SOIL SURVEY OF

Cameron County, Texas

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

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1963-69. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. 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 Southmost Soil and Water Conservation District.

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

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

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification, the yard and garden suitability group, the orchard suitability group, the pasture and hay suitability group, and the range

in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

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

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

Ranchers and others can find, under "Use of the Soils for 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, industrial buildings, and for recreation areas in the section "Engineering Uses of the Soils."

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

Scientists and others can read about how the soils formed and how they are classified

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SOIL SURVEY OF CAMERON COUNTY, TEXAS

BY DEWAYNE WILLIAMS, CHARLES M. THOMPSON, AND JERRY L. JACOBS, SOIL CONSERVATION SERVICE

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

CAMERON COUNTY is in the extreme southern

county. It consists of the Sejita-Lomalta-Barrada association, the Laredo-Lomalta association, and the Willamar association. In this group are the saline, wet soils along the lower Gulf Coast known as the salt flats or coastal flats as well as the Willamar association, an area that is marginal for crops. Most of the acreage of this group is range, and less than 10 percent is cropped.

1. Sejita-Lomalta-Barrada association

Level, poorly drained and very poorly drained clays and silty clay loams

This association occupies a large irregularly shaped area. It consists of areas of saline, loamy and clayey soils at or near sea level and broad areas of barren clay that are inundated by high tides and heavy rains. The flat topography is broken by numerous "clay dunes" at an elevation of 10 to 40 feet above the surrounding soils.

This association makes up about 23 percent of the county. It is about 31 percent Sejita soils, 29 percent Lomalta soils, 24 percent Barrada soils, and 16 percent soils of minor extent.

Sejita soils have a surface layer of light brownish-gray, calcareous silt loam about 2 inches thick. Below this layer is light-gray silty clay loam about 18 inches thick, over stratified silt loams and silty clay loams. They are well drained and moderately permeable.

Lomalta soils have a surface layer of light-gray, calcareous clay about 5 inches thick. The underlying material is stratified loamy materials. These soils are poorly drained and very slowly permeable.

Minor soils of this association are in the Chargo, Point Isabel, and Sejita series.

The soils in this association are used for range and wildlife habitat. A small acreage is dryfarmed. A seasonal high water table is at a depth of 2 to 6 feet. This association has a medium potential for the production of forage.

3. Willamar association

Nearly level, somewhat poorly drained fine sandy loams and sandy clay loams

This association occupies a nearly level area in which are many slickspots.

This association makes up about 4 percent of the county. It is about 71 percent Willamar soils and 29 percent soils of minor extent.

Willamar soils have a surface layer, 5 inches thick; it is grayish-brown, noncalcareous fine sandy loam in the upper part and gray fine sandy loam in the lower part. The next layer, to a depth of 30 inches, is clay

This association makes up about 19 percent of the county. It is about 65 percent Laredo soils, 20 percent Olmito soils, and about 15 percent soils of minor extent.

Laredo soils have a surface layer of dark grayish brown, calcareous silty clay loam about 8 inches thick. The next layer, to a depth of 41 inches, is silt loam. It is dark grayish brown in the upper part and light brownish gray in the lower part. The underlying material is stratified silt loam and silty clay loam

county. It consists of the Willacy-Racombes association, the Lyford-Raymondville-Lozano association the Hidalgo-Raymondville association, the Willacy-Raymondville association, and the Raymondville association. The soils in this group are dark and many

are leached of carbonates in the surface layer. They are used mostly for irrigated crops and dryfarming.

6. *Willacy-Racombes association*

Nearly level to gently sloping, well drained and

Lozano soils have a surface layer of dark grayish-brown, noncalcareous fine sandy loam, about 11 inches thick, over blocky sandy clay loam. They are well drained and moderately slowly permeable.

Minor soils of this association are in the Delfina, Hidalgo, Rio, Tiocano, Willacy, and Willamar series.

The soils in this association are used mostly for irrigated crops. A small acreage is dryfarmed. A seasonal high water table is at a depth of 2 to 6 feet in 40 to 50 percent of the acreage of this association. About 30 percent of the association is affected by moderate to severe salinity. This association has a medium potential for the production of most of the major crops commonly grown in the county. A few of the soils are suited to citrus trees.

8. Hidalgo-Raymondville association

Nearly level to gently sloping, well drained and moderately well drained sandy clay loams and clay loams

This association occupies an irregularly shaped area. It consists of nearly level to gently sloping sandy clay loams and nearly level clay loams.

This association makes up about 4 percent of the county. It is about 40 percent Hidalgo soils, 40 percent Raymondville soils, and 20 percent soils of minor extent.

Hidalgo soils have a surface layer of dark grayish-brown, calcareous sandy clay loam, about 12 inches thick, over friable sandy clay loam. They are well drained and moderately permeable.

Raymondville soils have a surface layer of calcareous clay loam about 25 inches thick. The upper 6 inches is gray, the next 8 inches is dark gray, and the lower 11 inches is gray. The next layer is calcareous, very firm clay. These soils are moderately well drained and slowly permeable.

Minor soils of this association are in the Mercedes, Racombes, Tiocano, and Willacy series.

The soils in this association are used for irrigated crops. A seasonal high water table is in 15 to 20 [illegible] of the area. Moderate salinity affects about [illegible] inches is gray. The next layer is calcareous, very firm clay. The soils are moderately well drained and slowly permeable.

Minor soils of this association are in the Hidalgo, Racombes, Rio, and Tiocano series.

The soils in this association are used mainly for dryfarmed crops. About 10 percent of the acreage is irrigated. Less than 5 percent of the acreage of this association is affected by a seasonal high water table and slight to moderate salinity. This association has a medium potential for the production of many of the crops commonly grown in the county. Willacy soils are suited to citrus trees.

10. Raymondville association

Nearly level, moderately well drained clay loams

This association occupies small irregularly shaped areas. It consists of a nearly level plain broken in places by slight rises.

This association makes up about 4 percent of the county. It is about 82 percent Raymondville soils and 18 percent soils of minor extent.

Raymondville soils have a surface layer of gray, calcareous clay loam about 25 inches thick. The upper 6 inches is gray, the next 8 inches is dark gray, and the lower 11 inches is gray. The next layer is calcareous, very firm clay. The soils are moderately well drained and slowly permeable.

Minor soils of this association are in the Hidalgo, Mercedes, Racombes, and Willacy series.

The soils in this association are used for irrigated and dryfarmed crops. A seasonal high water table is at a depth of 2 to 10 feet in irrigated areas. About 30 to 40 percent of the irrigated areas of the association are affected by slight to moderate salinity. Much of the acreage of the association lacks adequate surface drainage. This association has a medium potential for the production of many of the crops commonly grown in the county.

Harlingen soils have a surface layer of calcareous, grayish-brown clay, about 11 inches thick, over brown and light-brown clay that extends to a depth of several feet. They are moderately well drained and very slowly permeable.

Benito soils have a surface layer of calcareous, gray clay, about 54 inches thick, over loamy calcareous material. They are saline, poorly drained, and very slowly permeable.

Minor soils of this association are in the Camargo, Laredo, Lomalta, and Olmito series.

The soils in this association are used mainly for irrigated crops and improved pasture. A small acreage is dryfarmed. The soils are moderately to severely saline. The water table is generally below a depth of 5 feet. This association has a low potential for the production of a few of the major crops commonly grown in the county. Crop selection is restricted to those in which salt tolerance is medium or high.

12. Harlingen association

Level and nearly level, moderately well drained clays

This association is in broad clayey areas. It is on a level to nearly level plain that is broken only by a few slightly depressional drainageways.

This association makes up about 7 percent of the county. It is about 70 percent Harlingen soils and 30 percent soils of minor extent.

Harlingen soils have a surface layer of calcareous, grayish-brown clay, about 11 inches thick, over brown and light-brown clay that extends to a depth of several feet. They are moderately well drained and very slowly permeable.

Minor soils of this association are in the Benito, Laredo, and Olmito series.

The soils in this association are used mainly for irrigated crops. Most of the soils in this association lack adequate surface drainage and have a slight to moderate hazard of salinity. The water table is generally below a depth of 5 feet. This association has a medium potential for the production of most of the major crops commonly grown in the county.

13. Mercedes association

Level to gently sloping, moderately well drained clays

Nearly Level to Steep, Rapidly Permeable, Sandy Soils of Coastal Areas

This group of soils occupies about 3 percent of the county. It consists only of the Mustang-Coastal dunes association. In this group are the sandy soils on Padre and Boca Chica Islands along the Gulf Coast. This area is used mostly for recreation and for range.

14. Mustang-Coastal dunes association

Nearly level to steep, poorly drained fine sands and sand dunes

This association is in a long narrow band along the Gulf Coast. It is separated from the mainland by the shallow water of Laguna Madre. It consists of active to partly stabilized windblown sands that are as much as 30 feet above sea level and that are on the eastern or Gulf side of the islands. The Mustang soils are in a broad area 2 to 5 feet above mean high tide and extend from the dunes westward to the Laguna Madre.

This association makes up about 3 percent of the county. It is about 56 percent Mustang soils, about 19 percent Coastal dunes, and 25 percent soils of minor extent.

Mustang soils consist of very pale brown fine sands, about 8 inches thick, over fine sands that are several feet thick and that are saturated with saline or brackish water within a depth of 2 feet.

Coastal dunes consist of fine sands several feet thick. The size and shape of the dunes are constantly changing.

Minor soils of this association are small areas of Galveston soils and a narrow band of Coastal beach.

This association is one of the most important associations in the county for present and potential use for recreation. Urban development is increasing along the southern end of Padre Island.

Descriptions of the Soils

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

mapping unit. Unless otherwise stated, the colors given in the descriptions are those of a dry soil.

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

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit in which the mapping unit has been placed; also at the end of the description of some mapping units is the pasture and hay group, orchard group, or range site, or a combination of these. The page for the description of each capability unit, the range site, orchard group, and yard and garden group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

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

[1] UNITED STATES DEPARTMENT OF AGRICULTURE. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. 1951. [Supplement issued in May 1962]

Barrada Series

The Barrada series consists of deep, very poorly drained, calcareous, saline clays at or near sea level. These soils are on barren, nearly level, tidal flats a few inches to several feet below the surrounding topography near the Gulf Coast.

In a representative profile this soil is light brownish-gray clay from the surface to a depth of about 52 inches, and below this, extending to a depth of 63 inches, it is stratified light-gray silty clay loam.

Permeability is very slow. The available water capacity is very low. These soils are subject to flooding during Gulf storms, high tides, or high-intensity rains. The soil is saturated to the surface for periods of 4 to 6 months and is never dry in any horizon below a depth of 6 to 12 inches in most years.

Barrada soils have no use in farming. They are barren and produce no vegetation. These soils are used for range and as wildlife refuges.

Representative profile of Barrada clay, 12 miles east of Brownsville on State Highway 4, 4.5 miles north on ranch trail, and 0.2 mile east of ranch trail through range:

C1—0 to 4 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, very sticky and very plastic; saline; calcareous; strongly alkaline; abrupt, smooth boundary.

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

Soil	Acres	Percent	Soil	Acres	Percent
Barrada clay	34,860	5.6	Mercedes clay, 1 to 3 percent slopes	1,780	0.3
Benito clay	25,730	4.2	Mercedes clay, loamy substratum, 1 to 5		
[illegible]	050	1	[illegible]	2,240	4

C2—4 to 25 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; common, fine and medium, distinct, gray (5Y 4/1) and brownish-yellow (10YR 6/6) mottles; massive; saturated soil when squeezed in hand flows with difficulty between fingers; very sticky; few firm clay balls; saline; calcareous; strongly alkaline; diffuse, smooth boundary.

C3—25 to 52 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; many, coarse, prominent, dark-gray (5Y 4/1) mottles; massive; when squeezed, saturated soil flows with difficulty between fingers, very sticky; few very firm clay balls; few pockets of sand; saline; calcareous; strongly alkaline; diffuse, smooth boundary.

C4—52 to 63 inches, light-gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; many, coarse, prominent, gray (10YR 4/1) and yellowish-brown (10YR 5/8) mottles; massive; very firm, sticky and plastic; saline; calcareous; strongly alkaline.

Thickness of the soil over loamy material ranges from 36 to more than 50 inches. The content of clay in the 10- to 40-inch layer ranges from 45 to 60 percent. Reaction is moderately alkaline to strongly alkaline throughout. The soil, when moist, is dark grayish brown, grayish brown, dark gray, or gray and has common to many mottles of gray, dark gray, yellowish brown, and brownish yellow. The C1, C2, and C3 horizons range from clay to silty clay. The C4 horizon is silty clay loam or loam.

Barrada clay (BA).—This soil is in broad, barren areas that are a few inches to several feet below the surrounding topography. The elevation is less than 5 feet, and a few areas are below sea level.

Included with this soil in mapping are areas of Sejita and Lomalta soils which occur as slight, vegetated rises. Also included are a few areas of soils that are similar to Barrada soils but are less clayey.

Permeability is very slow, and runoff is very slow to ponded. During prolonged dry periods, the surface 2- to 4-inch crust breaks down, and the soil particles "fluff" into aggregates that are easily moved by wind. This soil is subject to flooding during Gulf storms, high tides, or high-intensity rainstorms.

This soil is used entirely for wildlife habitat. It is barren and produces no vegetation. Capability unit VIIIs–2, dryland.

Benito Series

The Benito series consists of deep, poorly drained, calcareous, saline soils that are level to slightly depressed. These soils are on old flood plains and deltas.

In a representative profile the surface layer, extending to a depth of about 54 inches, is gray clay. The next layer is light brownish-gray silty clay loam about 9 inches thick. The underlying material, extending to a depth of about 84 inches, is stratified pale-brown silt loam.

Permeability is very slow. The available water capacity is low to very low, depending on the degree of salinity. Runoff is very slow, and water stands on the surface for several weeks after heavy rains.

weak, fine, granular and subangular blocky structure; very hard, very firm, very sticky and very plastic; saline; calcareous; moderately alkaline; gradual, smooth boundary.

A12—8 to 54 inches, gray (N 5/0) clay, dark gray (N 4/0) moist; many prominent intersecting slickensides and many distinct parallelepipeds parting to moderate, fine, angular blocks; very hard, very firm, very sticky and very plastic; common salt threads; saline; calcareous; moderately alkaline; diffuse, smooth boundary.

AC—54 to 63 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; common, fine, distinct, pale-brown mottles; dark gray (10YR 4/1) moist streaks or burrow fillings; many, distinct, intersecting slickensides and many parallelepipeds; very hard, very firm, very sticky and very plastic; few salt threads; saline; calcareous; moderately alkaline; abrupt, smooth boundary.

IIC—63 to 84 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; common, fine, distinct, brownish-yellow mottles; many, gray (10YR 5/1), moist landcrab burrows; massive; slightly hard, very friable; many weakly cemented concretions and soft lumps of calcium carbonate; saline; calcareous; moderately alkaline.

The solum ranges from 50 to 72 inches in thickness. These soils have cracks 0.4 to 3.0 inches in width at a depth of 20 inches. Intersecting slickensides begin 8 to 20 inches below the surface; parallelepipeds are tilted to about 30° to 60° from the horizontal and part to moderate, fine and medium, angular blocks. Exchangeable sodium increases with increasing depth and may exceed 15 percent. Reaction ranges from moderately alkaline to strongly alkaline.

The A horizon ranges from 45 to 72 inches in thickness and from gray to light gray in color. The 10-to 40-inch layer is 60 to 78 percent clay and 1 to 4 percent sand. The AC horizon ranges from 5 to 15 inches in thickness and from silty clay loam to silty clay or clay in texture. The IIC horizon is silt loam, very fine sandy loam, or silty clay loam.

Benito clay (BE).—This soil is in broad, slightly depressional areas. A few areas of this soil are in long, narrow drainageways. Slopes are less than 0.5 percent, and the surface is concave. Areas are several hundred acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Laredo silty clay loam, saline, that are on slight rises in the nearly level landscape and areas of Harlingen clay, saline, and Chargo silty clay loam. Also included are a few areas of soils that are similar to Benito soils but are underlain by loamy material at a depth of 30 inches or more.

The surface is crusty and cloddy. The soil is poorly drained. It is saline and high in exchangeable sodium. Subsurface tile drains are not practical because this soil has a high content of clay. Capability units VIs–1, dryland, and IVw–1, irrigated; pasture and hay group 7F; Salty range site.

Benito-Urban land complex (BU).—This mapping unit is in the built-up areas of cities and towns. Most of the acreage is within Brownsville International Airport. Areas are slightly depressional to nearly level. Benito clay makes up about 60 percent of the

much of the soil has not been altered greatly during

grayish brown through light gray in color, from silt loam to

The A horizon ranges from 10 to 19 inches in thickness and from gray to dark grayish brown in color.

The B horizon ranges from 6 to 12 inches in thickness, from silty clay loam to silty clay or clay in texture, and from gray or light gray to dark grayish brown or grayish brown in color. Structure ranges from weak to moderate subangular and irregular blocky.

The IIC horizon is silt loam with or without thin strata of more sandy or clayey sediment. It ranges from 10 to about 27 percent clay and from light gray or grayish brown to very pale brown or pale brown in color. Secondary carbonates range from a few to about 6 percent by volume of weakly cemeted concretions and soft masses.

Cameron silty clay (CE).—This soil is mainly in

surface is plane or slightly concave. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Olmito and Laredo soils and areas of saline Cameron soils. Also included are a few areas of soils that are similar to Cameron soils but have a lighter colored surface layer.

Permeability is moderately slow, and runoff is slow. Almost all of the acreage is in irrigated crops. The suitability of citrus is questionable because the upper part of the soil has a high content of clay. Capability units IIs—1, dryland, and IIs–1, irrigated; pasture

water capacity is very low to medium depending on the degree of salinity. A seasonal high water table is at a depth of 24 to 36 inches.

Chargo soils are idle in most areas because the high salinity prevents the growth of field crops. A small acreage of this soil is irrigated.

Representative profile of Chargo silty clay, in a cultivated field, 1.4 miles south of the intersection of Farm Road 2480 and Farm Road 510 in Bayview, 2 miles northeast on county road, 100 feet north from right-of-way:

Ap—0 to 5 inches, gray (10YR 5/1) silty clay, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; massive; very hard, very firm, sticky and plastic; few salt threads; saline; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—5 to 12 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; very hard, very firm, sticky and plastic; few fine pores; common salt threads; saline; calcareous; moderately alkaline; gradual, smooth boundary.

A12—12 to 27 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, subangular blocky structure; few wedge-shaped peds; very hard, very firm, sticky and plastic; few fine pores; common salt threads; saline; calcareous; moderately alkaline; gradual, wavy boundary.

B2—27 to 36 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate, fine and medium, subangular blocky structure; few wedge-shaped peds; [illegible]

Areas of this soil range from 10 to about 100 acres in size.

Included with this soil in mapping are areas of Benito and the saline Harlingen soils. Also included are a few areas of the saline Laredo soils on a few slight rises.

Permeability and runoff are slow. Most areas of this soil are idle because high salinity prevents the growth of field crops. A small acreage is irrigated. The surface layer is hard and crusty when dry. A seasonal high water table is within 18 to 36 inches of the surface. If adequate outlets are available, tile drain systems can be used to effectively reduce the salinity in this soil. Capability units IVs–3, dryland, and IIIs–4, irrigated; pasture and hay group 7F; orchard group I; Salty range site.

Coastal Beach

Coastal beach (CO) consists of shores that have been washed and rewashed by waves. It is partly or completely covered by water at high tide. The soil material is light-gray to very pale brown fine sand that contains many fragments of seashells. The sand washed from the Gulf of Mexico to the eastern shore of Padre and Brazos Islands. It lies in a narrow band, 20 to 200 feet wide, that adjoins the Coastal dunes. From the eastern base of these dunes to the edge of the water, the slope of the beach ranges from 1 to 3

Delfina Series

The Delfina series consists of deep, well-drained, noncalcareous soils. These soils are on nearly level to gently sloping uplands.

In a representative profile the surface layer is dark grayish-brown, noncalcareous fine sandy loam about 15 inches thick. The next layer is firm, mottled sandy clay loam about 19 inches thick. The upper part is grayish brown, and the lower part is brown. The next layer is about 26 iinches thick; it is strong-brown sandy clay loam that is mottled and that contains a few weakly cemented and strongly cemented calcium carbonate concretions. The underlying material, extending to a depth of about 72 inches, is brownish-yellow sandy clay loam.

Permeability is moderately slow, and runoff is medium. The available water capacity is medium to high.

Delfina soils are used for irrigated crops and dryfarmed crops.

Representative profile of Delfina fine sandy loam, in a cultivated field, 1.7 miles east of State Highway 345 on Farm Road 106, then 2 miles north and 0.4 mile west on County Road, 50 feet north from right-of-way:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular and subangular blocky structure; hard, friable; neutral; abrupt, smooth boundary.

A1—7 to 15 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular and subangular blocky structure; slightly hard, very friable; neutral; clear, wavy boundary.

B21t—15 to 21 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; common, fine, distinct mottles of strong brown (7.5YR 5/6) moist; moderate, medium, angular and subangular blocky structure; very hard, firm; few fine pores; common clay films and organic-matter coatings on vertical and horizontal ped surfaces; organic coatings and stains are black (10YR 2/1) moist; few, weakly cemented, black iron-manganese concretions [illegible]

The A horizon ranges from 7 to 19 inches in thickness and from dark grayish brown to grayish brown in color. Reaction is neutral to mildly alkaline.

The B2t horizon ranges from 13 to 22 inches in thickness, from dark brown to brown or grayish brown in color, and from sandy clay loam to clay loam in texture. The content of clay is 25 to 35 percent. Structure ranges from moderate to strong compound prismatic and blocky. Mottling ranges from distinct to prominent in shades of brown, yellow, and red. Black and dark-gray coatings are on the ped faces. Reaction is neutral to mildly alkaline. The B3 horizon ranges from 20 to 30 inches in thickness. It is sandy clay loam to loam and is less clayey than the B2t horizon. The B3 horizon is brown, strong brown, or light brown. Calcium carbonate, in the form of weakly cemented and strongly cemented concretions that range from common to many, is at a depth of 34 to 50 inches.

The C horizon ranges from light brownish gray or brownish yellow in color and from sandy loam to sandy clay loam in texture. Concretions of calcium carbonate range from few to common and from weakly cemented to strongly cemented.

Delfina fine sandy loam (DE).—This nearly level to gently sloping soil is on uplands. Slopes are less than 2 percent, and the surface is slightly convex. Areas of this soil are mostly round in shape and range from 10 to 60 acres in size.

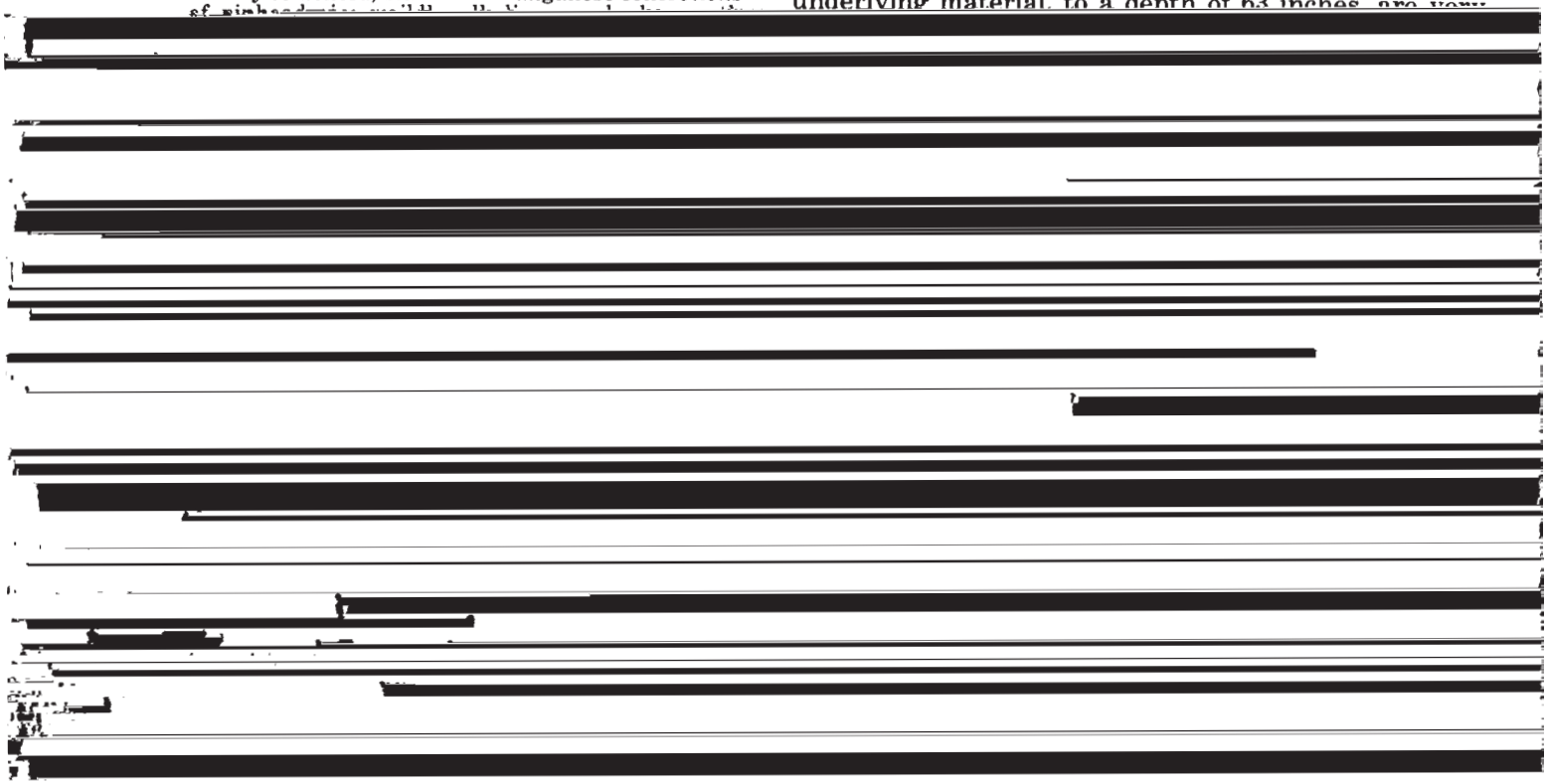
Included with this soil in mapping are areas of Lozano and Willacy soils on the tops of slight knolls. Also included are a few minor depressions in which Lyford soils occur.

