when dry.

Slope. Slope too great.

Slow intake. Water infiltration restricted.

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 (O.2 to O.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Small stones. Many rock fragments less than 10 inches across.

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).

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (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."

Thin layer. Inadequate thickness of suitable soil.

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.

Too clayey. Soil slippery and sticky when wet and slow to dry.

Too sandy. Soil soft and loose; droughty and low in fertility.

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.

Unstable fill. Banks of fills likely to cave or slough.

Tables

The tables in this soil survey contain information that affects land use planning in this survey area. More current data tables may be available from the Web Soil Survey at the Tabular Data tab.

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