Permeability is moderately slow, and runoff is medium. This soil is used for irrigated and dryfarmed crops. The surface is hard and massive when dry. The hazard of soil blowing is slight. Capability units IIw–1, dryland, and IIw–1, irrigated; pasture and hay group 8C; orchard group A.

Galveston Series

The Galveston series consists of deep, somewhat excessively drained, loose sandy soils. These soils are in hummocky areas on Padre and Boca Chica Islands. They are more than 5 feet above sea level.

In a representative profile the surface layer and underlying material, to a depth of 63 inches, are very



Island. Areas of this soil are irregularly shaped and range from less than 10 acres to 400 acres in size. Slopes are mainly 0 to 6 percent and are convex.

Included with this soil in mapping are areas of Mustang soils in small depressions, and a few small active dunes or "blowouts." Also included are a few areas that are calcareous because of sand-size shell fragments.

Permeability is rapid, and runoff is very slow. The hazard of soil blowing on this soil is severe. Areas of this soil are used for recreation, wildlife habitat, and urban development. Capability unit IVe–1, dryland; Coastal Sand range site.

Grulla Series

The Grulla series consists of deep, somewhat poorly drained, calcareous soils that are level. These soils are in partly filled resacas on the active flood plain of the Rio Grande.

In a representative profile, the plow layer is grayish-brown, calcareous clay about 7 inches thick. Below this and extending to a depth of about 62 inches is light brownish-gray clay that contains weak stratification, loamy sediment, and remnants of a buried former surface layer.

Permeability is very slow. The available water capacity is high to medium. Unless the soils are artificially drained, water remains on the surface for several

that is 30 to 70 percent clay. It ranges from grayish brown or light gray to grayish brown or pale brown.

The C horizon is 45 to 60 percent clay, except for a 1- to 2-inch layer of loamy sediment. Colors are about the same as in the Ap horizon, but yellowish and brownish mottles range from none to few.

Grulla clay (GR).—This soil is in resacas that have been cut off from the Rio Grande by major floods. Areas of the soil are in level, long oxbows on the active flood plain. The soils are 1 to 5 feet below the surrounding landscape and have no natural drainage outlet. Slopes are less than 0.5 percent, and the surface is plane to concave. Areas of the soil rarely exceed 40 acres in size.

Included with this soil in mapping are Matamoros and Rio Grande soils that occur along the edges and upper ends of the areas of this soil. Also included are a few areas of soils that are similar to Grulla soils, but they are dark gray.

Permeability is very slow, and runoff is ponded. Excess water is a limitation to use. Some areas remain wet several weeks each year. This soil is used almost entirely for irrigated crops. A few areas are idle. Capability unit IVw–2, irrigated; pasture and hay group 1A.

Harlingen Series

The Harlingen series consists of deep, moderately well drained, calcareous soils that are level to nearly

AC3—59 to 71 inches, brown (7.5YR 5/3) clay, dark brown (7.5YR 4/3) moist; few prominent intersecting slickensides, and parallelepipeds; very hard, very firm, very sticky and plastic; common films and threads of salt; few lumps of soft calcium carbonate; saline; calcareous; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. Intersecting slickensides begin at a depth of 20 to 30 inches. The axes of parallelepipeds are tilted 10° to about 45° from horizontal. Exchangeable sodium increases with increasing depth; and ranges from about 6 percent of the soil mass in the upper part of the solum to about 25 percent in the AC3 horizon.

percent of the complex, Urban land makes up 30 percent, and other soils the remaining 10 percent.

Harlingen clay consists of about 11 inches of grayish-brown, calcareous clay. Beneath this, extending to a depth of about 71 inches, is brown, calcareous clay. The underlying material is silty and clayey sediment.

Urban land consists mostly of areas where such works and structures as streets, sidewalks, buildings, driveways, and patios have been constructed. Most of

ish-yellow mottles; massive; hard, friable; common fine pores; 3 to 5 percent, by volume, is soft lumps of calcium carbonate, percentage of calcium carbonate remains relatively constant with increasing depth; calcareous; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. Secondary carbonates in the form of films, threads, and soft lumps are within 28 inches of the surface.

The A horizon ranges from 11 to 20 inches in thickness. It ranges from fine sandy loam to sandy clay loam in texture and from grayish brown or brown to dark grayish brown in color.

The B horizon ranges from 15 to 31 inches in thickness, from sandy clay loam to clay loam in texture, and from 23 to 32 percent in clay content. It ranges from light brownish gray or grayish brown to brown or pale brown in color. Secondary carbonates range from few to common and occur as films, threads, and small soft splotches. The volume of secondary carbonates increases with increasing depth.

The C horizon ranges from pale brown to very pale brown in color and from sandy clay loam to clay loam in texture. The percentage, by volume, of carbonates, to a depth of 12 feet or

because of filling operations, and many areas have a thin surface layer because of cutting operations. All of the surface layer has been removed from a few areas. Soil blowing is a slight hazard. Erosion by water is a moderate hazard. Capability units IIe–1, dryland, and IIe–1, irrigated; pasture and hay group 8C; orchard group D.

Hidalgo sandy clay loam (HO).—This nearly level soil is on rather broad coastal terraces. Slopes are less than 0.5 percent, and the surface is plane. Areas of this soil are irregularly shaped and generally are several hundred acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Raymondville and Racombes soils and Hidalgo fine sandy loam, 0 to 1 percent slopes. Also included are areas of a soil that is similar to Hidalgo sandy clay

Permeability is moderate, and runoff is slow. The available water capacity is very high to very low, depending on the degree of salinity.

Laredo soils are used for irrigated crops, dryfarmed crops, and pasture.

Representative profile of Laredo silty clay loam, 0 to 1 percent slopes, in a cultivated field, 0.9 mile south on Farm Road 1479 from its junction with Farm Road

ary carbonates in the form of films and threads range from few to common. The A horizon ranges from dark grayish brown or grayish brown to brown in color, from silt loam to silty clay loam in texture, and from 12 to 20 inches in thickness. The B horizon ranges from grayish brown or light brownish gray to pale brown in color and from weak to moderate subangular blocky in structure. Texture of the 10- to 40-inch layer ranges from silt loam to silty clay loam, and the content of clay is 18 to 35 percent. The amount of sand coarser than very fine sand ranges from 1 to 8 percent. Thin

2, dryland, and I–4, irrigated; pasture and hay group 7C; orchard group C.

Laredo silty clay loam, 1 to 3 percent slopes (LAB).—This soil is in long, narrow areas adjacent to resacas. Slopes are dominantly about 2 percent, and the surface is convex. Areas of this soil range in size from 5 to about 50 acres.

The surface layer is dark grayish-brown, calcareous silty clay loam about 13 inches thick. The next layer is grayish-brown silt loam about 28 inches thick. The underlying material, extending to a depth of about 60 inches, is stratified layers of silt loam and silty clay loam.

Included with this soil in mapping are areas of Laredo silty clay loam, 0 to 1 percent slopes, and areas of Reynosa soils. Also included are a few areas that have slopes of more than 3 percent and small areas that have varying degrees of salinity.

Permeability is moderate, and runoff is slow. A few areas of this soil have been altered for irrigation by land leveling. Some areas have a thin surface layer because of cutting operations, and a few areas have a thick surface layer because of filling operations. All of the surface layer has been removed from a few areas.

Because of the location and size of the areas, this soil generally is left idle. A few areas are used for irrigated crops and pasture. Capability units IIe–2, dryland, and IIe–3, irrigated; pasture and hay group 7C; orchard group D.

Laredo silty clay loam, saline (LC).—This soil is on old flood plains and deltas, generally adjacent to old meanders. Slopes are less than 2 percent, and the surface is plane or slightly convex. Areas of this soil vary widely in size and shape, but most are irregularly shaped and range from about 10 to 400 acres in size.

The surface layer is grayish-brown, calcareous silty clay loam about 12 inches thick. The next layer is grayish-brown silt loam about 31 inches thick. The underlying material, extending to a depth of about 60 inches, is stratified layers of silt loam and silty clay loam.

Included with this soil in mapping are areas of Chargo and Reynosa soils.

Permeability is moderate, and runoff is slow. Most areas of this soil are in pasture or range, but a few areas are irrigated. Where adequate outlets are available, tile drainage systems can be used effectively to reduce the salinity of the soil. Capability units IIIs–2, [illegible]

thick. The next layer is pale-brown silt loam 25 inches thick. The underlying material, extending to a depth of about 63 inches, is stratified layers of silt loam and silty clay loam.

The Olmito soil has a surface layer of dark-gray, calcareous silty clay about 23 inches thick. The next layer is brown silty clay 18 inches thick. The underlying material, reaching to a depth of about 63 inches, is pale-brown silty clay.

Included with these soils in mapping are areas of Cameron and Reynosa soils.

Permeability is moderate in the Laredo soil and slow in the Olmito soil. Runoff is slow on both soils. The soils of this complex are used for irrigated crops. The Laredo soil is suited to citrus trees, but the Olmito soil is not. Therefore, uniform growth and production of citrus are difficult. Capability units IIs–3, dryland, and IIs–3, irrigated; pasture and hay group 7C; orchard group F.

Laredo-Reynosa complex, 0 to 1 percent slopes (LEA).—The soils of this complex occur in such intricate patterns that it is not feasible to map them separately. Laredo silty clay loam makes up about 50 percent of the complex, and Reynosa silt loam makes up 35 percent. These soils are adjacent to some of the older or larger resacas, in nearly alternating, narrow streaks or bands parallel to the resacas. Both soils have plane to slightly convex surfaces. Areas of these soils are generally elongated and range from about 10 to 50 acres in size.

The Laredo soil has a surface layer of grayish-brown, calcareous silty clay loam about 15 inches thick. The next layer is light brownish-gray silt loam 22 inches thick. The underlying material, to a depth of about 63 inches, is stratified layers of silt loam and silty clay loam.

The Reynosa soil has the profile described as representative of the Reynosa series.

Included with these soils in mapping are areas of Olmito and Cameron soils. Also included are areas of soils that are similar to Laredo and Reynosa soils but are less clayey between depths of 10 and 40 inches.

Permeability is moderate, and runoff is slow. The Reynosa soil crusts badly if it is left bare. A few areas have been leveled for irrigation. Some areas have a thin surface layer as a result of cutting operations, and a few areas have a thick surface layer as a result of filling operations. Almost all the acreage of these soils is used for irrigated crops. Capability units IIc–2, [illegible]

to a depth of about 63 inches, is stratified layers of silt loam, silty clay loam, and very fine sandy loam.

The Reynosa soil has a surface layer of grayish-brown, calcareous silt loam about 11 inches thick. The next layer is light brownish-gray silt loam 23 inches thick. The underlying material, extending to a depth of about 63 inches, is stratified layers of silt loam, very fine sandy loam, and silty clay loam.

Included with these soils in mapping are soils that are similar to Laredo and Reynosa soils but are less

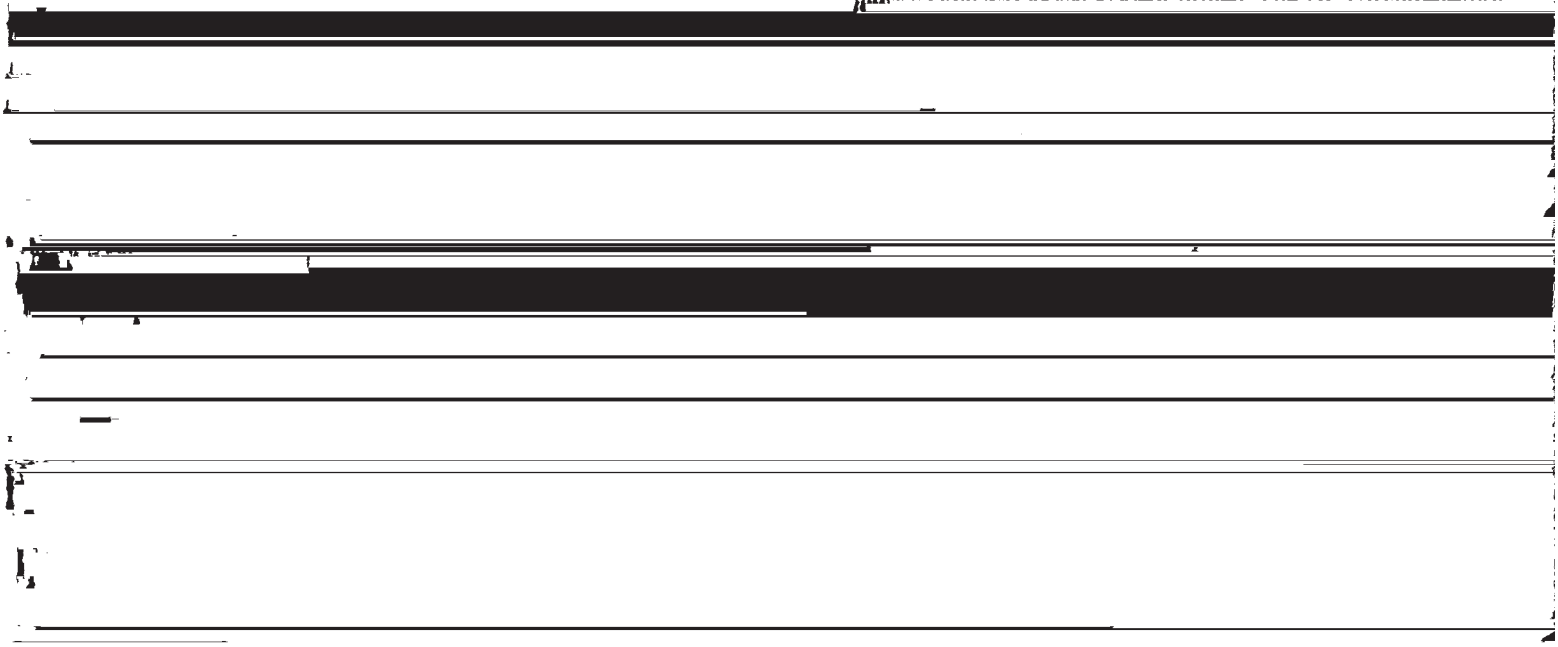
In a representative profile the surface layer is dark-gray, noncalcareous sandy clay loam about 4 inches thick. The next layer is dark-gray, dense noncalcareous sandy clay loam about 5 inches thick. The next layer is light brownish-gray, calcareous sandy clay loam about 21 inches thick. The underlying material, extending to a depth of 63 inches, is grayish-brown sandy clay loam.

Permeability is slow, and runoff is very slow. The available water capacity is very low.

Latina soils are used for range and as wildlife

salinity and a saline high water table are the major limitations to the use of this soil. Capability unit VIs–2, dryland; pasture and hay group 7F; Sandy Coastal Flat range site.

The A, B, and C horizons are gray or light gray. The B horizon ranges from weak medium to coarse prismatic in structure. The 10- to 40-inch layer is 60 to 75 percent clay. The IIC horizon is grayish brown, light brownish gray, light yellowish brown, or very pale brown and has few to common mottles and streaks of gray or brown. The IIC horizon is silty



The Lomalta series consists of deep, poorly drained, calcareous, saline clays that are level to slightly depressional. These soils are in semimarsh areas adjacent to the Gulf of Mexico only a few feet above tide water.

In a representative profile the light-gray clay extends from the surface to a depth of about 53 inches. The next layer is light brownish-gray silty clay loam about 4 inches thick. Beneath this, extending to a depth of about 72 inches, is stratified very pale brown silt loam.

Permeability is very slow, and the available water capacity is very low. Runoff is very slow to ponded, and water ponds on the surface for several days or weeks after heavy rains.

Lomalta soils are used for range and as wildlife habitat.

Representative profile of Lomalta clay, in range, 1.6 miles south on Farm Road 1847 from its junction with State Highway 100 in Los Fresnos and then 780 feet east:

A1—0 to 5 inches, light-gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; moderate, fine and medium, angular and subangular blocky structure; very hard, very firm, very sticky and very plastic; 1/4-inch surface crust of light gray (N 6/0) moist; numerous roots; saline; calcareous; moderately alkaline; gradual, smooth boundary.

B2g—5 to 19 inches, light-gray (5Y 6/1) clay, gray (5Y 5/1) moist; weak, coarse, prismatic structure and moderate, medium, blocky; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few fine pores; few films, threads, and crystals of salt; saline; calcareous; moderately alkaline; gradual, smooth boundary.

C1—19 to 31 inches, light-gray (10YR 6/1) clay, gray (10YR 5/1) moist; many small intersecting slickensides and parallelepipeds; extremely hard, extremely firm, very sticky and very plastic; few roots; few fine pores; few slightly darker colored streaks along old root channels and cracks; common films and threads of salts; saline; calcareous; moderately alkaline;

Lomalta clay (LM).—This level to slightly depressional soil is generally in broad areas several hundred acres in size, but a few areas occur as long, narrow drainageways. Slopes are less than 0.5 percent, and the surface is plane to concave. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Sejita, Willamar, and Benito soils. Also included are areas of soils that are in narrow drainageways and that are similar to Lomalta soils, but they are slightly darker colored.

Permeability is very slow, and runoff is very slow to ponded. This soil, which is saline, is high in exchangeable sodium. Subsurface tile drains are not practical because the soil has a high content of clay. Areas of this soil are used for range and as wildlife habitat. Capability unit VIIs–1, dryland; pasture and hay group 7F; Salty range site.

Lomalta-Urban land complex (LO).—This mapping unit is in the built-up areas of cities and towns. Most of the acreage is in the industrial areas of Port Brownsville. Slopes are less than 0.5 percent. Lomalta clay makes up about 40 percent of the complex, and Urban land makes up 40 percent.

Lomalta clay consists of about 53 inches of gray, saline, calcareous clay. The next layer is light brownish-gray silty clay loam about 4 inches thick. The underlying material is stratified very pale brown silty clay loam.

Urban land consists mostly of industrial sites connected with port operations. Among these are buildings, roads, railways, and oil storage tanks. Most structures are built on 1 to 3 feet of fill dirt, a practice that helps drainage. Most of the surfaces of this complex have been altered by the addition of oil and other waste connected with port operations.

Included in mapping are areas of Sejita and Willamar soils and Ustifluvents, clayey.

Permeability is moderately slow, and runoff is slow. The available water capacity is medium to high.

Lozano soils are used for irrigated crops, dryfarmed crops, range, and as wildlife habitat.

Representative profile of Lozano fine sandy loam, in a cultivated field, 0.7 mile east on Farm Road 106 from its junction with State Highway 345, then 1 mile north and 0.1 mile east on county road, 100 feet south:

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) fine sandy

water table is a limitation in this soil. Subsurface tile drains can be effectively used to lower the water table.

Areas of this soil are used for irrigated crops, dryfarmed crops, range, and as wildlife habitat. Capability units IIw–1, dryland, and IIw–1, irrigated; pasture and hay group 8C; orchard group F; Sandy Loam range site.

Lyford Series

horizon are dark grayish brown, light brownish gray, brown, or light gray. The C horizon is pale brown, very pale brown, or light gray. Accumulation of calcium carbonate in the form of soft lumps and strongly cemented concretions ranges from 1 to about 5 percent, by volume.

Lyford sandy clay loam (LY).—This nearly level soil is on coastal terraces. Slopes are less than 0.5 percent, and the surface is plane to slightly concave. Areas of this soil vary widely in size and shape, but some are several hundred acres in size, and others are in small, rounded, slight depressions or long, narrow drainageways.

Included with this soil in mapping are areas of Lozano, Hidalgo, and Raymondville soils. Also included are a few irregularly shaped areas that are high in content of sodium.

Permeability is moderate, and runoff is slow. A seasonal high water table is a limitation in this soil. Subsurface tile drains can be effectively used to lower the water table.

Areas of this soil are used for irrigated crops, dryfarmed crops, pasture, range, and as wildlife habitat. Capability units IIw–2, dryland, and IIw–2, irrigated; pasture and hay group 7C; orchard group F; Clay Loam range site.

Matamoros Series

The Matamoros series consists of deep, moderately well drained, calcareous soils that are nearly level. These soils are on the active flood plain of the Rio Grande.

In a representative profile the plow layer is light brownish-gray, calcareous silty clay about 8 inches thick. The next layer is light brownish-gray clay about 16 inches thick. The next layer is brown silt loam about 3 inches thick. The next lower layer is grayish-brown silty clay about 4 inches thick. Beneath this to a depth of 50 inches is light brownish-gray silty clay.

Permeability is slow. The available water capacity is medium to high.

Matamoros soils are used for irrigated crops and pasture.

Representative profile of Matamoros silty clay in a cultivated field, 0.1 mile east on U.S. Highway 281, from its junction with Farm Road 2520, then 0.2 mile south on a field road and 50 feet east:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; very hard, firm, sticky; many roots; calcareous; moderately alkaline; abrupt, smooth boundary.

C1—8 to 24 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; massive; clay consists of fragments about 2 inches across the axes; the interfaces of the fragments are dull and not shiny; few fine pores; distinct cleavage planes; very hard, very firm, sticky; many roots; calcareous; moderately alkaline; abrupt, smooth boundary.

C2—24 to 27 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; few, fine, faint, very dark brown mottles; few lenses of silty clay; massive; bedding planes evident; remnants of leaves, in various stages of decomposition, are along the fractures of the lenses of silty clay; hard, friable, slightly sticky in the matrix of silt loam; few fine roots; calcareous; moderately alkaline; abrupt, smooth boundary.

A1b—27 to 31 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak, blocky structure; hard, firm, sticky; few black charcoal spots about 1 to 2 centimeters in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

C3—31 to 50 inches, light brownish-gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; massive; silty clay consists of angular fragments having dull faces and no definite pattern of cleavage or size, ranging from about 1/2 to 3 inches across the axes; very hard, very firm, sticky; few, fine, distinct, dark-brown mottles made up of decomposed organic materials, on some of the interfaces; calcareous; moderately alkaline.

The uppermost 40 inches ranges from silty clay loam to silty clay in average texture. The A horizon ranges from grayish brown to light brownish gray in color, from silty clay loam to silty clay in texture, and from 5 to 12 inches in thickness. The C horizon, to a depth of about 40 inches, ranges from grayish brown or light brownish gray to brown or pale brown in color. It is silty clay loam to silty clay that has thin strata of loamy sediment. The C horizon is 35 to 50 percent clay. Cleavage planes along unaltered bedding planes are weakly expressed to strongly expressed. The sediment, below a depth of 40 inches, ranges from silt loam to clay and is also stratified.

Matamoros silty clay (MA).—This nearly level soil is on the flood plain of the Rio Grande. Slopes are less than 0.5 percent. Areas of this soil are irregularly shaped and range from 10 to about 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Rio Grande and Camargo soils that occur as narrow streaks or rounded pockets. Also included are a few areas of soils that are similar to Matamoros soils, but they are underlain by loamy material at a depth of 25 to 40 inches.

Permeability is slow, and runoff is slow. This soil is used for irrigated crops and pasture. Capability unit IIs–1, irrigated; pasture and hay group 1C; orchard group I.

Matamoros-Rio Grande complex (MC).—The soils of this complex occur in such intricate patterns that it is not feasible to map them separately. Matamoros silty clay makes up about 30 percent of the complex, and Rio Grande silt loam makes up 30 percent. These soils are on the inside bends of the river or remnants of resacas, in alternating bands parallel to the river or resacas. Both soils are nearly level. The Matamoros soil has a weakly concave surface, and the Rio Grande soil has a plane or slightly convex surface. Areas of this unit are irregularly shaped and range from 40 to about 100 acres in size.

The Matamoros soil has a surface layer of grayish-brown, calcareous silty clay about 12 inches thick. The underlying material, extending to a depth of about 50 inches, is grayish-brown silty clay stratified with loamy material.

The Rio Grande soil has a surface layer of grayish-brown, calcareous silt loam about 10 inches thick. The underlying material, extending to a depth of about 50 inches, is grayish-brown and pale-brown, stratified silt loam and very fine sandy loam.

Included with these soils in mapping are areas of Rio Grande silty clay loam and Camargo soils.

Permeability is slow in the Matamoros soil and moderate in the Rio Grande soil. Runoff is slow on both soils. These soils are used for irrigated crops. Capability unit IIs–3, irrigated; pasture and hay group 1C; orchard group I.

Mercedes Series

The Mercedes series consists of deep, moderately well drained, calcareous clays that are nearly level to gently sloping. These soils are on old flood plains and deltas.

In a representative profile the surface layer is gray, calcareous clay about 29 inches thick. The next layer is light brownish-gray about 18 inches thick. Beneath this, to a depth of about 74 inches, is clay that is pale brown in the upper part and very pale brown in the lower part.

Permeability is very slow, and runoff is slow. The available water capacity is low to high depending on the degree of salinity.

Mercedes soils are used for irrigated crops, dryfarmed crops, and pasture. A few areas are idle.

Representative profile of Mercedes clay, 0 to 1 percent slopes in a cultivated field, 1.6 miles north on Farm Road 1595 from its junction with Farm Road 106, then 150 feet west:

Ap—0 to 10 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine, granular and subangular blocky structure; hard, firm, very sticky and very plastic; common fine shell fragments; calcareous moderately alkaline; abrupt, smooth boundary.

A11—10 to 18 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine, angular blocky structure; hard, firm, very sticky and very plastic; few roots; few soft ferromanganese bodies of dark yellowish brown; many fine shell fragments; calcareous; moderately alkaline; gradual, wavy boundary.

A12—18 to 29 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine blocky structure that forms parallelepipeds; many intersecting slickensides; very hard, very firm, very sticky and very plastic; many fine shell fragments; few fine roots; calcareous; moderately alkaline; diffuse, wavy boundary.

AC1—29 to 47 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; a few gray streaks along apparently filled cracks as much as 2 inches across; moderate fine blocky structure that forms parallelepipeds; many distinct slickensides 14 inches across that have axes tilted about 45° from the horizontal; very hard, very firm, very sticky and very

surface is plane or weakly concave. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Hidalgo soils on small, rounded knolls. Also included are areas of Raymondville soils.

Permeability is very slow, and runoff is slow. Some areas lack adequate surface drainage. This soil cracks or shrinks when dry and swells when wet. Areas of this soil are used for irrigated crops, dryfarmed crops, and pasture. Capability units IIIs–1, dryland, and IIIs–1, irrigated; pasture and hay group 7A.

Mercedes clay, 1 to 3 percent slopes (MEB).—This soil is in irregularly shaped areas. Slopes are dominantly about 2 percent, and the surface is convex. Areas of this soil range from about 40 to 250 acres in size.

The surface layer is gray, calcareous clay about 22 inches thick. The next layer is light brownish-gray clay about 14 inches thick. The underlying material, extending to a depth of about 63 inches, is grayish-brown clay.

Included with this soil in mapping are areas of Raymondville soils and Mercedes clay, 0 to 1 percent slopes. Also included are areas of Hidalgo soils at the top of slope breaks and a few eroded areas.

Permeability is very slow, and runoff is slow. This soil cracks or shrinks when dry and swells when wet. Areas of this soil are used for irrigated crops, dryfarmed crops, and pasture. Capability units IIIe–1, dryland, and IIIe–1, irrigated; pasture and hay group 7A.

Mercedes clay, loamy substratum, 1 to 5 percent slopes (MGC).—This soil is in a narrow band adjacent to the Arroyo Colorado. Areas are irregularly shaped and are less than 300 feet wide on both sides of the Arroyo. Slopes are convex and range from 1 to 5 percent, and the surface is undulating. This mapping unit has many gullies that begin at the Arroyo and bisect the smooth plane of Mercedes soils. Gullies are

Mercedes clay has a surface layer of gray clay about 22 inches thick. The next layer is light brownish-gray clay about 18 inches thick. The underlying material, extending to a depth of about 60 inches, is clay that is pale brown in the lower part.

About 50 percent of the Urban land consists of areas where such works and structures as streets, sidewalks, buildings, driveways, and patios have been constructed. The remaining 50 percent consists of areas of industrial development and the Harlingen Municipal Airport. Because of the flat topography

this soil are irregularly shaped and range from less than 10 acres to about 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Galveston soils and Mustang fine sand, saline. In a few places effervescence can be obtained with hydrochloric acid because of sand-size shell fragments.

Permeability is rapid above the water table, and runoff is very slow. The hazard of soil blowing is severe. Areas of this soil are used for recreation, wildlife habitat, and urban development. Capability

sure faces; few weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

B2—23 to 34 inches, dark-brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate, fine and medium, subangular blocky structure in upper 7 to 8 inches and moderate, fine, angular blocky structure in the lower part; very hard, firm but crumbly; few fine pores; shiny pressure faces; few fine weakly cemented calcium carbonate concretions; calcareous;

layer is brown silty clay about 16 inches thick. The underlying material, extending to a depth of about 60 inches, is very pale brown silty clay.

Urban land consists of areas where such works and structures as streets, sidewalks, buildings, driveways, and patios have been constructed. Most of the structures are single-unit dwellings. Part of this complex is the Brownsville Country Club and Golf Course, but

ganese concretions; few small cemented calcium carbonate concretions; saline; calcareous; moderately alkaline; gradual, wavy boundary.

C—48 to 63 inches, gray (10YR 5/1) sandy clay loam, dark gray (10YR 4/1) moist; common, medium, distinct, strong-brown mottles; massive; hard, friable; few small manganese concretions; few small cemented calcium carbonate concretions; saline; calcareous; moderately alkaline.

The solum ranges from 36 to 55 inches in thickness. The A horizon and B21t horizon are gray, dark gray, dark grayish brown, or grayish brown and are neutral to mildly alkaline. The B21t horizon and B22t horizon are sandy clay or clay. The B22t horizon and B3t horizon are dark grayish brown, grayish brown, or brown and have few to common, faint to distinct mottles in shades of gray, brown, and yellow. The B3 horizon is sandy clay, clay loam, or sandy clay loam. The C horizon is gray, grayish brown, or light brownish gray and has common to many distinct mottles in shades of gray, brown, or yellow. The C horizon is sandy clay loam or clay loam.

Orelia clay loam, clayey subsoil variant (OR).—This nearly level soil is on coastal terraces. Slopes are less than 0.5 percent, and the surface is plane to concave. Most areas of this soil are rounded in shape and range from about 6 to 40 acres in size. Included in mapping are areas of Tiocano, Lyford, and Willamar soils.

Permeability is slow, and runoff is very slow. A seasonal high saline water table is at a depth of 1 to 4 feet. Subsurface tile drains are generally not practical because this soil has a high content of clay. The surface of this soil is generally crusty and cloddy. Areas of this soil are used for pasture and range. Many areas are idle, but a few are cropped. Capability unit IVs-3, dryland; pasture and hay group 7F; orchard group I; Clay Loam range site.

Point Isabel Series

The Point Isabel series consists of deep, well-drained, calcareous soils that are gently sloping to sloping. These soils are on clayey dunes along the lower part of the Gulf Coast in this county.

In a representative profile the surface layer is light brownish-gray clay loam about 8 inches thick over 4 inches of dark grayish-brown clay. The next layer is light brownish-gray clay 7 inches thick. Beneath this is grayish-brown clay loam about 3 inches thick. The next layer, extending to a depth of 65 inches, is clay. It is light brownish gray in the upper 15 inches, gray in the next 5 inches, and light gray in the lower 23 inches.

Permeability is slow, and runoff is rapid. The available water capacity is very low to medium, depending on the degree of salinity.

Point Isabel soils are used for range and wildlife habitat. A few areas are in pasture.

Representative profile of Point Isabel clay loam, in an area of native range, 7.6 miles east on State Highway 4 from its junction with Farm Road 511, then 0.2 mile north on a field road and 250 feet west:

A11—0 to 8 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular and subangular blocky structure; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

A12—8 to 12 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, firm; calcareous; moderately alkaline; clear, wavy boundary.

B2—12 to 19 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; moderate, coarse, prismatic structure parting to moderate, fine and medium, angular blocky; hard, firm; common films and threads of carbonates; calcareous; moderately alkaline; abrupt, wavy boundary.

IIAb—19 to 22 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, coarse, prismatic structure parting to moderate, fine, angular blocky; hard, firm; common films and threads of carbonates; calcareous; moderately alkaline; abrupt, wavy boundary.

IIBb—22 to 37 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; moderate, fine and medium, angular blocky structure; hard, firm; few films and threads of carbonates; calcareous; moderately alkaline; abrupt, wavy boundary.

IIIAb—37 to 42 inches, gray (10YR 5/1) clay, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, firm; few threads of carbonates; calcareous; moderately alkaline; clear, wavy boundary.

IIIBb—42 to 65 inches, light-gray (10YR 7/2) clay, grayish brown (10YR 5/2) moist; moderate, fine and medium, angular blocky structure; hard, firm; common threads and films of carbonates; calcareous; moderately alkaline.

Depth to an underlying contrasting layer of loamy material or seams of shells is more than 6 feet. Depth to a buried A horizon or B horizon ranges from 18 to 50 inches. The A horizon is clay loam, clay, or silty clay loam. The A11 horizon is grayish brown, light brownish gray, or pale brown, and the A12 horizon is grayish brown or dark grayish brown. The B horizon is grayish brown, light brownish gray, brown, or pale brown. It is clay loam or clay that is 35 to 55 percent clay. This horizon contains few to common films, threads, and filaments of secondary carbonates. In areas where the buried horizons are at a depth of 40 to 50 inches, there is a weakly developed ca horizon in some places.

Point Isabel clay loam (PO).—This is a gently sloping to sloping soil on long, narrow, "clayey" dunes along the lower part of the Gulf Coast (fig. 4) in this county. Most areas are on the northwestern edge of large areas of Barrada soils. Slopes range from 1 to 8 percent, and the surface is convex. Elevations range from 5 to 30 feet above mean high tide. Areas of this soil range from 10 to about 250 acres in size. This soil has the profile described as representative of the series.

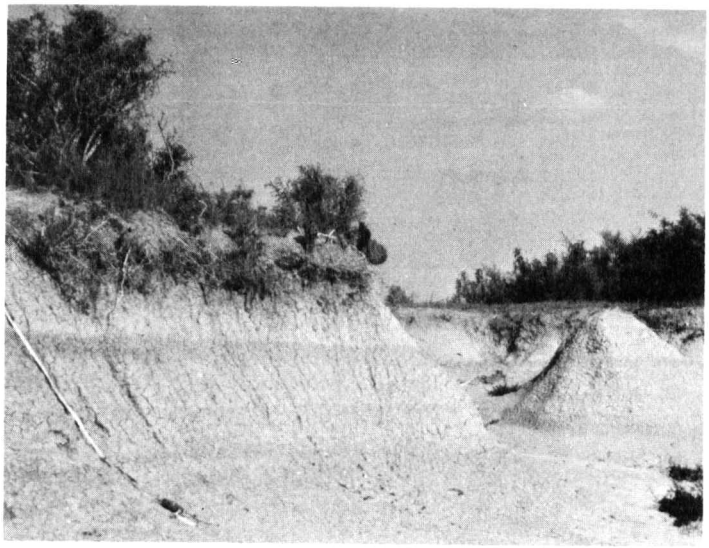


Figure 4.—**Point Isabel clay loam. Darker colored streaks are buried surface layers.**

Included with this soil in mapping are areas of Lomalta and Sejita soils, and some areas where slopes are as much as 15 percent. Also included are a few areas of soils that are similar to Point Isabel soils, but they are less clayey.

Permeability is slow, and runoff is rapid. The hazard of erosion is severe. Most areas are gullied to a depth of 1 to 5 feet on both sides of the dunes. Salinity ranges from low to very high. Areas of this soil are used for range and wildlife habitat. A few areas are in improved pasture. Capability unit VIe–1, dryland; pasture and hay group 7G; Coastal Ridge range site.

Point Isabel-Urban land complex (PU).—This mapping unit is in the built-up areas of cities and towns. Most of the acreage is in Port Isabel. Areas are saline. Slopes range from 1 to 8 percent. Point Isabel clay loam makes up about 55 percent of the complex, and Urban land makes up 30 percent.

The Point Isabel soil has a surface layer of light brownish-gray clay loam about 8 inches thick. The next layer is dark grayish-brown clay 4 inches thick. The next layer is light brownish-gray clay 7 inches thick. The underlying material, reaching to a depth of 65 inches, is brownish and grayish clay loam and clay.

Urban land is in areas where such works and structures as houses, churches, schools, small industrial buildings, streets, sidewalks, and paved parking lots have been constructed. Little alteration has taken place on the Point Isabel soil, but fills are [illegible] adjacent to the bay and ship

Ap—0 to 7 inches, dark-gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; weak, fine, subangular blocky structure; slightly hard, friable; few earthworm casts; mildly alkaline; abrupt, smooth boundary.

A1—7 to 13 inches, dark-gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; weak, fine, subangular blocky structure; slightly hard; friable; few earthworm casts; mildly alkaline; clear, smooth boundary.

B1t—13 to 17 inches, dark grayish brown (10YR 4/2) sandy clay loam, very dark brown (10YR 2/2) moist; weak, medium, blocky structure; hard, friable; common fine pores; few earthworm casts; few clay films on ped surfaces; mildly alkaline; gradual, smooth boundary.

B2t—17 to 31 inches, grayish-brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, blocky and prismatic structure; very hard, firm; common fine pores; common earthworm casts; common clay films; mildly alkaline; gradual, wavy boundary.

B3—31 to 44 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak, fine, subangular blocky structure; hard, friable; common fine pores; common earthworm casts; few snail shell fragments; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—44 to 74 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; few, fine, distinct strong-brown mottles in lower part; massive; hard, friable; common fine pores; few snail shell fragments; about 5 percent, by volume, weakly cemented and strongly cemented calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 30 to 55 inches in thickness. The A

Racombes soils and Urban land (RDX).—This mapping unit is in the built-up areas of cities and towns. Most of the acreage is in Harlingen and Rio Hondo. Slopes range from 0 to 1 percent. Racombes sandy clay loam makes up about 40 percent of the complex, and Urban land makes up 30 percent.

The Racombes soil has a surface layer of dark-gray, noncalcareous sandy clay loam about 13 inches thick. The next layer is sandy clay loam about 18 inches thick; it is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material, extending to a depth of 74 inches, is pale-

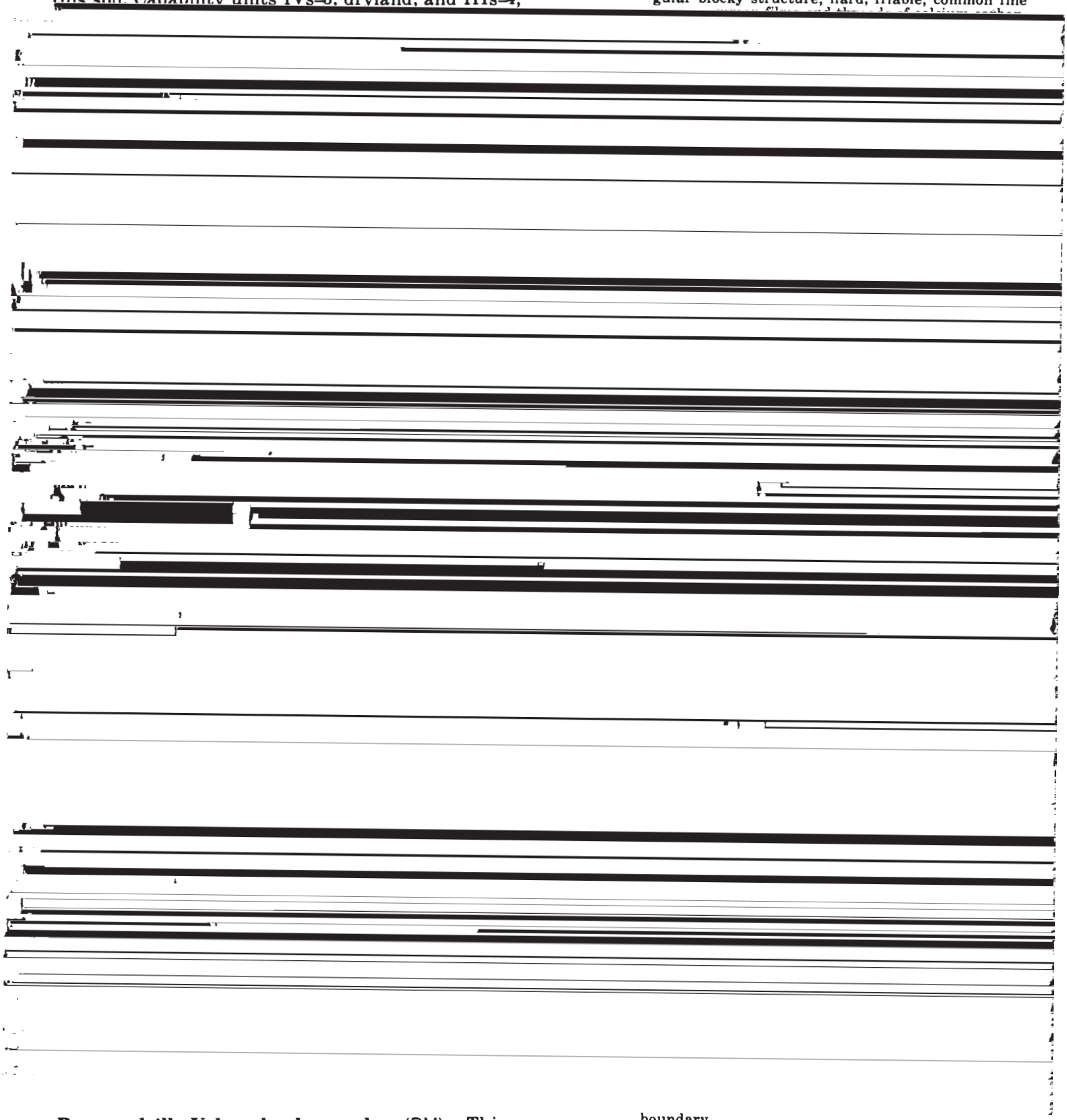
B2ca—25 to 37 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; moderate, medium, blocky structure; many wedge-shaped peds; few slickensides; very hard, very firm; few films, threads, and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—37 to 60 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; moderate, fine and medium, blocky structure; very hard, very firm; about 5 percent, by volume, of concretions and soft lumps of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C2ca—60 to 78 inches, light brownish-gray (10YR 6/2) clay, brown (10YR 5/3) moist; weak, blocky structure; very

tems can be used effectively to reduce the salinity of this soil. Capability units IVs–3, dryland, and IIIs–4,

grayish brown (10YR 5/2) moist; weak, fine, subangular blocky structure; hard, friable; common fine



Raymondville-Urban land complex (RM).—This mapping unit is in the built-up areas of cities and towns. Most of the acreage is in Harlingen. Slopes are 0 to 1 percent. Raymondville clay loam makes up

boundary.

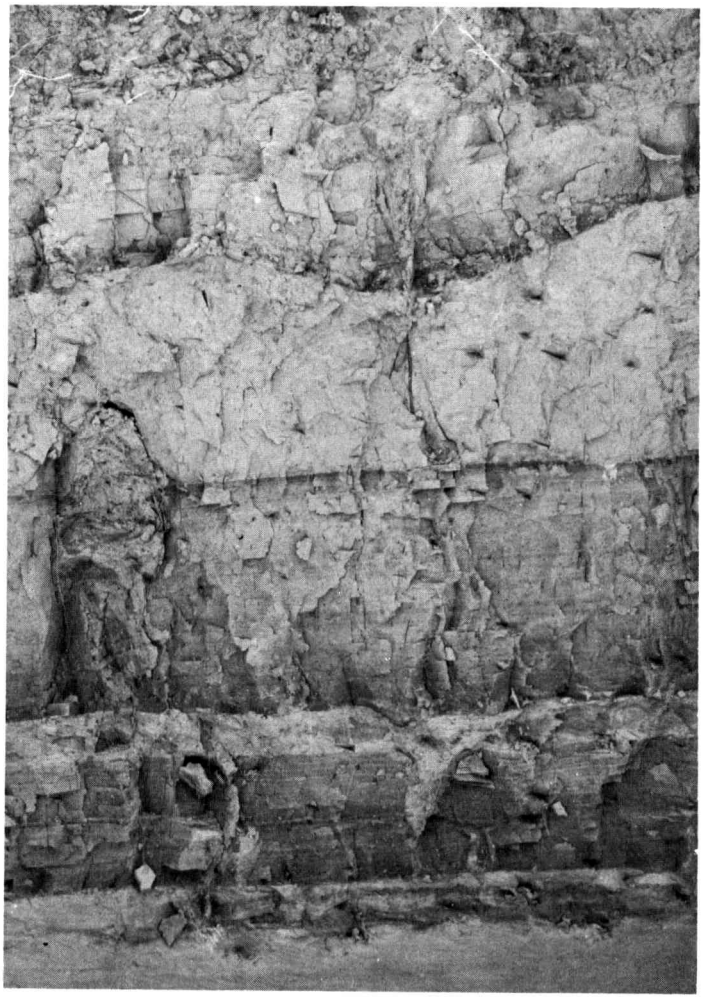
Cca—37 to 41 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; massive; hard, friable; few fine pores; 3 percent, by volume, soft lumps of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

ped surfaces; mildly alkaline; gradual, wavy boundary.

B3—37 to 49 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; few, fine, distinct, strong-brown mottles and common medium gray streaks; weak, medium, blocky structure; very hard, firm, sticky and plastic; few small round magnesium concretions; few films and threads of carbonates and few weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—49 to 63 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; common, fine, gray and strong-brown mottles; massive; hard, firm; few small round magnesium concretions; about 3 percent, by volume, weakly cemented calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from about 32 to 56 inches in thickness. The A horizon ranges from gray or grayish brown to very dark grayish brown or dark gray in color. It ranges from neutral to mildly alkaline. The Bt horizon ranges from clay loam to clay, and the content of clay is 35 to 50 percent. This horizon is very dark grayish brown or very dark gray to grayish brown or gray and has mottles that range from yellow or brown to gray. This horizon ranges from mildly alkaline to moderately alkaline. The Cca horizon ranges from gray to pale brown or very pale brown in color, from sandy clay loam to clay in texture, and from 1 to about 5 percent, by volume, in content of calcium carbonate.



Rio clay loam (RO).—This nearly level soil is on coastal terraces. Most areas occur as small, rounded depressions about 3 to 10 acres in size, but many areas occupy the outer rim of small enclosed potholes. Slopes are less than 0.5 percent.

Included with this soil in mapping are areas of Tiocano and Racombes soils. Also included are small areas of Willacy soils.

Permeability is slow, and runoff is very slow to ponded. Surface drains are needed to remove excess runoff. Areas of this soil are used for irrigated crops, dryfarmed crops and pasture. Capability units IIs-2, dryland, and IIs-2, irrigated; pasture and hay group 7E; orchard group I.

Rio Grande Series

The Rio Grande series consists of deep, well-drained, calcareous soils that are nearly level to gently sloping. These soils are on the active flood plain of the Rio Grande. The surface is plane to slightly convex.

In a representative profile (fig. 5) the plow layer is light-gray, calcareous silt loam about 9 inches thick. The underlying material, extending to a depth of about 63 inches, is light-gray and very pale brown, stratified silt loam, silty clay loam, and very fine sandy loam.

Permeability is moderate, and runoff is slow. The available water capacity is high to very high. These soils are rarely flooded. The high lime content of the soils causes chlorosis of some plants.

Rio Grande soils are used for irrigated crops and pasture.

Representative profile of Rio Grande silt loam, in a cultivated field, 0.2 mile west on U.S. Highway 281 from its junction with Farm Road 2520, 0.2 mile south on field road and 100 feet east:

Ap—0 to 9 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; friable; few mica flakes; calcareous; moderately alkaline; abrupt, smooth boundary.

C1—9 to 16 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; few brownish-yellow mottles along root channels and cleavages on bedding planes; massive; bedding planes evident; friable; common fine pores; few mica flakes; calcareous; moderately alkaline; clear, wavy boundary.

C2—16 to 28 inches, very pale brown (10YR 7/3) silt loam that has few pockets of very fine sandy loam, dark grayish brown (10YR 4/2) moist; few brownish-yellow mottles along root channels and cleavages of bedding planes; massive; bedding planes evident; friable; common fine pores; few mica flakes; calcareous; moderately alkaline; clear, wavy boundary.

C3—28 to 33 inches, very pale brown (10YR 7/3) silty clay loam, grayish brown (10YR 5/2) moist; common strong-brown mottles along root channels and cleavage planes; massive; bedding planes evident; firm; few fine pores; few mica flakes; calcareous; moderately alkaline; clear, wavy boundary.

C4—33 to 39 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; few yellow-brown mottles along root channels; massive; bedding planes evident; friable; common fine pores; few mica flakes; calcareous; moderately alkaline; diffuse, wavy boundary.

The texture in the uppermost 40 inches of the profile ranges from silt loam to very fine sandy loam. The A horizon ranges from grayish brown to light brownish gray or light gray in color, from silt loam to silty clay loam in texture, and from 5 to 17 inches in thickness. The C horizon ranges from grayish brown to light gray, pale brown, or very pale brown in color, and in texture from silt loam to very fine sandy loam

and patios have been constructed. Most of the structures are single-unit dwellings, but about 15 percent are industrial buildings, businesses, streets, and paved parking lots near the International Bridge. Only minor alteration of the Rio Grande soils has taken place.

about 30 inches but ranges from 20 to 48 inches. The available water capacity is very low.

Sejita soils are used for range and as wildlife habitat.

Representative profile of Sejita silty clay loam, in range, 4.3 miles northeast on Farm Road 1792 from its junction with Farm Road 511 at Port Brownsville, 0.6 mile north on trail and 100 feet east:

A1sa—0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; slightly hard. friable;

The next layer is light-gray silty clay loam about 18 inches thick. The underlying material, extending to a depth of about 40 inches, is very pale brown, stratified silt loam, silty clay loam, and clay loam.

Urban land consists of areas of industrial buildings, storage tanks, and other works and structures that are connected with a chemical plant and port operations. Areas of this complex at Port Isabel consist of single-unit dwellings, and the accompanying streets, driveways, sidewalks, and utility services. Most structures are built on 1 to 3 feet of fill dirt, a practice that helps the drainage. Most of the surface of this com

concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—57 to 74 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; hard, firm, sticky and plastic; few, very small, weakly cemented calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from about 40 to 60 inches in thickness. These soils have cracks that are 3/8 inch to about 4 inches in width and 30 to 40 inches in depth and that remain open from 90 to 150 days during most years. Reaction is neutral to moderately alkaline throughout, and the soil ranges from noncalcareous to calcareous. The thickness of the A horizon ranges from 12 inches in the center of the microknolls to about 50 inches in the center of the microbasins. The A horizon is dark gray or very dark gray. The AC horizon ranges in thickness from about 6 inches in the microbasins to 24 inches in the microknolls. It is gray or dark gray.

Tiocano clay (TC).—This soil is in small enclosed level depressions that are 1 to 3 feet lower than the surrounding soils. Slopes are less than 0.5 percent,

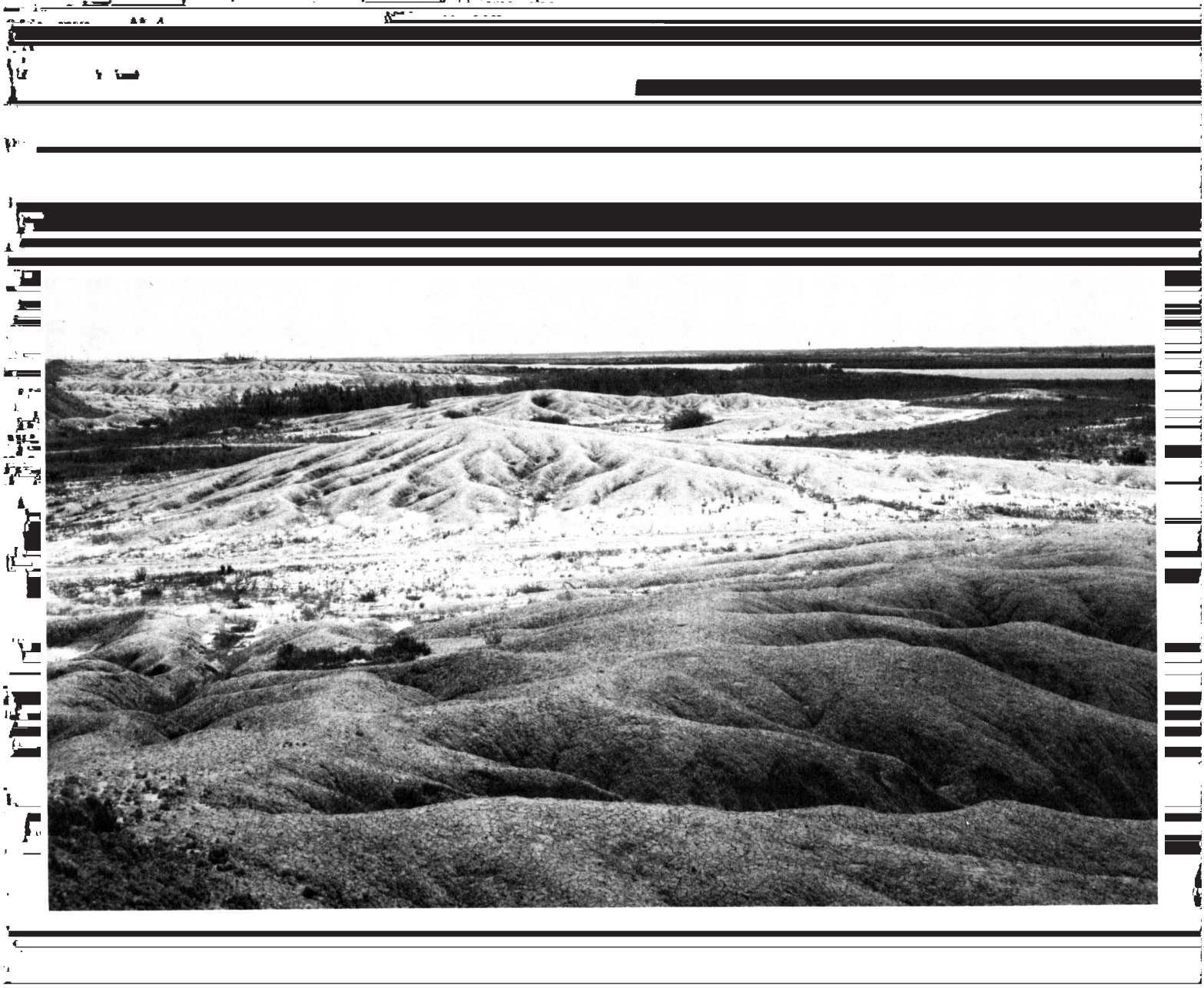
Urban Land

Urban land consists of areas where such works and structures as streets, sidewalks, buildings, driveways, churches, schools, yards, and patios have been constructed. Most of the structures are single-unit dwellings, but some are industrial buildings, business and professional buildings, paved parking lots, and airports.

The installation of works and structures has so altered soil features that the soils cannot be recognized.

Urban land is mapped in a complex with Benito, Harlingen, Hidalgo, Laredo, Lomalto, Mercedes, Olmito, Point Isabel, Raymondville, Rio Grande, and Sejita soils. It is also mapped in an undifferentiated unit with the Racombes soils.

Ustifluvents, Clayey



Sejita and Lomalta soils. Also included are a few areas of soils similar to Ustifluvents, clayey, but they are more sandy throughout.

Permeability is very slow, and runoff is slow to rapid. This soil is not suited to crops or pasture, but it is suited to wildlife habitat or urban development. Among the concerns of management for urban development are failure of pipelines and steel because of cor-

brown (10YR 5/3) moist; massive; hard, friable; 4 percent of soft lumps and strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 39 to 60 inches in thickness. Secondary lime occurs at a depth of 34 to 50 inches.

The A horizon is very dark grayish brown, dark grayish brown, or grayish brown and is 11 to 20 inches thick. Reaction is neutral or mildly alkaline.

sions. Slopes are dominantly about 2 percent, and the surface is convex. Areas of this soil range from 5 to about 50 acres in size.

The surface layer is dark grayish-brown, noncalcareous fine sandy loam about 16 inches thick. The next layer is brown sandy clay loam about 21 inches thick. The underlying material, extending to a depth of about 60 inches, is pale-brown sandy clay loam.

Included with this soil in mapping are areas of Willacy fine sandy loam, 0 to 1 percent slopes, and Hidalgo soils. Also included are a few areas of soils that are similar to Willacy soils, but they either contain secondary lime at a depth of less than 34 inches, or they are less clayey throughout.

Permeability is moderate, and runoff is medium. A few areas of this soil have been altered by land leveling for irrigation. Some areas have a thin surface layer because of cutting operations, and a few areas have a thick surface layer because of filling operations. All of the surface layer has been removed from a few areas.

This soil is used for irrigated crops, dryfarmed crops, citrus, and pasture. Capability units IIe-3, dryland, and IIe-2, irrigated; pasture and hay group 8C; orchard group B; Sandy Loam range site.

Willamar Series

The Willamar series consists of deep, somewhat poorly drained, noncalcareous soils that are nearly level. These soils are saline and have a high content of sodium below the surface layer. They are on deltas or coastal terraces.

In a representative profile the surface layer is grayish-brown fine sandy loam about 3 inches thick. Below this is gray fine sandy loam about 2 inches thick. The next layer is about 13 inches of dark grayish-brown clay loam that is saline and high in content of exchangeable sodium. The next layer is light brownish-gray, saline clay loam 12 inches thick. The underlying material, extending to a depth of about 60 inches, is very pale brown, saline sandy clay loam.

Permeability is very slow, and runoff is very slow. The available water capacity is very low to low.

B3ca—18 to 30 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; few, faint and distinct, brownish-yellow mottles; moderate, fine and medium, blocky structure; hard, firm; thin clay films; black thin clay flows in insect tunnels; few weakly cemented concretions and soft masses of calcium carbonate; saline; calcareous; strongly alkaline; gradual, smooth boundary.

Ccasa—30 to 60 inches, very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; few to common, distinct, brownish-yellow mottles; massive; hard, friable; few fine pores; few dark stains along old root channels; common films and nests of salts; common soft masses and weakly cemented concretions of calcium carbonate; saline; calcareous; strongly alkaline.

The solum ranges from 20 to 38 inches in thickness. Sodium saturation is more than 15 percent in the B horizon and C horizon and increases with increasing depth.

The A horizon is grayish-brown or gray fine sandy loam or sandy loam 1 to 7 inches thick. It is neutral to mildly alkaline. In cultivated areas the Ap horizon is a mixture of the A and B horizons and is sandy clay loam. In these areas an A2 horizon is lacking. Great differences in thickness occur within short distances of 5 to 20 feet.

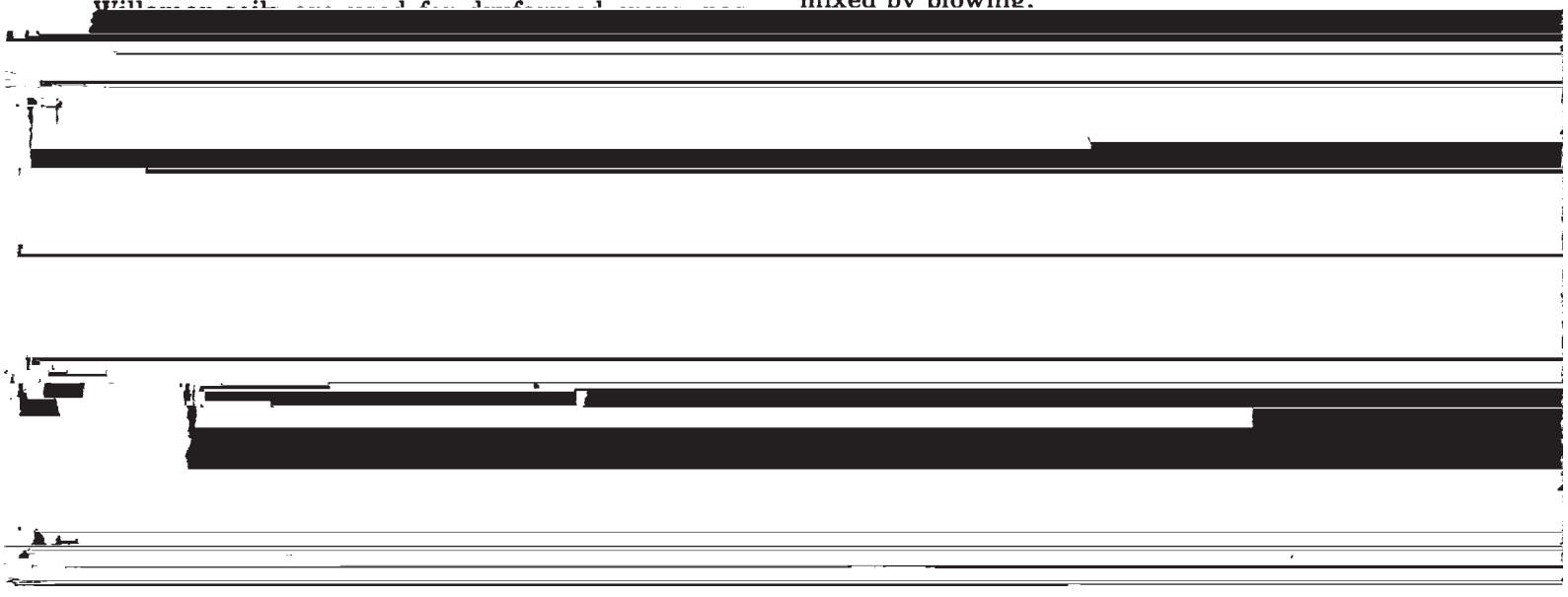
The B2t horizon is dark grayish-brown or dark-gray sandy clay loam or clay loam, and the content of clay is 25 to 35 percent. The B3 horizon is grayish-brown or light brownish-gray sandy clay loam or clay loam. The B2t horizon and B3 horizon are mildly alkaline to strongly alkaline.

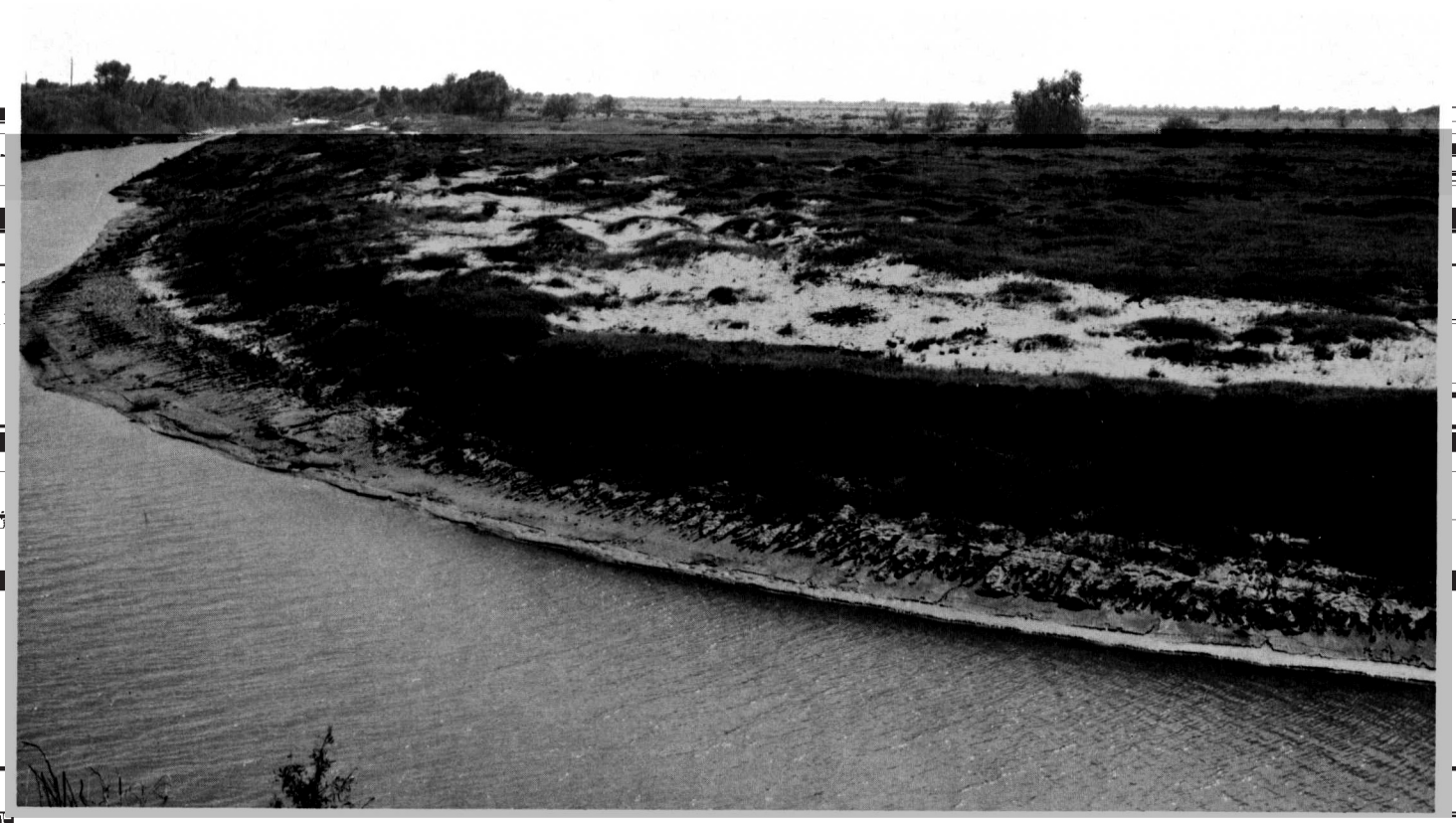
The C horizon is very pale brown or pale-brown sandy clay loam or clay loam. The C horizon is moderately alkaline or strongly alkaline, and contains as much as 7 or 8 percent, by volume, of weakly cemented concretions and soft masses of calcium carbonate.

Willamar soils (WM).—In this unit are nearly level, somewhat poorly drained soils on coastal terraces. Willamar fine sandy loam makes up about 40 percent of this mapping unit, and Willamar sandy clay loam makes up about 40 percent. In areas of range the surface layer is fine sandy loam. In cultivated areas, the surface layer has been mixed with the underlying material and averages sandy clay loam. Slopes are less than 0.5 percent, and the surface is plane. Areas of this soil are broad and irregularly shaped, and most are several hundred acres in size.

Willamar fine sandy loam has the profile described as representative of the series.

Willamar sandy clay loam has a profile similar to that described as representative of the series, but the surface layer and upper part of the subsoil have been mixed by plowing.





Use and Management of the Soils

This section concerns the use and management of the soils of the county for crops, orchard, pasture, range, wildlife habitat, and in engineering works.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is main-

Figure 9.—**Level furrow irrigation of cabbage on Laredo silty clay loam, 0 to 1 percent slopes.**

CAPABILITY UNIT I-1, IRRIGATED

This unit consists of deep, nearly level soils on bottom lands. These soils have a surface layer of silt loam. Permeability is moderate, and the available water capacity is high to very high. These soils are subject to flooding.

These soils are well suited to cultivation. The main crops are cotton, grain sorghum, and a wide variety of cool-season vegetables.

The main concerns of management are maintaining or improving soil condition and managing irrigation water. A cropping system that includes such high residue-producing crops as grain sorghum is needed to help maintain soil tilth. Crop residue left on or near the surface helps to prevent surface crusting. Land leveling minimizes soil erosion and increases the efficiency of irrigation. Land-leveling cuts should be made carefully because of the contrasting textures below the surface layer. Undesirable material may be exposed in places. Temporary field ditches and diff-

CAPABILITY UNIT I-2, IRRIGATED

This unit consists of deep, nearly level soils on bottom lands. These soils have a surface layer of silty clay loam. Permeability is moderate, and the available water capacity is high to very high. These soils are subject to flooding.

These soils are well suited to cultivation. The main crops are cotton, grain sorghum, and cool-season vegetables.

The main concerns of management are maintaining or improving soil condition and managing irrigation water. A cropping system that includes such high residue-producing crops as grain sorghum is needed to maintain soil tilth. Land leveling controls soil erosion and increases the efficiency of irrigation. Land-leveling cuts should be made carefully because of the contrasting textures below the surface layer. Undesirable material may be exposed in places.

CAPABILITY UNIT I-3, IRRIGATED

0 to 1 percent slopes. It is a deep, nearly level soil. Permeability is moderate, and the available water capacity is medium to high.

This soil is well suited to cultivation. The main crops are cotton, grain sorghum, citrus, and a wide variety of cool-season vegetables.

The main concerns of management are maintaining or improving soil condition and managing irrigation water. A cropping system that includes such high residue-producing crops as grain sorghum is needed to maintain soil tilth. Crop residue left on or near the surface helps to control soil blowing. Land leveling controls soil erosion and increases the efficiency of irrigation. Areas where land-leveling cuts are deeper than about 2 feet need special management practices such as mulching or manuring, to offset the loss of organic matter. The risk of chlorosis increases in the more limy material below a depth of 2 feet. Temporary field ditches are difficult to maintain.

CAPABILITY UNIT I-4, IRRIGATED

controls soil erosion and increases the efficiency of irrigation. Areas where land-leveling cuts are deeper than about 3 feet need such special management practices as mulching or manuring to offset the loss of organic matter. The risk of chlorosis increases in the more limy material below a depth of 3 to 4 feet. Temporary field ditches are difficult to maintain.

CAPABILITY UNIT IIe-1, DRYLAND

The only soil in this unit is Hidalgo fine sandy loam, 1 to 3 percent slopes. It is a deep, gently sloping soil. Permeability is moderate, and the available water capacity is medium to high. The hazard of water erosion is moderate. The hazard of soil blowing is slight.

This soil is suited to cultivation. The main crops are cotton and grain sorghum. The high content of lime in this soil causes chlorosis in grain sorghum.

The main concerns of management are controlling erosion and maintaining or improving soil condition. Cropping systems that include such high residue-

soil structure, provide a continuing supply of organic material, and to help control erosion. Contour farming helps to reduce soil losses from erosion.

CAPABILITY UNIT IIe-2, IRRIGATED

The only soil in this unit is Willacy fine sandy loam, 1 to 3 percent slopes. It is a deep, gently sloping soil. Permeability is moderate, and the available water capacity is medium to high. The hazard of water erosion is moderate. The hazard of soil blowing is slight.

This soil is suited to cultivation. The main crops are

CAPABILITY UNIT IIw-1, DRYLAND

This unit consists of deep, nearly level to gently sloping soils that have a surface layer of fine sandy loam. These soils have a seasonal high saline water table. Permeability is moderately slow, and the available water capacity is medium to high. The hazard of soil blowing is slight.

These soils are suited to crops. The main crops are cotton and grain sorghum.

The main concerns of management are conserving moisture and maintaining or improving soil condition.

CAPABILITY UNIT IIw-2, IRRIGATED

The only soil in this unit is Lyford sandy clay loam. It is a deep, nearly level soil that has a seasonal high saline water table. Permeability is moderate, and the

CAPABILITY UNIT IIs-2, IRRIGATED

The only soil in this unit is Rio clay loam. It is a deep, nearly level soil. Permeability is slow, and the available water capacity is medium to high.

reduce evaporation. Land leveling increases the efficiency of irrigation, and tile drains help to provide uniform leaching of harmful salts.

CAPABILITY UNIT IIc-1, DRYLAND

The only soil in this unit is Hidalgo fine sandy loam, 0 to 1 percent slopes. It is a deep, nearly level soil that has a surface layer of fine sandy loam. Permeability is moderate, and the available water capacity is high to very high.

This soil is well suited to cultivation. The main crops are cotton and grain sorghum, but the high content of lime in this soil causes chlorosis in grain sorghum.

The main concerns of management are conserving soil moisture and maintaining or improving soil condition. Cropping systems that include such high residue-producing crops as grain sorghum are needed to reduce evaporation, improve soil structure, provide a continuing supply of organic material, and control soil blowing. Stripcropping or wind strips help to reduce soil blowing.

CAPABILITY UNIT IIc-2, DRYLAND

provide a continuing supply of organic material. The soils of this unit receive extra water as runoff from surrounding areas. During years of above average rainfall or heavy rains, the soils are flooded in places for short periods of time.

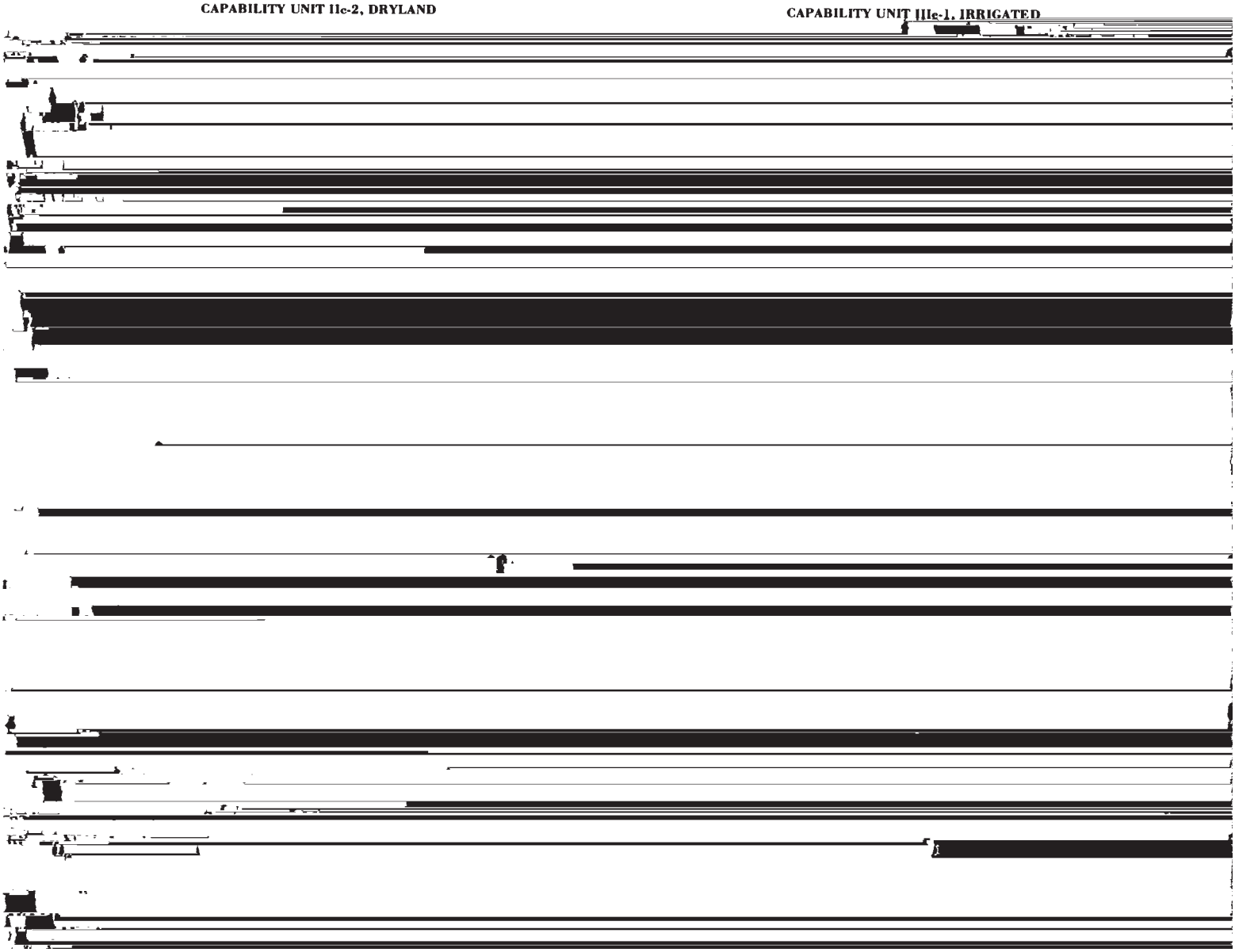
CAPABILITY UNIT IIIe-1, DRYLAND

The only soil in this unit is Mercedes clay, 1 to 3 percent slopes. It is a deep, gently sloping soil. The intake of water is high when the soil is dry and cracked, but permeability is very slow when the soil is wet. The available water capacity is low to high. The hazard of water erosion is moderate.

This soil is suited to crops. The main crops are cotton and grain sorghum.

The main concerns of management are controlling erosion and maintaining or improving soil condition. Cropping systems that include such high residue-producing crops as grain sorghum are needed to improve soil structure and to reduce the hazard of erosion. Oats, forage sorghum, or another cover crop is also beneficial.

CAPABILITY UNIT IIIe-1, IRRIGATED



crops are cotton, grain sorghum, and a few such cool-season vegetables as carrots and onions.

The main concerns of management are maintaining or improving soil condition and managing irrigation water. Cropping systems that include such high residue-producing crops as grain sorghum are needed to improve soil structure and maintain soil tilth. Oats, forage sorghum, or another cover crop is also beneficial. In some areas surface drains are needed to remove ponded water after heavy rains. Land leveling increases the efficiency of irrigation.

CAPABILITY UNIT IIIs-2, DRYLAND

The only soil in this unit is Laredo silty clay loam, saline. It is a deep, nearly level to gently sloping soil that has excess soluble salts in the root zone. Permesurface to control soil blowing. Efficient irrigation by sprinkler helps to conserve water.

CAPABILITY UNIT IIIs-4, IRRIGATED

This unit consists of deep, nearly level, saline soils that have a surface layer of clay loam or silty clay. Permeability is moderately slow to slow, and the available water capacity is very low to medium.

These soils can be cultivated, but special management and careful selection of crops are necessary. The main crop is cotton, but grain sorghum is grown in some of the less saline areas.

The main concerns of management are maintaining or improving soil condition, adapting cropping systems to soil limitations, and managing irrigation water. Crop residue should be left on or near the

available water capacity is medium to high. This soil is subject to flooding.

This soil can be cultivated, but loss of crops is a risk because of flooding. The main crops are cotton, grain sorghum, and some cool-season vegetables.

The main concerns of management are maintaining or improving soil condition and managing irrigation water. Crop residue should be left on or near the surface. Land leveling increases the efficiency of irrigation. Surface drains are needed to remove ponded water.

CAPABILITY UNIT IVs-1, DRYLAND

The only soil in this unit is Harlingen clay, saline. It is a deep, level, saline soil. The intake of water is high when the soil is dry and cracked, but permeability is very slow when the soil is wet. The available water capacity is very low to medium.

This soil can be cultivated, but special management and careful selection of crops are necessary. The main crop is cotton, but most areas are better suited to pasture.

The main concerns of management are maintaining or improving soil condition and adapting cropping systems to the soil limitations. Crop residue should be left on the surface to reduce evaporation. Mulches, such as cotton burs, also are beneficial. Because of the high content of clay in this soil, tile drainage systems cannot be used to leach out harmful salts. In some areas surface drains are needed to remove ponded water after heavy rains.

CAPABILITY UNIT IVs-1, IRRIGATED

The only soil in this unit is Harlingen clay, saline. It is a deep, level, saline soil. The intake of water is high when the soil is dry and cracked, but permeability is very slow when the soil is wet. The available water capacity is very low to medium.

This soil can be cultivated, but special management and careful selection of crops are necessary. The main crop is cotton, but most areas are better suited to pasture.

The main concerns of management are maintaining or improving soil condition, adapting cropping systems to the soil limitations, and managing irrigation water. Crop residue should be left on the surface to reduce evaporation and improve soil structure. Mulches, such as cotton burs, are also beneficial. Land leveling increases the efficiency of irrigation. Because of the high content of clay in this soil, tile drainage systems cannot be used to leach out harmful salts. Some areas need surface drains to remove ponded water after heavy rains.

CAPABILITY UNIT IVs-2, DRYLAND

The only soils in this unit are Willamar soils. These are deep, nearly level, saline soils that have a surface layer of fine sandy loam or sandy clay loam. They have a seasonal high water table. Permeability is very slow, and the available water capacity is very low to low.

These soils can be cultivated, but special management and careful selection of crops are necessary. The main crops are cotton and grain sorghum.

The main concerns of management are maintaining or improving soil condition and adapting cropping systems to the soil limitations. Crop residue should be left on or near the surface to reduce evaporation and surface crusting. Mulches, such as cotton burs, are also beneficial. Soil salinity increases with increasing depth, and deep plowing should be avoided because it brings to the surface those materials that are higher in salt content.

CAPABILITY UNIT IVs-3, DRYLAND

This unit consists of deep, nearly level, saline soils that have a surface layer of clay loam and silty clay. Permeability is moderately slow to slow, and the available water capacity is very low to medium.

These soils can be cultivated, but special management and careful selection of crops are necessary. The main crop is cotton. Grain sorghum is grown in some of the less saline areas.

The main concerns of management are maintaining or improving soil condition and adapting cropping systems to the soil limitations. Crop residue should be left on the surface to reduce evaporation and surface crusting. Mulches, such as cotton burs, are also beneficial. Tile drains help to provide uniform leaching of harmful salts.

CAPABILITY UNIT Vw-1, DRYLAND

The only soil in this unit is Tiocano clay. It is a deep, nearly level to depressional soil that has a surface layer of clay. Permeability is very slow, and the available water capacity is medium to high. This soil is subject to frequent flooding.

Areas of this soil are not suitable for cultivation, but are better suited to pasture or wildlife habitat.

CAPABILITY UNIT VIe-1, DRYLAND

The only soil in this unit is Point Isabel clay loam. It is a deep, gently sloping to sloping soil. Permeability is slow, and the available water capacity is very low to medium. The hazard of erosion is severe.

Areas of this soil are not suitable for cultivation but are better suited to range or wildlife habitat.

CAPABILITY UNIT VIw-1, DRYLAND

The only soil in this unit is Mustang fine sand. It is a deep, nearly level to gently sloping soil. Permeability is rapid above the water table, which is within 3 feet of the surface. The available water capacity is very low.

Areas of this soil are not suitable for cultivation but are better suited to recreation, wildlife habitat, or range.

CAPABILITY UNIT VIs-1, DRYLAND

The only soil in this unit is Benito clay. It is a deep, nearly level to slightly depressional, saline soil. The intake of water is high when the soil is dry and cracked, but permeability is very slow when the soil is wet. The available water capacity is low to very low.

Areas of this soil are not suitable for cultivation but are better suited to pasture, range, or wildlife habitat.

CAPABILITY UNIT VIs-2, DRYLAND

The only soil in this unit is Latina sandy clay loam. It is a deep, nearly level, saline soil. Permeability is slow, and the available water capacity is very low.

Areas of this soil are not suitable for cultivation but are better suited to range or wildlife habitat.

CAPABILITY UNIT VIIs-1, DRYLAND

The only soil in this unit is Lomalta clay. It is a deep, nearly level to slightly depressional, saline soil that is only a few feet above tidal water. Permeability is very slow, and the available water capacity is very low.

Areas of this soil are not suitable for cultivation but are better suited to range or wildlife habitat.

CAPABILITY UNIT VIIs-2, DRYLAND

The only soil in this unit is Sejita silty clay loam. It is a deep, nearly level, saline soil that is only a few feet above tidal water. Permeability is moderately slow, and the available water capacity is very low.

Areas of this soil are not suitable for cultivation, but are better suited to range or wildlife habitat.

CAPABILITY UNIT VIIIs-1, DRYLAND

The only land type in this unit is Coastal dunes. It [illegible] gently sloping to steep, loose sand

CAPABILITY UNIT VIIIs-2, DRYLAND

This unit consists of deep, nearly level to gently sloping, saline, barren soils that have a surface layer of sand or clay. Most areas are at or near sea level, but some are below sea level. Most areas are frequently flooded. A water table is at or near the surface throughout the year.

Areas of these soils support no vegetation because of the salinity. These soils are used mainly for wildlife habitat and recreation.

CAPABILITY UNIT VIIIs-3, DRYLAND

The only soil in this unit is Ustifluvents, clayey. It consists of nearly level to steep silty and clayey materials that have been excavated from canals and ditches or from the bottoms of lagoons and bays. Permeability is very slow.

Areas of this soil are not suitable for crops or pasture. They are better suited to wildlife habitat or urban development than to most other uses. The salinity of this soil is very high and prevents the growth of most plants.

TABLE 2.—*Predicted average acre yields of principal crops under a high level of management—Continued*

Soil series and map symbols	Carrots, irrigated	Cotton (lint)		Grain sorghum		Onions, irrigated	Pasture		Grapefruit	Oranges
		Nonirrigated	Irrigated	Nonirrigated	Irrigated		Nonirrigated	Irrigated		
	Tons	*Lb*	*Lb*	*Lb*	*Lb*	*50-lb sacks*	*AUM* [1]	*AUM* [1]	*Boxes*	*Boxes*
Laredo:										
LAA, LD, LEA, LG	17	500	1,200	4,000	7,500	900	8.0	14.0	375	270
For the Olmito part of LD and the Reynosa part of LEA, see the Olmito and Reynosa series.										
LAB, LEB	14	425	950	3,400	6,000	720	8.0	14.0	375	270
For the Reynosa part of LEB, see the Reynosa series.										

and others who have knowledge of yields in the county. The yields are average yields that can be expected by commercial farmers at the level of management that tends to produce the highest economic return per acre.

Yields are given for irrigated and nonirrigated soils if the soils are used for both methods of farming, otherwise, yields for only one method are given. Not included in this table are soils that are used only as range or for recreation.

Crops other than those shown in table 2 are grown

9. Irrigation is timed to meet the need of the soil and crops.
10. Irrigation systems are properly designed and effectively used.

Suitability of the Soils for Specified Yard and Garden Plants

Homeowners, businesses, garden clubs, and others who want to landscape and garden need to know what kinds of soil they have on their property and

nizing the limitations of the soils for such uses and on the use of management practices that offset the limitations as much as possible. The main factors that affect gardening in this county are high tempera-

generally favorable and that limitations can be easily overcome. A rating of *fair* means that the soil properties are moderately favorable, but the soils have one or two major limitations that can be overcome or

TABLE 3.—*Suitability of the soils for specified yard and garden plants—Continued*

Plant	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Flowers—Continued						
Marigold	Good: fertilize, keep in good tilth.	Good: keep in good tilth.	Good: add organic matter, keep in good tilth.	Fair: add organic matter, keep in good tilth.	Poor	Poor.
Pansy	Good: water often, fertilize with phosphate.	Good: fertilize with phosphate.	Fair: slow permeability; fertilize with phosphate.	Fair: slow permeability, too clayey.	Poor	Poor.
Petunia	Good	Good	Good	Fair	Poor	Poor.
Periwinkle	Good	Good	Good	Fair	Poor	Poor.
Snapdragon	Good: water regularly.	Fair: too limy, fertilize, water regularly.	Fair: too limy, poor internal drainage; water regularly.	Poor: too limy, too clayey; water regularly.	Poor	Poor.
Sweetpea	Good: keep in good tilth.	Fair: too limy; fertilize, add organic matter.	Fair: too limy, poor internal drainage.	Poor: too limy, too clayey, root growth limited.	Poor	Poor.
Zinnia	Good	Good	Good	Fair: too clayey.	Poor	Poor.
Shrubs:						
Barbados-cherry	Good	Good	Good: keep in good tilth.	Fair: too clayey.	Poor	Poor.
Bougainvillaea	Good	Good: young plants may develop chlorosis.	Fair: add organic matter, keep in good tilth.	Fair: keep in good tilth, add organic matter.	Poor	Poor.
Boxwood	Good	Fair: too limy; add chelates.	Fair: too limy; add chelates.	Fair: too limy; add chelates.	Poor	Poor.
Cenizo	Good	Good	Good	Fair: poor drainage.	Fair	Poor.
Copper leaf	Good	Good	Fair: poor internal drainage.	Fair: poor internal drainage.	Poor	Poor.
Firecracker bush	Good	Good	Good	Fair: too clayey, poor internal drainage.	Poor	Poor.
Gardenia	Fair: fertilize twice a year, water regularly.	Poor: too limy; fertilize, water regularly.	Poor: too limy, poor internal drainage.	Poor: too limy, poor internal drainage.	Poor	Poor.
Hibiscus	Good: fertilize, water often.	Fair: too limy; fertilize, water often.	Poor: poor internal drainage.	Poor: too clayey, poor internal drainage.	Poor	Poor.
Hydrangea	Fair: not acid enough; add organic matter, fertilize, and water regularly.	Poor: too limy; chlorosis is a problem.	Poor: too limy, slow permeability.	Poor: too limy, too clayey.	Poor	Poor.
Jasmine, yellow	Good: fertilize, keep in good tilth.	Good: fertilize, keep in good tilth.	Good: fertilize, keep in good tilth.	Fair: too clayey; fertilize, keep in good tilth.	Poor	Poor.

TABLE 3.—*Suitability of the soils for specified yard and garden plants—Continued*

Plant	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Shrubs—Continued						
Ligustrum (Privet)	Good	Fair: too limy	Fair: too limy, poor internal drainage.	Fair: too limy, poor internal drainage.	Poor	Poor.
Natal-plum (Carissa)	Good	Fair: too limy	Fair: too limy, poor internal drainage.	Fair: too limy, poor internal drainage.	Poor	Poor.
Oleander	Good	Good	Good	Good	Fair: water regularly.	Poor: plants may adapt.
Pfitzer juniper	Good	Good	Fair: poor internal drainage.	Fair: poor internal drainage.	Poor	Poor.
Philodendron	Good	Fair: too limy	Fair: too limy	Poor: too limy, too clayey.	Poor	Poor.
Pittosporum	Good	Fair: too limy; add chelates.	Fair: too limy: add chelates.	Fair: too limy; add chelates.	Poor	Poor.
Plumbago, blue	Good	Good	Good	Fair: poor internal drainage.	Poor	Poor.
Pyracantha	Good	Fair: too limy; add chelates.	Fair: too limy; add chelates.	Fair: too limy; add chelates.	Poor	Poor.
Roses, common root stock.	Fair: not acid enough; fertilize, water regularly.	Poor: too limy; add chelates.	Poor: too limy, poor internal drainage.	Poor: too limy, poor internal drainage.	Poor	Poor.
Roses, Mexican root stock.	Good	Fair: keep in good tilth.	Poor	Poor	Poor	Poor.
Cacti and succulents:						
Aloe vera	Good	Good	Good	Fair	Fair	Poor.
Pricklypear	Good	Good	Good	Fair	Fair	Poor.
Strawberry cactus	Good	Good	Good	Fair	Fair	Poor.
Tasajillo	Good	Good	Good	Fair	Fair	Poor.
Yucca, Spanish dagger	Good	Good	Good	Fair	Fair	Poor.
Yucca, soft leaf	Good	Good	Good	Fair	Fair	Poor.
Trees:						
Anaqua	Good	Good	Good	Fair: poor internal drainage.	Fair: water regularly.	Poor.
Avocado	Good: fertilize, water regularly.	Fair: chlorosis is a problem.	Poor: slow internal drainage, too clayey.	Poor: slow internal drainage, too clayey.	Poor	Poor.
Ash, Arizona	Good	Good	Good	Fair: too clayey.	Poor	Poor.
Ash, Rio Grande	Good	Good	Good	Fair: too clayey.	Poor	Poor.
Bottlebrush	Good	Good	Good	Fair: poor internal drainage.	Poor	Poor.
Brazilian pepper	Good	Good	Good	Fair: poor internal drainage.	Poor	Poor.

TABLE 3.—*Suitability of the soils for specified yard and garden plants—Continued*

Plant	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Trees—Continued						
Citrus (all varieties)	Good: fertilize, water when needed.	Fair: too limy; add chelates, fertilize, water frequently.	Poor: too clayey, poor internal drainage, too limy.	Poor: too clayey, poor internal drainage, too limy.	Poor	Poor.
Chinese tallow	Good: fertilize, water regularly.	Good: fertilize, water regularly.	Good: internal drainage is a problem.	Fair: too clayey, poor internal drainage.	Poor	Poor.
Cottonwood	Good	Good	Good	Fair: poor internal drainage.	Poor	Poor.
Crapemyrtle	Good: fertilize at time of pruning.	Good: fertilize at time of pruning.	Good: fertilize at time of pruning.	Fair: too clayey; fertilize at time of pruning.	Poor	Poor.
Desert willow	Good	Good	Good	Fair: poor internal drainage.	Fair	Poor.
Hackberry	Good	Good	Good	Good	Poor	Poor.
Japanese yew	Good	Good	Fair: poor internal drainage.	Fair: poor internal drainage.	Poor	Poor.
Live oak	Good	Good	Fair: slow permeability.	Poor: too clayey, slow permeability.	Poor	Poor.
Loquat	Good	Good	Good	Fair: poor internal drainage.	Poor	Poor.
Mesquite	Good	Good	Good	Fair	Fair	Poor.

Group 3.—This group consists of soils of the Cameron, Olmito, Matamoros, Raymondville, and Rio series. These soils have a surface layer of clay loam or silty clay that is neutral to moderately alkaline. The underlying material is slowly permeable to moderately slowly permeable. These soils are moderately well drained to somewhat poorly drained, and their available water capacity is medium to high. Under special management, the soils in this group are suited to many flowers, shrubs, and trees grown in the county.

Group 4.—This group consists of soils of the Grulla, Harlingen, Mercedes, and Tiocano series. These soils have a surface layer of clay that is neutral to moderately alkaline. The underlying material is very slowly permeable. These soils are somewhat poorly drained to moderately well drained, and their available water capacity is low to high. The soils in this group are suited to poorly suited for flowers, shrubs, and trees grown in the county. Special management practices are needed for good growth.

Group 5.—This group consists of soils of the Galveston, Mustang, and Zalla series. These soils have a surface layer of fine sand or loamy fine sand that is

Orchard suitability groups

The soils in Cameron County have been placed in orchard groups according to their suitability for producing orchard crops. The soils in each group are enough alike to be suited to the same orchard crop, to have similar limitations and hazards, to require similar management, and to have similar productivity and other responses to management. Thus, the orchard group is a convenient grouping of soils for their management. The orchard suitability groups in Cameron County are identified by capital letters A through I. Groups E, G, and H have been omitted because none of the soils in these groups occur in Cameron County. Some of the soils in Cameron County were not placed in an orchard group because soil limitations or location preclude their use for orchards. The "Guide to Mapping Units" at the back of this survey lists the soils assigned to orchard suitability groups.

ORCHARD SUITABILITY GROUP A

This group consists of deep, nearly level to gently sloping soils that have a surface layer of fine sandy

tain.

ORCHARD SUITABILITY GROUP C

This group consists of deep, nearly level to gently

noncalcareous soils of this group are suited to peaches.

Good orchard management includes proper fertilization and weed and insect control. If herbicides are

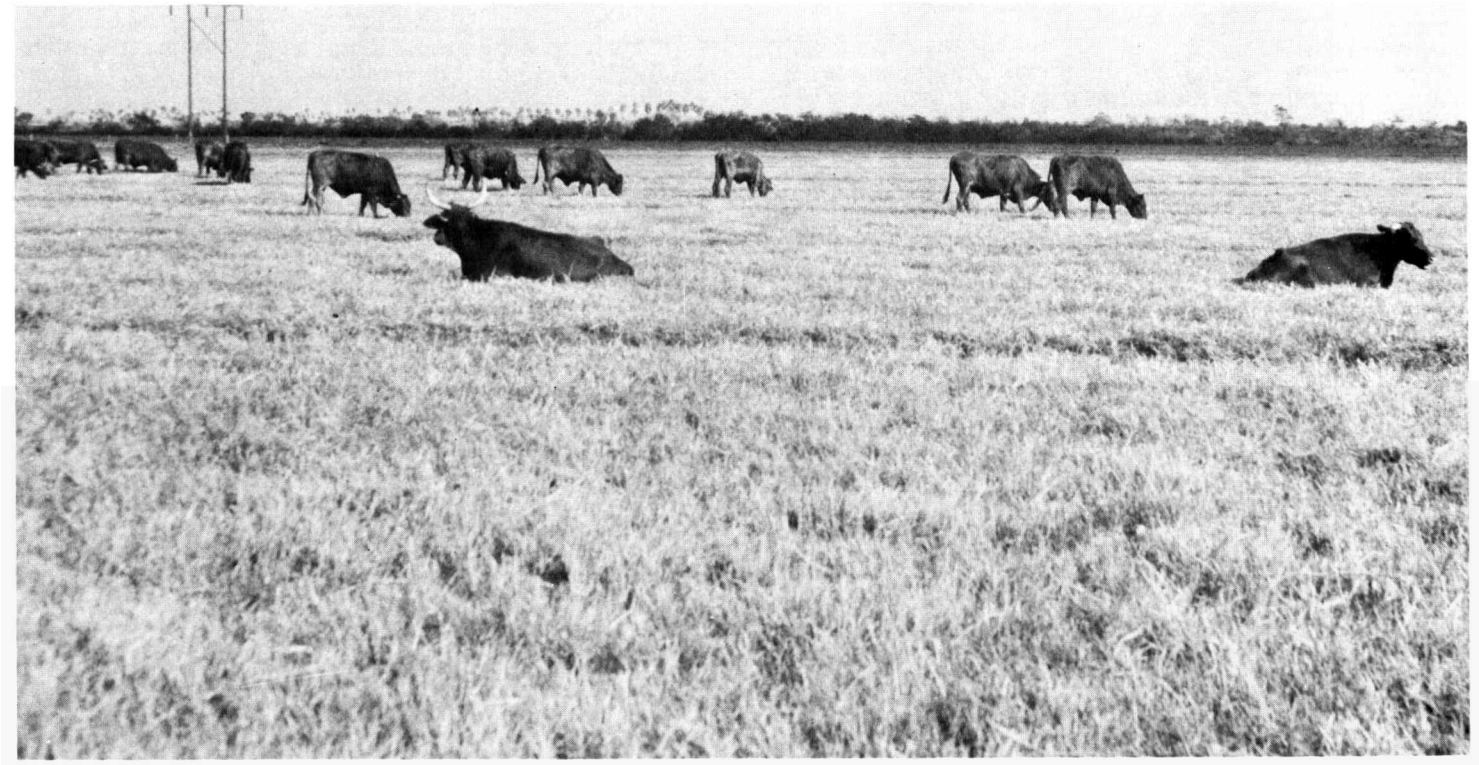


Figure 11.—**Cattle grazing irrigated Coastal bermudagrass pasture on Laredo silty clay loam, 0 to 1 percent slopes.**

tilization, rotational grazing, and weed control is needed on this soil. An adequate water supply is also necessary. The soil puddles if it is grazed when wet. Seedbed preparation is difficult on this clayey soil.

PASTURE AND HAY GROUP 1C

This group consists of deep, nearly level, clayey to loamy soils. These soils are subject to overflow. Permeability is moderate to slow, and the available water capacity is medium to very high.

These soils are used mostly for pasture, but a few areas are used for hay. Production potential is high for Coastal bermudagrass, African stargrass, and other grasses.

Pasture management that includes proper use, fertilization, rotational grazing, and weed control is needed on these soils. An adequate water supply is also necessary. Land leveling increases the efficiency of irrigation.

PASTURE AND HAY GROUP 2A

This group consists of deep, nearly level to gently sloping, loamy to sandy soils that are subject to overflow. These soils have a surface layer of silty clay loam or silt loam about 8 inches thick. The underlying material is stratified, friable silt loam or silty clay loam. Permeability is moderate to rapid, and the available water capacity is low to very high.

These soils are used mostly for pasture, but a few areas are used for hay. Production potential is high for Coastal bermudagrass, African stargrass, and other grasses.

Pasture management that includes proper use, fertilization, rotation grazing, and weed control is needed on these soils. An adequate water supply is also needed. Land leveling increases the efficiency of irrigation.

PASTURE AND HAY GROUP 3A

The only soil in this group is Zalla loamy fine sand. It is a gently sloping soil that is subject to overflow. Permeability is rapid, and the available water capacity is low.

This soil is used only for pasture. Production potential is medium to high for common or improved bermudagrass.

Pasture management that includes proper use, fertilization, rotation grazing, and weed control is needed on this soil. An adequate water supply is also needed. The loose seedbeds of this soil make establishing grass difficult. Fertilizer should be applied frequently during the growing season.

PASTURE AND HAY GROUP 7A

This group consists of deep, nearly level to gently sloping, clayey soils. These soils have a high water intake rate when they are dry and cracked, but they are very slowly permeable when wet. The available water capacity is low to high.

These soils are used for pasture and hay. Production potential is high for Coastal bermudagrass, African stargrass, and introduced bluestems.

Pasture management that includes proper use, fertilization, rotation grazing, and weed control is needed on these soils. An adequate water supply is also needed. The soils puddle if they are grazed when wet. Seedbed preparation is difficult because the soils are clayey.

PASTURE AND HAY GROUP 7C

This group consists of deep, nearly level to gently sloping, loamy to clayey soils. Permeability is moderate to slow, and the available water capacity is medium to very high.

These soils are used for pasture and hay. Production potential is high for Coastal bermudagrass, African stargrass, introduced bluestems, and other grasses.

Pasture managment that includes proper use, fertilization, rotation grazing, and weed control is needed on these soils. An adequate water supply is also needed. Land leveling increases the efficiency of irrigation.

PASTURE AND HAY GROUP 7E

This group consists of deep, nearly level and slightly depressional to gently sloping, clayey soils. Permeability is slow to very slow, and the available water capacity is medium to high.

PASTURE AND HAY GROUP 8C

This group consists of deep, nearly level to gently sloping, loamy soils. Permeability is moderate to moderately slow, and the available water capacity is medium to high.

These soils are used for pasture and hay. Production potential is high for improved bermudagrass and buffelgrass.

Pasture management that includes proper use, fertilization, rotation grazing, and weed control is needed on these soils. An adequate water supply is also needed. Land leveling increases the efficiency of irrigation. Forage production is used mainly for grazing, any excess is cut for hay.

Use of the Soils for Range[2]

Approximately 145,000 acres in Cameron County is used as range, and the native vegetation is used for grazing livestock and for food and cover for wildlife.

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 the growing season.

A primary objective of good range management is to keep range 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. The changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may make the range appear to be in good condition, when actually the cover is weedy and the long-term trend is toward lower production. In other places, range that has been closely grazed for short periods, but that has been carefully managed may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of range sites

In the following pages, the range sites of Cameron 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. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey. Not all of the soils of Cameron County, but only those that are in native vegetation, or range, have been placed in a range site.

CLAY LOAM RANGE SITE

The soils that make up this site are deep, nearly level, clay loams and sandy clay loams. They are moderately permeable to slowly permeable and are moderately well drained to somewhat poorly drained. These soils receive very little runoff from surrounding soils.

The climax vegetation is grasses, some forbs, and a few scattered woody plants. In excellent condition, the site has fourflowered trichloris, Arizona cottontop, and lovegrass tridens. These plants make up about 65 percent of the vegetation. Among other less numerous plants are pink pappusgrass, plains bristlegrass, curly-mesquite, slim tridens, and perennial forbs.

Under continued heavy grazing by cattle, trichloris, cottontop, and lovegrass tridens decrease and pink pappusgrass and curly mesquite increase. If the range condition deteriorates, red grama, three-awn, whorled dropseed, and many annual forbs invade the site. Other invaders are mesquite, spiny hackberry, whitebrush, condalias, and other woody plants.

If this site is in excellent condition, the total annual production of air-dry forage is about 2,500 pounds per acre in unfavorable years and 4,500 pounds per acre in favorable years. This site can be reseeded successfully after the seedbed has been prepared and the brush controlled.

COASTAL RIDGE RANGE SITE

The soils that make up this site are deep, nearly level to sloping, saline clay loams and silty clay loams. They are moderately permeable to slowly permeable and well drained.

This site is preferred by livestock because it is on high ground and because the vegetation is more palatable than that on adjacent sites. In dry years, the vegetation is severely damaged because deposits of saline soil particles blown from nearly barren mud flats accumulate.

The climax vegetation is grasses, forbs, and shrubs, dominated by big sacaton, fourflowered trichloris, Arizona cottontop, and lovegrass tridens. These plants make up about 70 percent of the vegetation. Among the other less numerous plants are pink pappusgrass, slim tridens, plains bristlegrass, fall witchgrass, and hooded windmillgrass. Among the palatable browse plants are fiddlewood, Texas kidneywood, and desert yaupon.

Under continued heavy grazing by cattle, sacaton, trichloris, cottontop, and lovegrass tridens decrease and pink pappusgrass, plains bristlegrass, and hooded windmillgrass increase. If the range condition deteriorates, slim tridens, fall witchgrass, scrub mesquite, spiny hackberry, condalias, wolfberry, cactus, and coyotillo brush invade. Deer use this site for food and cover.

If this site is in excellent condition, the total annual production of air-dry forage is about 2,000 pounds per acre in unfavorable years and 4,000 pounds per acre in favorable years.

COASTAL SAND RANGE SITE

The soils that make up this site are deep, nearly level to gently sloping, fine sands. They are rapidly permeable and are poorly drained to somewhat excessively drained. These soils are in small mounds and depressions adjacent to the Gulf.

The climax vegetation is open grassland and some forbs. The site has dependably high forage production, but the forage is deficient in phosphorus. The mounds support the taller grasses, and the depressions support the short water-tolerant grasses. If this site is in excellent condition, about 75 percent of the vegetation is seacoast bluestem, crinkle-awn, and gulfdune paspalum. Among the other less numerous plants are brownseed paspalum, knotroot bristlegrass, and perennial legumes and forbs. Some marshhay cordgrass, switchgrass, sedges, and rushes grow particularly in the depressions.

Under continued heavy grazing by cattle, seacoast bluestem and crinkle-awn on the mounds and marshhay cordgrass and switchgrass in the depression decrease, and gulfdune paspalum, brownseed paspalum, and knotroot bristlegrass increase. If the range condition deteriorates, red lovegrass, grass bur, annual forbs, and annual grasses invade the site.

The hazard of soil blowing is severe on this site as [redacted] acre in unfavorable years and 5,000 pounds per acre [redacted]

scaled (blue) quail, white-winged dove, mourning dove, cottontail rabbit, jackrabbit, waterfowl, and many kinds of nongame birds. There are also raccoon, fox, skunk, opossum, and other furbearers. The whitetail deer, javelina, and turkey are found only on or near the Laguna Atascosa National Wildlife Refuge, which occupies about 45,000 acres in the northeastern corner of the county. Common predators are bobcats

domestic grasses and legumes that are established by planting. These plants provide food and cover for wildlife. Among the grasses are Kleingrass, ryegrass, and panicgrass; among the legumes are hubam and sweetclover.

Wild herbaceous upland plants.—This group consists of native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland

TABLE 4.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat				
	Grain and seed crops		Grasses and legumes		Wild herbaceous upland plants
	Dryland	Irrigated	Dryland	Irrigated	
Barrada: BA	Very poor		Very poor		Very poor
Benito: BE, BU Ratings are for Benito soils only in these mapping units. Urban land in BU is too variable to be rated.	Poor	Poor	Poor	Fair	Fair
Camargo: CA, CC	Good	Good	Good	Good	Good
Cameron:					
CE	Good	Good	Good	Good	Fair
CF	Poor	Fair	Poor	Fair	Poor
Chargo: CH	Poor	Fair	Poor	Fair	Poor
Coastal beach: CO. Too variable to be rated.					
Coastal dunes: CU. Too variable to be rated.					
Delfina: DE	Good	Good	Good	Good	Good
Galveston: GA	Fair	Fair	Fair	Fair	Fair
Grulla: GR	Poor	Poor	Fair	Fair	Fair
Harlingen:					
HA, HE Ratings are for Harlingen soils only in these mapping units. Urban land in HE is too variable to be rated.	Fair	Fair	Fair	Fair	Fair
HC	Poor	Poor	Poor	Poor	Poor
Hidalgo: HGA, HGB, HO, HU Ratings are for Hidalgo soils only in these mapping units. Urban land in HU is too variable to be rated.	Good	Good	Good	Good	Good
Laredo:					
LAA, LAB, LD, LEA, LEB, LG Ratings are for Laredo soils only in these mapping units. For the Olmito part of LD and the Reynosa part of LEA, LEB, see Olmito and Reynosa series. Urban land in LG is too variable to be rated.	Good	Good	Good	Good	Good
LC	Fair	Good	Fair	Good	Poor
Latina: LK	Very poor		Very poor		Very poor
Lomalta: LM, LO Ratings are for Lomalta soils only in these mapping units. Urban land in LO is too variable to be rated.	Very poor		Very poor		Very poor
Lozano: LR	Good	Good	Good	Good	Good
Lyford: LY	Good	Good	Good	Good	Good
Matamoros: MA, MC Ratings are for Matamoros soils only in these mapping units. For the Rio Grande part of MC, see the Rio Grande series.	Good	Good	Good	Good	Fair
Mercedes: MEA, MEB, MGC, MM Ratings are for Mercedes soils only in these mapping units. Urban land in MM is too variable to be rated.	Fair	Fair	Fair	Fair	Fair
Mustang:					
MS	Poor		Poor		Fair
MU	Very poor		Very poor		Very poor

of wildlife habitat and kinds of wildlife

Elements of wildlife habitat—Continued			Kinds of wildlife			
			Openland		Rangeland	Wetland
Shrubs and trees	Wetland food and cover plants	Shallow water developments	Dryland	Irrigated		
Very poor	Very poor	Very poor	Very poor		Very poor	Very poor.
Poor	Poor	Good	Poor	Fair	Poor	Fair.
Good	Fair	Fair	Good	Good	Good	Fair.
Fair	Poor	Fair	Good	Good	Fair	Poor.
Poor	Poor	Fair	Poor	Fair	Poor	Poor.
Poor	Poor	Good	Poor	Fair	Poor	Fair.
Good	Fair	Fair	Good	Good	Good	Fair.
Fair	Very poor	Very poor	Fair	Fair	Fair	Very poor.
Fair	Poor	Good	Fair	Fair	Fair	Fair.
Fair	Poor	Good	Fair	Fair	Fair	Fair.
Poor	Poor	Good	Poor	Poor	Poor	Fair.
Good	Fair	Fair	Good	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Good	Fair.
Poor	Fair	Fair	Fair	Fair	Poor	Fair.
Very poor	Fair	Fair	Very poor		Very poor	Fair.
Very poor	Poor	Good	Very poor		Very poor	Fair.
Good	Fair	Fair	Good	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Good	Fair.
Fair	Poor	Good	Good	Good	Fair	Fair.
Fair	Poor	Good	Fair	Fair	Fair	Fair.
Fair	Poor	Very poor	Poor		Fair	Very poor.
Very poor	Very poor	Very poor	Very poor		Very poor	Very poor.

TABLE 4.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat				
	Grain and seed crops		Grasses and legumes		Wild herbaceous upland plants
	Dryland	Irrigated	Dryland	Irrigated	
Olmito: OM, ON Ratings are for Olmito soils only in these mapping units. Urban land in ON is too variable to be rated.	Good	Good	Good	Good	Fair
Orelia variant: OR	Poor	Poor	Poor	Poor	Poor
Point Isabel: PO, PU Ratings are for Port Isabel soils only in these mapping units. Urban land in PU is too variable to be rated.	Poor		Poor		Poor
Racombes: RA, RDX Ratings are for Racombes soils only in these mapping units. Urban land in RDX is too variable to be rated.	Good	Good	Good	Good	Good
Raymondville: RE, RM Ratings are for Raymondville soils only in these mapping units. Urban land in RM is too variable to be rated.	Good	Good	Good	Good	Good
RG	Poor	Fair	Poor	Fair	Poor
Reynosa Mapped only in a complex with Laredo soils.	Good	Good	Good	Good	Good
Rio: RO	Good	Good	Good	Good	Fair
Rio Grande: RR, RT, RU, RZ Ratings are for Rio Grande soils only in these mapping units. For the Zalla part of RZ, see the Zalla series. Urban land in RU is too variable to be rated.	Good	Good	Good	Good	Good
Sejita: SE, SU Ratings are for Sejita soils only in these mapping units. Urban land in SU is too variable to be rated.	Very poor		Very poor		Very poor
Tiocano: TC	Very poor		Poor		Poor
Urban land. Mapped only in complexes with Benito, Harlingen, Hidalgo, Laredo, Lomalta, Mercedes, Olmito, Point Isabel, Raymondville, Rio Grande, and Sejita soils and in an undifferentiated unit with Racombes soils. Too variable to be rated.					
Ustifluvents, clayey: USX. Too variable to be rated.					
Willacy: WAA, WAB	Good	Good	Good	Good	Good
Willamar: WM	Poor	Fair	Poor	Fair	Poor
Zalla: ZA	Fair	Fair	Fair	Fair	Fair

Among properties of soils highly important in engineering are permeability, strength, compressibility, 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 sand or clay.
4. Plan farm drainage systems, irrigation systems, ponds, 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

of wildlife habitat and kinds of wildlife—Continued

Elements of wildlife habitat—Continued			Kinds of wildlife			
			Openland		Rangeland	Wetland
Shrubs and trees	Wetland food and cover plants	Shallow water developments	Dryland	Irrigated		
Fair	Poor	Good	Good	Good	Fair	Fair.
Poor	Fair	Fair	Poor	Poor	Poor	Fair.
Poor	Poor	Very poor	Poor	----------	Poor	Very poor.
Good	Fair	Fair	Good	Good	Good	Fair.
Fair	Good	Good	Good	Good	Fair	Good.
Poor	Good	Good	Poor	Fair	Poor	Good.
Good	Fair	Fair	Good	Good	Good	Fair.
Good	Good	Good	Good	Good	Fair	Good.
Good	Fair	Fair	Good	Good	Good	Fair.
Very poor	Good	Fair	Very poor	----------	Very poor	Fair.
Very poor	Poor	Good	Poor	----------	Very poor	Fair.
Good	Fair	Fair	Good	Good	Good	Fair.
Poor	Good	Good	Poor	Fair	Poor	Good.
Fair	Very poor	Very poor	Fair	Fair	Fair	Very poor.

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

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 table 5 and 6, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigation at sites selected for engineering works, especially works that involve heavy loads, or that require excavations to depths greater

TABLE 5.—*Estimated soil properties*

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

Soil series and map symbols	Flood hazard		Depth to seasonal high water table	Hydrologic soil group	Depth from surface [1]	USDA texture	Classification		Liquid limit
	Frequency	Duration					Unified	AASHO	
			Inches		*Inches*				*Percent*
Barrada: BA	Frequent	Long	8–36	D	0–52	Clay	CH	A–7–6	55–70
					52–63	Silty clay loam	CL	A–6, A–7–6	35–50
Benito: BE, BU	Frequent	Brief	60–120	D	0–8	Clay	CH	A–7–6	79–88
Properties of Urban land in BU are too variable to be rated.					8–54	Clay	CH	A–7–6	70–88
					54–63	Silty clay loam	CL	A–6, A–7–6	35–50
					63–84	Silt loam	CL	A–6	28–40
Camargo:									
CA	Infrequent	Brief	(2)	B	0–14	Silt loam	CL, CL-ML	A–4, A–6	20–35
					14–51	Silty clay loam	CL, ML	A–6, A–7	30–50
					51–63	Silt loam	CL, CL-ML	A–4, A–6	20–35
CC	Infrequent	Brief	(2)	B	0–11	Silty clay loam	CL	A–7	41–50
					11–63	Silty clay loam, silt loam.	CL	A–6, A–7	30–50
Cameron:									
CE	None	None	(3)	D	0–23	Silty clay	CH	A–7–6	51–70
					23–63	Silt loam	CL, CL-ML	A–4, A–6	20–40
CF	None	None	24–60	D	0–26	Silty clay	CH	A–7–6	51–70
					26–32	Silty clay loam	CL	A–7	41–50
					32–38	Silt loam	CL, CL-ML	A–4, A–6	20–40
					38–63	Very fine sandy loam.	ML, CL-ML	A–4	25
Chargo: CH	None	None	24–36	D	0–12	Silty clay	CH	A–7–6	51–70
					12–41	Silty clay	CH	A–7–6	51–70
					41–47	Silt loam	CL	A–4, A–6	25–40
					47–63	Silty clay	CH	A–7–6	51–70
Coastal beach: CO. Properties are too variable to be estimated.									
Coastal dunes: CU. Properties are too variable to be estimated.									

significant in engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring means less than. Dashes indicate that the properties were not estimated]

Plasticity index	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to—	
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*	*Mmhos per cm*			
30–45	100	100	100	95–100	<0.06	0.0–0.01	7.9–9.0	50–150	High	Very high	High.
15–25	100	100	100	70–90	<0.06	0.0–0.01	7.9–9.0	50–150	High	Very high	High.
45–60	100	100	100	95–100	<0.06	0.06–0.14	7.9–9.0	4–8	Very high	Very high	Low.
45–60	100	100	100	95–100	<0.06	0.01–0.10	7.9–9.0	7–20	Very high	Very high	Low.
15–25	100	100	100	70–90	0.20–0.63	0.01–0.11	7.9–9.0	7–20	Moderate	Very high	Low.
11–20	100	100	90–100	70–90	0.63–2.0	0.01–0.14	7.9–9.0	7–20	Low	Very high	Low.
4–16	100	100	100	70–95	0.63–2.0	0.16–0.24	7.9–8.4	0–2	Low	Moderate	Low.
11–28	100	100	100	90–100	0.63–2.0	0.18–0.22	7.9–8.4	0–2	Moderate	Moderate	Low.
4–16	100	100	100	70–95	0.63–2.0	0.16–0.24	7.9–8.4	0–2	Low	Moderate	Low.
20–28	100	100	100	95–100	0.63–2.0	0.18–0.22	7.9–8.4	0–2	Moderate	Moderate	Low.
16–28	100	100	100	90–100	0.63–2.0	0.18–0.24	7.9–8.4	0–2	Moderate	Moderate	Low.
25–45	100	100	100	95–100	0.20–0.63	0.11–0.18	7.9–8.4	0–4	Very high	Very high	Low.
4–20	100	100	100	70–95	2.0–6.3	0.08–0.18	7.9–8.4	2–8	Low	Very high	Low.
25–45	100	100	100	95–100	0.20–0.63	0.01–0.15	7.9–8.4	4–30	Very high	Very high	Moderate.
20–28	100	100	100	90–100	0.63–2.0	0.01–0.18	7.9–8.4	4–30	Moderate	Very high	Moderate.
4–20	100	100	100	70–95	2.0–6.3	0.01–0.18	7.9–8.4	4–30	Low	Very high	Moderate.
2–7	100	100	90–100	60–80	2.0–6.3	0.01–0.14	7.9–8.4	4–30	Low	Very high	Moderate.
30–45	100	100	100	90–100	0.06–0.20	0.07–0.18	7.9–8.4	3–10	Very high	Very high	Low.
30–45	100	100	100	90–100	0.06–0.20	0.01–0.11	7.9–8.4	6–30	Very high	Very high	Low.
8–20	100	100	100	70–85	2.0–6.3	0.01–0.16	7.9–8.4	6–30	Low	Very high	Low.
30–45	100	100	100	90–100	0.06–0.20	0.01–0.11	7.9–8.4	6–30	Very high	Very high	Low.
4–10	100	100	95–100	25–50	2.0–6.3	0.10–0.15	6.6–7.8	0–2	Low	Low	Low.
15–23	100	100	95–100	40–55	0.20–0.63	0.09–0.17	6.6–7.8	0–4	Moderate	High	Low.
11–20	100	95–100	80–90	36–50	0.63–2.0	0.06–0.17	7.9–8.4	1–8	Moderate	High	Low.
[4] NP	100	95–100	65–80	5–10	6.3–20	0.05–0.08	7.4–8.4	0–2	Low	High	Low.
30–45	100	100	100	97–100	< 0.06	0.12–0.18	7.9–8.4	0–2	Very high	Very high	Low.
45–60	100	100	100	95–100	< 0.06	0.08–0.18	7.9–8.4	2–6	Very high	High	Low.
45–60	100	100	100	95–100	< 0.06	0.03–0.18	7.9–8.4	3–12	Very high	High	Low.
45–60	100	100	100	95–100	< 0.06	0.01–0.11	7.9–8.4	6–30	Very high	High	Low.
45–60	100	100	100	95–100	< 0.06	0.01–0.11	7.9–9.0	6–30	Very high	High	Moderate.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Flood hazard		Depth to seasonal high water table	Hydrologic soil group	Depth from surface [1]	USDA texture	Classification		Liquid limit
	Frequency	Duration					Unified	AASHO	
			Inches		*Inches*				*Percent*
Hidalgo:									
HGA, HGB	None	None	(3)	B	0–15	Fine sandy loam	SM, SM-SC	A–4, A–6, A–2–4, A–2–6	20–30
					15–39	Sandy clay loam	CL, SC	A–6	30–40
					39–60	Sandy clay loam	CL	A–6	30–40
HO, HU	None	None	(3)	B	0–12	Sandy clay loam	CL, SC	A–6	30–40
					12–37	Sandy clay loam	CL, SC	A–6	30–40
					37–63	Sandy clay loam	CL	A–6	30–40
Properties of Urban land in HU are too variable to be estimated.									
*Laredo:									
LAA, LAB, LD, LEA, LEB, LG. For Olmito part of LD and the Reynosa part of LEA and LEB, see the Olmito and Reynosa series. Properties of Urban land in LG are too variable to be estimated.	None	None	(3)	B	0–8	Silty clay loam	CL	A–6, A–7–6	30–45
					8–72	Silty clay loam, silt loam.	CL	A–6	30–40
LC	None	None	36–72	B	0–12	Silty clay loam	CL	A–6	30–40
					12–43	Silt loam	CL	A–6	30–40
					43–60	Silty clay loam	CL	A–6	30–40
					60–80	Silt loam	CL	A–6	30–40
Latina: LK	Infrequent	Brief	12–36	D	0–4	Sandy clay loam	CL	A–6	30–40
					4–63	Sandy clay loam	CL	A–6, A–7	35–45
Lomalta: LM, LO	Frequent	Brief	48–120	D	0–53	Clay	CH	A–7–6	70–85
					53–57	Silty clay loam	CH, CL	A–7	41–55
					57–72	Silt loam	CL	A–6	30–40
Properties of Urban land in LO are too variable to be estimated.									
Lozano: LR	None	None	36–72	B	0–11	Fine sandy loam	SC, SM-SC	A–4	20–30
					11–35	Sandy clay loam	CL	A–6, A–7	35–45
					35–63	Sandy clay loam	CL	A–6, A–7	35–45
Lyford: LY	None	None	36–72	C	0–11	Sandy clay loam	CL	A–6	30–40
					11–25	Sandy clay loam	CL	A–6, A–7	35–45
					25–63	Sandy clay loam	CL	A–6, A–7	35–45
*Matamoros: MA, MC	Infrequent	Brief	(2)	C	0–50	Silty clay	CH	A–7–6	51–65
For the Rio Grande part of MC, see the Rio Grande series.									

See footnotes at end of table.

significant in engineering—Continued

Plasticity index	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to—	
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*	*Mmhos per cm*			
5–15	100	100	100	30–50	0.63–2.0	0.10–0.15	7.9–8.4	0–2	Low	High	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Flood hazard		Depth to seasonal high water table	Hydrologic soil group	Depth from surface [1]	USDA texture	Classification		Liquid limit
	Frequency	Duration					Unified	AASHO	
			Inches		*Inches*				*Percent*
Mercedes:									
MEA, MEB, MM—Properties of Urban land in MM are too variable to be rated.	None	None	60–120	D	0–18	Clay	CH	A–7–6	60–80
					18–47	Clay	CH	A–7–6	60–80
					47–74	Clay	CH	A–7–6	60–80
MGC	None	None	(2)	D	0–19	Clay	CH	A–7–6	60–80
					19–31	Clay	CH	A–7–6	60–80
					31–60	Clay	CH	A–7–6	60–80
					60–72	Silt loam, very fine sandy loam.	CL, CL-ML	A–4, A–6	20–35
Mustang:									
MS	Very frequent.	Very brief	6–40	A	0–50	Fine sand	SP-SM	A–3	
MU	Very frequent.	Very brief	6–24	A	0–36	Fine sand	SP-SM	A–3	
Olmito: OM, ON—Properties of Urban land in ON are too variable to be estimated.	None	None	(3)	D	0–23	Silty clay	CH	A–7–6	51–70
					23–34	Silty clay	CH	A–7–6	51–70
					34–63	Silty clay	CH	A–7–6	51–70
Orelia variant: OR	Frequent	Brief	12–48	D	0–8	Clay loam	CL	A–6, A–7–6	35–45
					8–48	Sandy clay	CH, CL	A–7–6	41–55
					48–63	Sandy clay loam	CL	A–6, A–7–6	30–45
Point Isabel: PO, PU—Properties of Urban land in PU are too variable to be estimated.	None	None	(2)	C	0–8	Clay loam	CL	A–7–6	41–50
					8–19	Clay	CH	A–7–6	51–70
					19–22	Clay loam	CL	A–7–6	41–50
					22–65	Clay	CH	A–7–6	51–70
Racombes: RA, RDX—Properties of Urban land in RDX are too variable to be estimated.	Frequent	Very brief	(3)	B	0–13	Sandy clay loam	CL, SC	A–6	27–35
					13–74	Sandy clay loom	CL, SC	A–6, A–7–6	30–45
Raymondville:									
RE, RM—Properties of Urban land in RM are too variable to be estimated.	None	None	(3)	D	0–14	Clay loam	CL	A–6, A–7–6	37–50
					14–25	Clay loam	CL	A–6, A–7–6	37–50
					25–78	Clay	CL	A–6, A–7–6	37–50
RG	None	None	36–72	D	0–15	Clay loam	CL	A–6, A–7–6	37–50
					15–63	Clay	CL	A–6, A–7–6	37–50
Reynosa—Mapped only in a complex with Laredo soils.	None	None	(3)	B	0–37	Silt loam	CL	A–6	30–40
					37–55	Silty clay loam, silt loam.	CL	A–6	30–40
					55–71	Very fine sandy loam.	CL-ML, ML	A–4, A–6	20–35
Rio: RO	Frequent	Brief	36–72	D	0–10	Clay loam	CL	A–6, A–7–6	35–45
					10–37	Clay	CH, CL	A–7–6	41–55
					37–63	Clay loam, sandy clay loam.	CL	A–6, A–7–6	35–50

See footnotes at end of table.

significant in engineering—Continued

Plasticity index	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to—	
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*	*Mmhos per cm*			
35-50	100	100	90-100	75-90	< 0.06	0.09-0.18	7.9-8.4	0-4	Very high	Very high	Low.
35-50	100	100	90-100	75-90	< 0.06	0.06-0.18	7.9-8.4	1-8	Very high	Very high	Low.
35-50	100	100	90-100	75-90	< 0.06	0.03-0.15	7.9-8.4	3-12	Very high	Very high	Low.
35-50	100	100	90-100	75-90	< 0.06	0.09-0.18	7.9-8.4	0-4	Very high	Very high	Low.
35-50	100	100	90-100	75-90	< 0.06	0.06-0.18	7.9-8.4	1-8	Very high	Very high	Low.
35-50	100	100	90-100	75-90	< 0.06	0.03-0.15	7.9-8.4	3-12	Very high	Very high	Low.
4-16	100	100	95-100	70-95	0.63-2.0	0.03-0.15	7.9-8.4	3-12	Low	Very high	Low.
NP	100	95-100	65-80	5-10	6.3-20	0.01-0.05	6.6-8.4	0-2	Very low	High	Moderate.
NP	100	95-100	65-80	5-10	6.3-20	0.00-0.01	7.4-8.4	60-200	Very low	Very high	High.
30-45	100	100	100	90-100	0.06-0.20	0.10-0.18	7.9-8.4	0-4	Very high	Very high	Low.
30-45	100	100	100	90-100	0.06-0.20	0.10-0.18	7.9-8.4	0-4	Very high	Very high	Low.
30-45	100	100	100	90-100	0.06-0.20	0.10-0.18	7.9-8.4	2-16	Very high	Very high	Low.
15-25	100	100	95-100	70-80	0.20-0.63	0.01-0.15	6.6-7.8	4-30	Moderate	High	Moderate.
20-37	100	100	90-100	75-95	0.06-0.20	0.01-0.09	6.6-8.4	8-30	Moderate	High	Moderate.
15-25	100	100	85-95	55-80	0.20-0.63	0.01-0.09	7.9-8.4	8-30	Moderate	High	Moderate.
20-30	100	100	100	80-90	0.20-0.63	0.03-0.16	7.9-8.4	2-14	Moderate	Very high	Moderate.
30-45	100	100	100	85-95	0.06-0.20	0.03-0.16	7.9-8.4	2-14	High	Very high	Moderate.
20-30	100	100	100	80-90	0.06-0.20	0.01-0.12	7.9-8.4	4-20	Moderate	Very high	Moderate.
30-45	100	100	100	85-95	0.06-0.20	0.01-0.09	7.9-8.4	8-30	High	Very high	Moderate.
12-24	100	100	95-100	45-65	0.63-2.0	0.15-0.20	6.6-7.8	0-2	Low	High	Low.
15-30	98-100	97-100	95-100	45-75	0.63-2.0	0.12-0.20	6.6-8.4	1-4	Low	High	Low.
22-35	100	100	100	80-90	0.20-0.63	0.11-0.18	7.9-8.4	0-4	Very high	Very high	Low.
22-35	100	100	100	80-90	0.06-0.20	0.11-0.18	7.9-8.4	1-4	Very high	Very high	Low.
22-35	100	100	95-100	80-90	0.06-0.20	0.06-0.18	7.9-8.4	2-10	Very high	Very high	Low.
22-35	100	100	100	80-90	0.06-0.20	0.01-0.15	7.9-8.4	4-30	Very high	Very high	Moderate.
22-35	100	100	95-100	80-90	0.06-0.20	0.01-0.10	7.9-8.4	8-30	Very high	Very high	Moderate.
11-20	100	100	95-100	80-95	0.63-2.0	0.16-0.24	7.9-8.4	0-2	Low	High	Low.
11-20	100	100	95-100	85-95	0.63-2.0	0.09-0.24	7.9-8.4	1-8	Moderate	High	Low.
2-12	100	100	95-100	70-95	0.63-2.0	0.06-0.20	7.9-8.4	1-8	Very low	High	Low.
15-22	100	100	95-100	70-80	0.63-2.0	0.11-0.20	6.6-7.8	0-4	Moderate	High	Low.
20-30	100	100	90-100	75-95	0.06-0.20	0.09-0.18	7.4-8.4	1-4	Moderate	High	Low.
15-27	100	100	85-95	55-80	0.20-0.63	0.05-0.18	7.9-8.4	1-12	Moderate	High	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Flood hazard		Depth to seasonal high water table	Hydrologic soil group	Depth from surface [1]	USDA texture	Classification		Liquid limit
	Frequency	Duration					Unified	AASHO	
			Inches		*Inches*				*Percent*
*Rio Grande:									
RR, RU, RZ	Infrequent	Brief	(2)	B	0–9	Silt loam	CL, CL-ML	A–4, A–6	20–35
					9–63	Silt loam, very fine sandy loam.	CL, CL-ML	A–4, A–6	20–35
For the Zalla part of RZ, see the Zalla series. Properties of Urban land in RU are too variable to be estimated.									
RT	Infrequent	Brief	(2)	B	0–17	Silty clay loam	CL	A–6, A–7	35–50
					17–63	Silt loam, very fine sandy loam.	CL, CL-ML	A–4, A–6	20–35
Sejita: SE, SU	Frequent	Brief	20–48	D	0–40	Silty clay loam	CL	A–6	30–40
Properties of Urban land in SU are too variable to be estimated.									
Tiocano: TC	Frequent	Long	(2)	D	0–74	Clay	CH	A–7–6	55–75
Urban land. Mapped only in complexes with Benito, Harlingen, Hidalgo, Laredo, Lomalta, Mercedes, Olmito, Point Isabel, Raymondville, Rio Grande, and Sejita soils and in an undifferentiated unit with Racombes soils. Properties are too variable to be estimated.									
Ustifluvents, clayey:	Infrequent	Extremely	(2)	D	0–60	Clay, clay loam	CH, CL	A–6, A–7	30–70

significant in engineering—Continued

Plasticity index	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to—	
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*	*Mmhos per cm*			
4–16	100	100	95–100	70–95	0.63–2.0	0.16–0.24	7.9–8.4	0–2	Low	Moderate	Low.
4–16	100	100	95–100	70–95	0.63–2.0	0.12–0.24	7.9–8.4	0–4	Low	Moderate	Low.
15–30	100	100	100	80–95	0.63–2.0	0.18–0.22	7.9–8.4	0–2	Moderate	Moderate	Low.
4–16	100	100	95–100	70–95	0.63–2.0	0.12–0.24	7.9–8.4	0–4	Low	Moderate	Low.
11–18	100	100	100	85–100	0.20–0.63	0.00–0.01	7.4–9.0	35–70	Low	Very high	Moderate.
35–50	100	100	100	95–100	<0.06	0.09–0.18	6.6–8.4	0–4	Very high	Very high	Low.
11–45	95–100	90–100	85–100	80–90	<0.06	0.00–0.01	7.9–9.0	30–200	High	Very high	High.
5–10	100	100	95–100	30–45	2.0–6.3	0.14–0.18	6.6–7.8	0–2	Low	Moderate	Low.
8–16	98–100	97–100	95–100	36–55	0.63–2.0	0.10–0.18	7.4–8.4	0–4	Low	Moderate	Low.
1–7	100	100	100	36–70	0.63–2.0	0.10–0.18	6.6–8.4	0–4	Low	Very high	Moderate.
11–20	100	100	100	51–70	<0.06	0.01–0.09	7.4–9.0	8–30	Moderate	Very high	Moderate.
11–20	100	100	100	51–70	0.06–0.20	0.00–0.04	7.9–9.0	15–40	Moderate	Very high	Moderate.
NP	100	100	70–85	10–25	6.3–20.0	0.05–0.10	7.9–8.4	0–2	Very low	Very low	Low.

[3] In some irrigated fields, the water table may be at depths of 36 to 120 inches.
[4] NP means nonplastic.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. series as indicated in the first column of this table. Soil characteristics in this table are expressed in computer- page 92, for definition of "percs slowly" and

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields [1]	Sewage lagoons	Shallow excavations [1]	Dwellings	Sanitary landfill [1, 2] (trench)	Local roads and streets
Barrada: BA	Severe: floods; percs slowly; wet.	Severe: floods; wet.	Severe: floods; too clayey; wet.	Severe: floods; shrink-swell; wet.	Severe: floods; too clayey; wet.	Severe: floods; low strength; shrink-swell; wet.
Benito: BE, BU. Properties of Urban land in BU are too variable for interpretations to be made.	Severe: percs slowly; wet.	Slight	Severe: floods; too clayey; wet.	Severe: floods; shrink-swell; wet.	Severe: floods; too clayey; wet.	Severe: low strength; shrink-swell; wet.
Camargo: CA, CC	Moderate: floods.	Moderate: seepage.	Severe: floods	Severe: floods	Severe: floods	Moderate: floods; low strength; shrink-swell.
Cameron:						
CE	Slight	Severe: seepage.	Moderate: wet.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
CF	Moderate: wet.	Severe: seepage.	Severe: wet	Severe: shrink-swell.	Severe: too clayey; wet.	Severe: low strength; shrink-swell.
Chargo: CH	Severe: percs slowly.	Moderate: wet.	Severe: too clayey; wet.	Severe: shrink-swell.	Severe: too clayey; wet.	Severe: low strength; shrink-swell.
Coastal beach: CO. Properties are too variable for interpretations to be made.						
Coastal dunes: CU. Properties are too variable for interpretations to be made.						
Delfina: DE	Severe: percs slowly.	Slight	Slight	Moderate: shrink-swell.	Slight	Moderate: low strength; shrink-swell.
Galveston: GA	Severe: floods	Severe: seepage.	Severe: too sandy.	Severe: floods	Severe: floods; too sandy.	Moderate: floods.
Grulla: GR	Severe: floods; percs slowly.	Severe: floods	Severe: floods; too clayey; wet.	Severe: floods; shrink-swell; wet.	Severe: floods; too clayey; wet.	Severe: low strength; shrink-swell; wet.
Harlingen:						
HA, HE. Properties of Urban land in HE are too variable for interpretations to be made.	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
HC	Severe: shrink-swell.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.

See footnotes at end of table.

properties of the soils

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other adapted terms that differ from those in the Soil Survey Manual. Refer to "Computer-Adapted Terms," other terms that describe soil characteristics]

Degree and kind of limitation for—Continued			Suitability as a source of—		Soil features affecting—	
Light industry	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Drainage of crops and pasture	Irrigation
Severe: floods; shrink-swell; wet.	Severe: floods	Moderate: compressible; low strength; unstable fill.	Poor: low strength; shrink-swell; wet.	Poor: excess salt; too clayey; wet.	Excess salt; floods; percs slowly.	Excess salt; floods; wet.
Severe: floods; shrink-swell; wet.	Moderate: seepage.	Moderate: compressible; low strength; unstable fill.	Poor: low strength; shrink-swell; wet.	Poor: excess salt; too clayey; wet.	Floods: percs slowly; wet.	Excess salt; floods; slow intake; wet.
Severe: floods	Severe: seepage	Moderate: compressible; piping.	Fair: low strength; shrink-swell.	Fair: excess lime; too clayey.	All features favorable.	All features favorable.
Severe: shrink-swell.	Severe: seepage	Moderate: compressible; piping.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly	Slow intake.
Severe: shrink-swell.	Severe: seepage	Moderate: compressible; piping.	Poor: low strength; shrink-swell.	Poor: excess salt; too clayey.	Percs slowly	Excess salt; slow intake
Severe: shrink-swell.	Moderate: seepage.	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: excess salt; too clayey.	Percs slowly	Excess salt; slow intake.
Moderate: shrink-swell.	Moderate: seepage.	Slight	Fair: low strength; shrink-swell.	Fair: thin layer.	All features favorable.	Seasonal High water table.
Severe: floods	Severe: seepage	Severe: seepage; piping; unstable fill.	Good	Poor: too sandy.	Cutbanks cave	Droughty; erodes easily; rapid intake.
Severe: floods; shrink-swell; wet.	Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly; wet.	Slow intake; wet.
Severe: shrink-swell.	Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly	Slow intake.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields [1]	Sewage lagoons	Shallow excavations [1]	Dwellings	Sanitary landfill [1, 2] (trench)	Local roads and streets
Hidalgo: HGA, HGB	Slight	Moderate: seepage.	Slight	Moderate: shrink-swell.	Slight	Moderate: low strength; shrink-swell.

properties of the soils—Continued

Degree and kind of limitation for—Continued			Suitability as a source of—		Soil features affecting—	
Light industry	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Drainage of crops and pasture	Irrigation
Moderate: shrink-swell.	Moderate: seepage.	Moderate: compressible.	Fair: low strength; shrink-swell.	Good	All features favorable.	All features favorable.
Moderate: shrink-swell.	Moderate: seepage.	Moderate: compressible.	Fair: low strength; shrink-swell.	Fair: too clayey.	All features favorable.	All features favorable.
Moderate: shrink-swell.	Severe: seepage	Moderate: compressible.	Fair: low strength; shrink-swell.	Fair: too clayey.	All features favorable.	All features favorable.
Moderate: shrink-swell; wet.	Severe: seepage	Moderate: compressible.	Fair: low strength; shrink-swell.	Poor: excess salt.	All features favorable.	Excess salt.
Severe: floods; wet.	Slight	Moderate: compressible; piping.	Fair: low strength; wet.	Poor: excess salt; too clayey.	Excess salt; floods.	Excess salt; wet.
Severe: floods; shrink-swell; wet.	Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell; wet.	Poor: excess salt; too clayey; wet.	Excess salt; floods.	Excess salt; floods; slow intake; wet.
Moderate: shrink-swell.	Moderate: seepage.	Moderate: compressible.	Fair: low strength; shrink-swell.	Fair: thin layer.	All features favorable.	Seasonal high water table.
Severe: shrink-swell.	Moderate: seepage.	Moderate: compressible.	Fair: low strength; shrink-swell.	Fair: too clayey.	All features favorable.	Seasonal high water table.
Severe: floods; shrink-swell.	Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly	Slow intake.
Severe: shrink-swell.	Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly	Slow intake.
Severe: shrink-swell.	Slight	Moderate: compressible; unstable fill.	Poor: low strength: shrink-swell.	Poor: too clayey.	Percs slowly	Slope: slow intake.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields [1]	Sewage lagoons	Shallow excavations [1]	Dwellings	Sanitary landfill [1, 2] (trench)	Local roads and streets
Mustang: MS	Severe: floods;	Severe: floods;	Severe: floods;	Severe: floods;		

properties of the soils—Continued

Degree and kind of limitation for—Continued			Suitability as a source of—		Soil features affecting—	
Light industry	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Drainage of crops and pasture	Irrigation
Severe: floods; wet.	Severe: seepage	Severe: seepage; piping; unstable fill.	Poor: wet	Poor: too sandy; wet.	Cutbanks cave: floods; wet.	Rapid intake; wet.
Severe: floods; wet.	Severe: seepage	Severe: seepage; piping; unstable fill.	Poor: wet	Poor: excess salt; too sandy; wet.	Wet areas lower than available outlets.	Excess salt; rapid intake; wet.
Severe: shrink-swell.	Moderate: seepage.	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly	Slow intake.
Severe: floods; shrink-swell; wet.	Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink swell.	Poor: excess salt.	Slowly permeable.	Excess salt; slow intake.
Severe: shrink-swell; slope.	Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: excess salt; too clayey.	Percs slowly; slope.	Excess salt; slope; slow intake.
Severe: floods	Moderate: seepage.	Slight	Fair: low strength.	Fair: too clayey.	All features favorable.	All features favorable.
Severe: shrink-swell.	Slight	Moderate: compressible.	Poor: shrink-swell.	Fair: too clayey.	Percs slowly	Slow intake.
Severe: shrink-swell.	Slight	Moderate: compressible.	Poor: shrink-swell.	Poor: excess salt.	Percs slowly	Excess salt; slow intake.
Moderate: shrink-swell.	Moderate: seepage.	Moderate: compressible.	Fair: low strength; shrink-swell.	Good	All features favorable.	All features favorable.
Severe: floods; wet.	Slight	Moderate: compressible.	Fair: low strength; shrink-swell; wet.	Fair: too clayey.	All features favorable.	Slow intake.
Severe: floods	Severe: seepage	Moderate: compressible; unstable fill.	Fair: low strength.	Good	All features favorable.	All features favorable.
Severe: floods	Severe: seepage	Moderate: compressible; unstable fill.	Fair: low strength.	Fair: too clayey.	All features favorable.	All features favorable.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields [1]	Sewage lagoons	Shallow excavations [1]	Dwellings	Sanitary landfill [1, 2] (trench)	Local roads and streets
Sejita: SE, SU----------	Severe: floods;	Severe: floods;	Severe: floods;	Severe: floods;	Severe: floods;	Severe: floods;

properties of the soils—Continued

Degree and kind of limitation for—Continued			Suitability as a source of—		Soil features affecting—	
Light industry	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Drainage of crops and pasture	Irrigation
Severe: floods	Slight	Moderate: com	Poor: wet	Poor: excess	Excess salt:	Excess salt:

TABLE 7.—*Engineering*

[Tests performed by the Texas

Soil name and location	Parent material	Report No.	Depth	Shrinkage limit	Linear shrinkage
			Inches	*Percent*	*Percent*
Harlingen clay:					
1120 feet east and 40 feet north of NW. corner, Block 155, San Benito Land and Water Company Subdivision; 4 miles southwest of San Benito. (Modal).	Calcareous alluvial sediments.	95–R	23–35	13	21.9
Laredo silty clay loam:					
0.9 mile south of Rangerville school on Farm Road 1479 and 200 feet west in a cultivated field; 8.0 miles southwest of Harlingen.	Calcareous alluvial sediments.	88–R 89–R	8–18 18–46	16 18	11.2 8.0
Lomalta clay:					
1.6 miles south on Farm Road 1847 from its intersection with	Calcareous saline	74–R	13–29	13	21.9

Highway Department except as noted]

	Mechanical analysis [1]				Classification [2]
Shrinkage	Percentage passing sieve—	Percentage smaller than	Liquid limit	Plasticity index	

"silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey. There are no gravelly or stony soils in Cameron County.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a semisolid. If the moisture content is further increased, the material changes from a semisolid to a plastic and finally to a liquid. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic, and the liquid limit, from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. 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 the soil characteristics observed in the field

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

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 in others nearby or adjoining, and on the experience that engineers and soil scientists have with the soils of Cameron County. In table 6, ratings are used to summarize limitations or suitability of the soils for all listed purposes other than for drainage of crops and pasture and irrigation. For these particular uses, table 6 lists those soil features not be overlooked in planning, installation, and maintenance.

Following are explanations of most of the columns in table 6.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent

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.

Ratings for light industry are for the undisturbed soils that are used to support building foundations. Emphasis is on foundations, ease of excavation for underground utilities, and corrosion potential of uncoated steel pipe. The undisturbed soil is rated for spread footing foundations for buildings less than three stories high or foundation loads not in excess of that weight.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage.

Pond embankments are raised structures of soil material constructed across drainageways in order to impound water. These embankments are generally less than 20 feet high, are constructed of "homogeneous" soil material, and compacted to medium density. Embankments having core and shell type construction are not rated in this table. Embankment foundation, reservoir area, and slope are assumed to be suitable for pond construction. Soil properties are considered that affect the embankment and the availability of borrow material.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and (2) the relative ease of excavating the material at borrow areas.

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

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

Engineering test data

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

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 of 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 the 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.

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

Use of the Soils for Recreational Development

Many areas of Cameron County have a medium potential to high potential for the development of various types of recreation enterprises. The county has many scenic, natural, and historical areas that are of special interest to the outdoor recreationist. The county contains about 30 miles of coastal beaches along the Gulf of Mexico. Abundant and unique fishing is available in the warm waters of the Gulf of Mexico and Laguna Madre. Cameron County is a winter resort area and a major gateway to Mexico. The mild winters provide for year-round outdoor activities.

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 8 the soils of Cameron County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

In table 8 of the soil limitations for the specified uses are expressed as slight, moderate, or severe. It is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means

TABLE 8.—*Limitations of the soils for recreational development*

[Soil characteristics in this table are expressed in computer-adapted terms that differ from those in the Soil Survey Manual. Refer to "Computer-adapted terms," page 92, for the definition of "percs slowly" and other terms that describe soil characteristics]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Barrada: BA	Severe: floods; percs slowly; wet.	Severe: floods; too clayey; wet.	Severe: floods; percs slowly; wet.	Severe: floods; too clayey; wet.
Benito: BE, BU. Ratings are for Benito soils only in these mapping units. Urban land in BU is too variable to be rated.	Severe: percs slowly; wet.	Severe: too clayey; wet.	Severe: percs slowly; too clayey; wet.	Severe: too clayey; wet.
Camargo:				
CA	Slight	Slight	Slight	Slight.
CC	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.
Cameron: CE, CF	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Chargo: CH	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Coastal beach: CO. Too variable to be rated.				
Coastal dunes: CU. Too variable to be rated.				
Delfina: DE	Slight	Slight	Slight	Slight.
Galveston: GA	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 8.—*Limitations of the soils for recreational development—Continued*

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Latina: LK	Severe: wet	Moderate: too clayey; wet.	Severe: wet	Moderate: too clayey; wet.
Lomalta: LM, LO. Ratings are for Lomalta soils only in these mapping units. Urban land part of LO is too variable to be rated.	Severe: percs slowly; too clayey; wet.	Severe: too clayey; wet.	Severe: percs slowly; too clayey; wet.	Severe: too clayey; wet.
Lozano: LR	Moderate: percs slowly	Slight	Moderate: percs slowly	Slight.
Lyford: LY	Moderate: too clayey; wet.	Moderate: too clayey; wet.	Moderate: too clayey; wet.	Moderate: too clayey.
Matamoros: MA, MC. Ratings are for Matamoros soils only in these mapping units. For the Rio Grande part of MC, see the Rio Grande series.	Severe: floods; too clayey.	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Mercedes: MEA, MEB, MGC, MM. Ratings are for Mercedes soils only in these mapping units. Urban land in MM is too variable to be rated.	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: percs slowly; too clayey.	Severe: too clayey.
Mustang: MS, MU	Severe: too sandy; wet	Severe: too sandy; wet	Severe: too sandy; wet	Severe: too sandy; wet.
Olmito: OM, ON. Ratings are for Olmito soils only in these units. Urban land in ON is too variable to be rated.	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Orelia variant: OR	Severe: wet	Moderate: too clayey	Severe: wet	Moderate: too clayey.
Point Isabel: PO, PU. Ratings are for Point Isabel soils only in these mapping units. Urban land in PU is too variable to be rated	Moderate: too clayey	Moderate: too clayey	Severe: slope	Moderate: too clayey.

TABLE 8.—*Limitations of the soils for recreational development—Continued*

Rio: RO	Severe: wet	Moderate: too clayey; wet.	Moderate: percs slowly; too clayey; wet.	Moderate: too clayey; wet.
Rio Grande: RR, RU, RZ. Ratings are for Rio Grande soils only in these mapping units. For the Zalla part of RZ, see the Zalla series. Urban land in RU is too variable to be rated.	Severe: floods	Slight	Moderate: floods	Slight.
RT	Severe: floods	Moderate: too clayey	Moderate: floods; too clayey.	Moderate: too clayey.
Sejita: SE, SU. Ratings are for Sejita soils only in these mapping units. Urban land part of SU is too variable to be rated.	Severe: wet	Severe: wet	Severe: wet	Severe: wet.
Tiocano: TC	Severe: percs slowly; too clayey; wet.	Severe: too clayey; wet.	Severe: percs slowly; too clayey; wet.	Severe: too clayey; wet.
Urban land. Mapped only in complexes with Benito, Harlingen, Hidalgo, Laredo, Lomalta, Mercedes, Olmito, Point Isabel, Raymondville, Rio Grande, and Sejita soils and in an undifferentiated unit with Racombes soils. Too variable to be rated.				
Ustifluvents, clayey: USX	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Willacy: WAA, WAB	Slight	Slight	Slight	Slight.
Willamar: WM	Severe: percs slowly	Moderate: wet	Severe: percs slowly	Moderate: wet.
Zalla: ZA	Severe: floods	Moderate: floods; too sandy.	Moderate: floods; too sandy.	Moderate: too sandy.

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, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

[redacted]

greatly increase cost of leveling sites or of building access roads.

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, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

[redacted]

Formation and Classification of the Soils

This section explains how soils form and discusses the factors that affected the formation of soils in Cameron County. It describes briefly the current system of soil classification and classifies the soil series represented in the county by higher categories.

Factors of Soil Formation

Soil is the product of the interaction of the five major factors of soil formation. These factors are climate, living organisms (especially vegetation), parent material, relief, and time. The kind of soil that forms in one area differs from the kind of soil in another area if there has been a difference between the two areas in one or more of the major factors.

Climate

Rainfall, temperature, humidity, and wind have been important in the formation of soils in Cameron County. The wet climate of past geologic ages influenced the deposition of parent materials. Later, rainfall was limited as it is today, and it seldom wets the soil below the root zone. As a result, horizons of calcium carbonate formed in many of the soils. Most of the soils have lime throughout the profile because not enough rainwater has moved downward to leach out the lime.

Wind has definitely affected the formation of soils in this county. The soil materials that made up the offshore barrier islands—Padre and Boca Chica—were deposited by waves and currents and later reworked by wind into complex dunes. Soil blowing from intermittently dry depressions along the Gulf Coast resulted in the formation of clay dunes occupied by soils of the Point Isabel series. The poorly defined, northwest-tending grain of the topography north of the Arroyo Colorado indicates that eolian activity has affected the formation of the soils.

[redacted]

has changed the moisture supply by irrigation and, in some places, drainage.

Parent material

The soils of Cameron County formed in geologic materials of Pleistocene age or younger. Most of the soils formed in fluviatile deposits. The older deposits in the northern part of the county have probably been reworked by wind. The geology of the parent material is discussed in more detail in the section, "Surface Geology."

Relief

Cameron County is on a nearly level coastal plain where slopes generally are less than 1 percent. The fluviatile deposition of the parent materials determined relief in the county.

Relief has influenced soil formation in this County through its effect on drainage and runoff. The degree of development of a soil profile depends on the amount of water that enters a soil provided other factors of soil formation are equal. For example, Willacy soils, which are higher and better drained, absorb less moisture and have less well-developed profiles than Racombes soils, which are in weakly concave depressions that receive extra water.

Time

The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have been active. A long time is generally required for the formation of well-defined, genetically related horizons. Geologically, the soils of Cameron County are very young. There are differences in the age of these soils, however, that can be noted from the appearance of the profile. For example, in the soils of the Rio Grande, Zalla, Camargo, Matamoros, and Grulla series on the active flood plain, recent sediments were stratified as they were laid down in each successive flooding. Soils of the Delfina, Racombes, and Willacy series, which formed in sediment of Pleistocene age, have been in place long enough to develop

[redacted]

FAMILY.—Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used to differentiate families. An example is the fine-silty, mixed (calcareous) hyperthermic family of Typic Ustifluvents.

Additional Facts About the County

The first settlers in what is now Cameron County were mainly wealthy Spanish cattle owners who controlled large Spanish land grants. Cameron County, formed from part of Nueces County, was organized in 1848. Later, parts of it were used to form two other counties: Hidalgo County in 1852 and Willacy County in 1912. In 1846, Fort Brown was built, and shortly afterward the town of Brownsville was established. The first courthouse was erected in Brownsville in 1886.

Irrigation was begun about 1876, and the first irrigation systems were established about 1905. These systems were built by large land and irrigation companies that also cleared the land, divided it, and sold it to new settlers. By 1914, most of these companies were bankrupt. The irrigated acreage was [illegible]

stock numbered 28,422 cattle and calves, 2,040 hogs and pigs, 203 sheep and lambs, and 68,969 chickens.

The population of Cameron County was 14,959 in 1880, and it more than doubled in the next 40 years. According to the census, it was 151,098 in 1960, and according to the preliminary census, it had declined slightly to 137,506 in 1970. Approximately 90 percent of the population is urban, and of this, almost 80 percent is in Brownsville, Harlingen, and San Benito.

Among the major transportation facilities in Cameron County are three U.S. highways, two major railroads, three ocean ports, and two major airports. There is also an extensive network of state highways and farm roads within the county. Several county roads are paved. Two international bridges at Brownsville serve as a gateway to Mexico. The Matamoros Bridge crosses the Rio Grande and connects with a major highway route to the interior of Mexico.

Among the industries of economic importance to the county are the shrimp industry and several plants for freezing and processing seafood. The area made up of Port Isabel and Port Brownsville is considered the shrimp capital of the world. Among the other industries are cotton gins, grain-storage facilities, fertilizer and chemical plants, and garment factories. Oil and gas development as well as the tourist trade, especially the winter tourist trade, are also important to the economy of the county.

Climate[7]

Cameron County has a warm temperature, subtropical climate, characterized by dry winters and hot

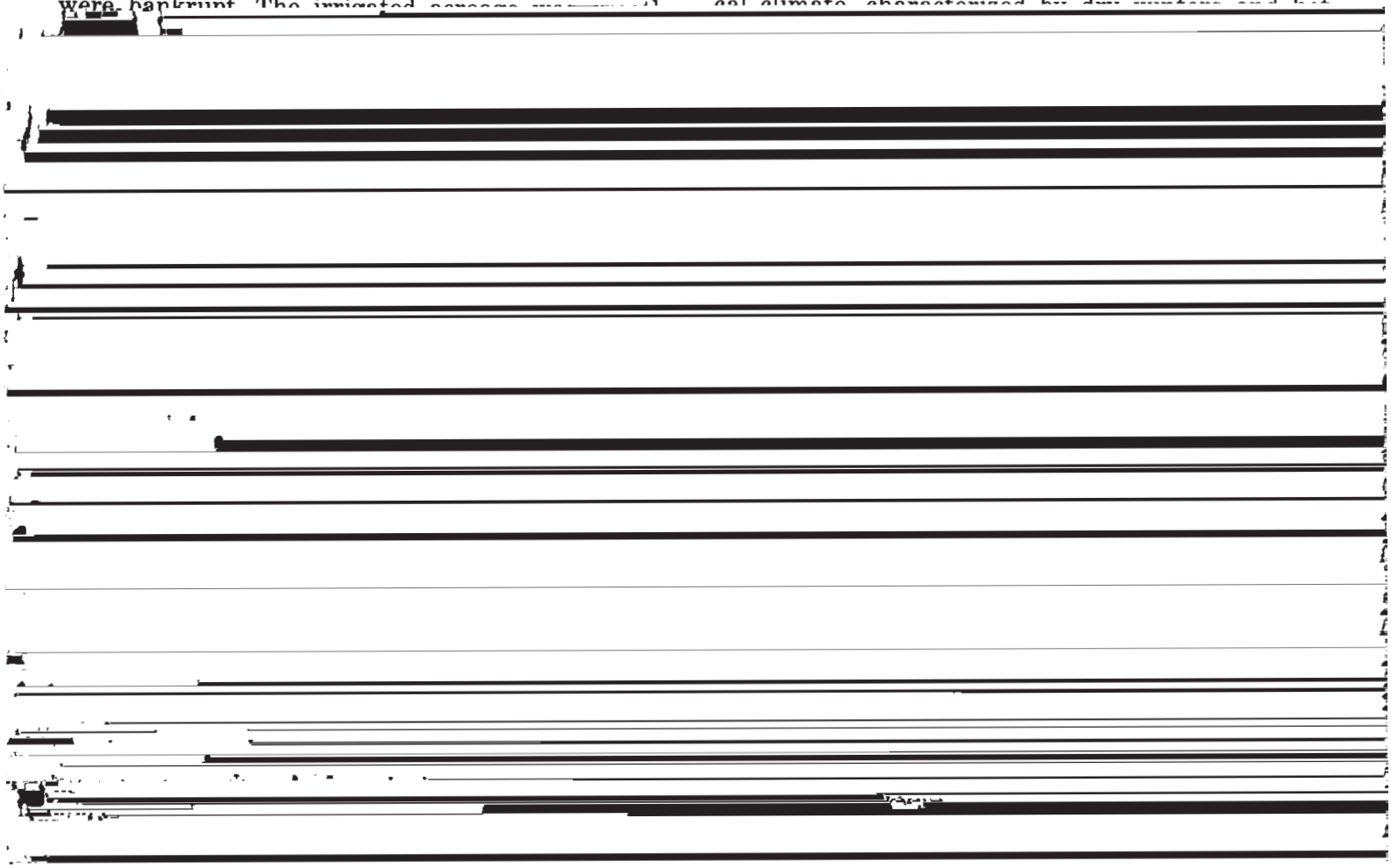
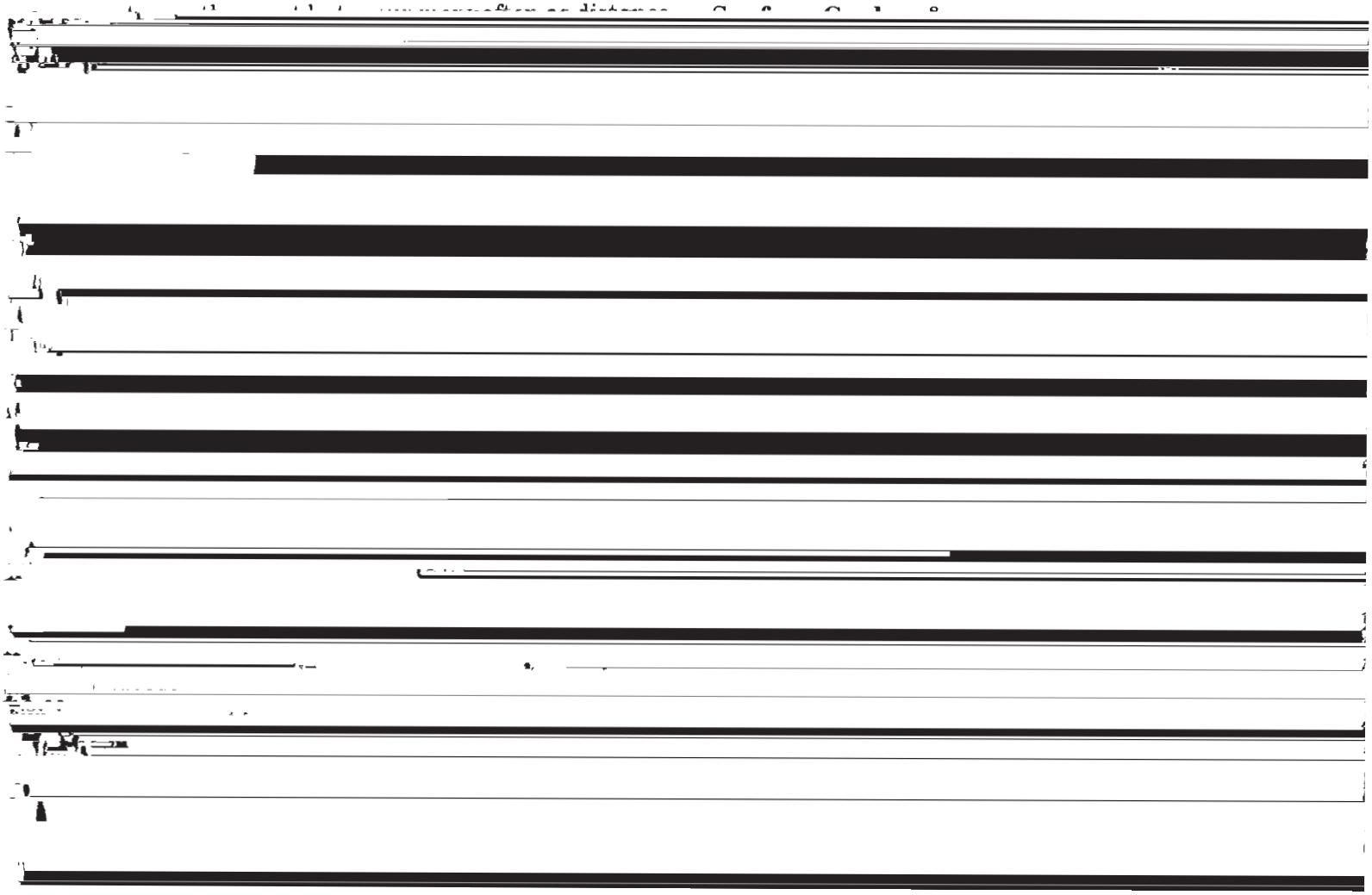


TABLE 10.—*Temperature*

[All data from Harlingen, Texas, elevation (ground) 38 feet,

Month	Temperature [1]				Precipitation		
	Average daily maximum	Average monthly highest temperature	Average daily minimum	Average monthly lowest temperature	Average total [1]	Probability of receiving—	
						0 or trace	0.5 inch or more
	°F	°F	°F	°F		*Percent*	*Percent*
January	70.9	85.8	49.8	31.4	1.43	5	70
February	74.5	89.0	52.3	34.8	1.22	2	70
March	79.0	92.7	57.2	39.4	.95	<1	68
April	85.9	97.0	64.5	49.4	1.47	1	68
May	90.0	97.3	69.3	58.5	3.18	<1	88
June	93.7	99.4	72.9	66.2	2.49	<1	80
July	96.0	101.1	73.8	69.5	1.71	1	70
August	96.7	102.1	73.6	68.9	3.04	1	81
September	92.3	99.2	71.0	62.1	4.80	<1	96
October	87.1	95.0	64.2	51.4	2.56	1	90
November	78.9	90.1	56.4	39.9	1.43	1	70
December	73.0	86.1	51.2	34.0	1.57	1	65
Year	84.8	----------	63.0	----------	25.85	----------	----------

[1] Average length of record is 39 years.
[2] Average length of record is 14 years.



and precipitation

for the period 1931–1969. The symbol < means less than]

Precipitation—Continued								
Probability of receiving—Continued						Average number of days with [2]—		
1 inch or more	2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.1 inch or more	0.5 inch or more	1 inch or more
Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*			
50	25	15	7	3	1	3	1	([3])
50	20	10	5	1	1	3	1	([3])
40	18	5	3	<1	<1	2	([3])	([3])
50	30	17	10	5	3	2	1	1
69	49	30	18	12	7	3	2	1
65	44	30	20	12	10	4	2	1
54	30	18	12	7	3	2	1	([3])
70	50	35	24	14	12	3	1	1
90	70	60	50	34	30	6	3	1
90	60	40	30	20	10	5	2	1
50	20	10	3	1	<1	3	1	1
50	30	18	10	5	5	3	1	1
						39	16	8

[3] Less than one-half day.

Geologic history

The deposition of the materials of the Beaumont Formation that are of Pleistocene age and of the more recent materials that are of Holocene age is related to the rise and fall of the sea during and after the last major advance of the continental glaciers in North America. During periods when water was abstracted from the ocean to form the glaciers, the sea fell, perhaps as much as 450 feet below its present level, and the major streams deepened their channels, flowed across the Continental Shelf, and discharged into the Gulf many miles beyond the present shoreline. During interglacial periods when water from the melting glaciers flowed back into the ocean, the sea rose, the deepened valleys were backfilled, and the coalescing deposits formed a broad delta plain along the margins of the Gulf of Mexico.

The materials of the Beaumont Formation were deposited during the last of the interglacial periods. They may have been deposited during a mid-Wisconsin interglacial interval or during the Sangamon Stage, an interval between the Wisconsin and Illinoisan glaciers.[10] The Sangamon Stage is currently estimated as taking place about 70,000 years ago. According to the results of radiocarbon dating of wood and shell from the Beaumont clay, this deposit is more than 40,000 years old, but all the material was "dead" and beyond the range of accurate analysis. After the materials of the Beaumont Formation had been deposited, the sea level fell again, but about 20,000 years ago, it started to rise and, about 5,000 to 3,000 years ago, reached its present level.

All the deposits of Holocene age along the Rio Grande as well as those of the barrier island are less than 5,000 years old.[10] The materials making up the three Holocene subdeltas are exposed at the surface on Padre Island, a barrier island. They were probably deposited when the sea was at about its present level.

Geology related to soil associations

In the following paragraphs the surface geology of the county is discussed in relation to the soil associations of the county. The younger deposits can be divided roughly into deposits of beach sand, fluviatile deposits, and modified fluviatile deposits. Some of the beach sand has been reworked into dunes. The fluviatile deposits have been modified by subsidence, differential compaction, and the action of wind and waves. The soil associations are described under the heading "General Soil Map."

Deposits of beach sand.—The soils of the Mustang-Coastal dunes association are the only ones that formed in deposits of beach sand. This association occurs only on the barrier islands where the sand has been deposited by waves and currents and then reworked by wind into complex dunes. These dunes have substantially increased the altitude of the islands.

Fluviatile deposits.—The soils of the Rio Grande-Matamoros association formed in the youngest fluviatile sediments in the county. They formed in the deposits on levees and point bars and in backswamps. Locally, some formed in the lacustrine fillings of meander cutoffs and in segments of an abandoned channel. These deposits make up the youngest meander belt of the Rio Grande where the sedimentary bedding is still preserved.

The soils of the Laredo-Olmito association, Harlingen association, and Harlingen-Benito association formed in older fluviatile deposits. The soils of the

[10] BERNARD, HUGH A., and LEBLANC, RUFUS J. Resume of the Quaternary geology of the northwestern Gulf of Mexico province. Quaternary of the U.S. Princeton Univ. Press: 146, 1965.

[redacted]

bonate and iron oxide are examples of material commonly found in concretions.

Delta. An alluvial deposit formed where a stream or river drops its sediment load on entering a body of more quiet water.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Exchangeable sodium percentage. The degree of saturation of the soil exchange complex with sodium. It may be calculated by the formula:

$$ESP = \frac{\text{Exchangeable sodium}}{\text{Cation exchange capacity}} \times 100$$

See Alkali soil.

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

Flood hazard. Water from stream overflow, runoff or seepage that stands or flows above the soil surface. Commonly expressed by frequency and duration classes as listed below.

Frequency	
None	Less than once in 50 years
Very infrequent	Once in 20 to 50 years
Infrequent	Once in 5 to 20 years
Frequent	Once in 1 to 5 years
Very frequent	More often than once every year
Duration	
Extremely brief	Shorter than 2 days
Very brief	2 to 7 days
Brief	7 days to 1 month
Long	1 month to 6 months
Very long	Longer than 6 months

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and 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.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural soil drainage. 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 recog-

	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

generally overlies material that weathered in place, and it is ordinarily overlain by sediment of variable thickness.

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*

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or other interpretative group, read the introduction to the section for general information about management. Yard and garden suitability groups are discussed on pages 47-51, orchard suitability groups on pages 51-52, pasture and hay suitability groups on pages 52-54, and range sites on pages 55-56. Dashes in a column mean that the mapping unit was not placed in that particular grouping. Other information is given in tables as follows:

Acreage and extent, table 1, page 7.
Predicted yields, table 2, page 44.
Suitability for yard and garden plants, table 3, page 47.
Suitability for wildlife habitat, table 4, page 58.
Engineering uses of the soils, tables 5, 6, and 7, pages 62 through 79.
Recreational development, table 8, page 82.

Map symbol	Mapping unit	Page	Capability unit				Yard and garden suitability group	Orchard suitability group	Pasture and hay suitability group	Range site
			Dryland		Irrigated					
			Symbol	Page	Symbol	Page	Symbol	Symbol	Symbol	Name

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Yard and garden suitability group Symbol	Orchard suitability group Symbol	Pasture and hay suitability group Symbol	Range site Name
LR	Lozano fine sandy loam--	20	IIw-1	39	IIw-1	39	1	F	8C	Sandy Loam

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