Issued March 1971

SOIL SURVEY

Eddy Area, New Mexico

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
NEW MEXICO AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1960–1965. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in this publication refer to conditions in the Area in 1965. This survey was made cooperatively by the Soil Conservation Service and the New Mexico Agricultural Experiment Station. It is part of the technical assistance furnished to the Carlsbad, Central Valley, and Penasco Soil and Water Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

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 agriculture, industry, and recreation.

Locating Soils

All the soils of the Eddy Area 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 Area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit and range site in which the soil has been placed. The first part of the guide lists the soils mapped at low intensity; the second part lists the soils mapped at high intensity.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

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

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.

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

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

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

Cover: An aerial view near Carlsbad. Water is piped to cultivated crops from the irrigation canal in the foreground.

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Issued March 1971

SOIL SURVEY OF EDDY AREA, NEW MEXICO

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

THE EDDY AREA is in the southeastern part of New Mexico (fig. 1). It consists of all of Eddy County except the Shattuck Valley in the southwestern part, which has been set aside as the Lincoln National Forest. It contains 2,524,517 acres, or about 3,945 square miles. Carlsbad, the county seat, is in the south-central part. The Pecos River flows generally north to south, approximately through the central part of the Area.

About 97 percent of the survey Area is used for grassland. Ranching is the main enterprise, and beef cattle the most important kind of livestock. In the mountains, hills, and valleys that make up about a fifth of the western part of the survey Area, sheep and cattle are the principal kinds of livestock.

About 3 percent of the survey Area is used for irrigated crops. The irrigated tracts are generally at the lower elevations along the Pecos and Black Rivers. The principal irrigated crops are cotton, alfalfa, sorghum, and small grain.

In small areas scattered throughout the survey Area, oil is produced and potash and salt are mined. Most of the oil-bearing areas are east of the Pecos River or in the Indian Basin of the South Seven Rivers. The potash- and salt-bearing areas are in the east-central part of the Area, along the Quahada and Nimenim Ridges and in the Clayton Basin.

How This Soil Survey Was Made

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

[1] Part of the fieldwork was done by THOMAS U. YAGER, RAYMOND D. TAYLOR, CARLTON J. CARMICHAEL, LYLE D. PASCHKE, and GARY J. DELANEY, Soil Conservation Service.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this publication efficiently, it

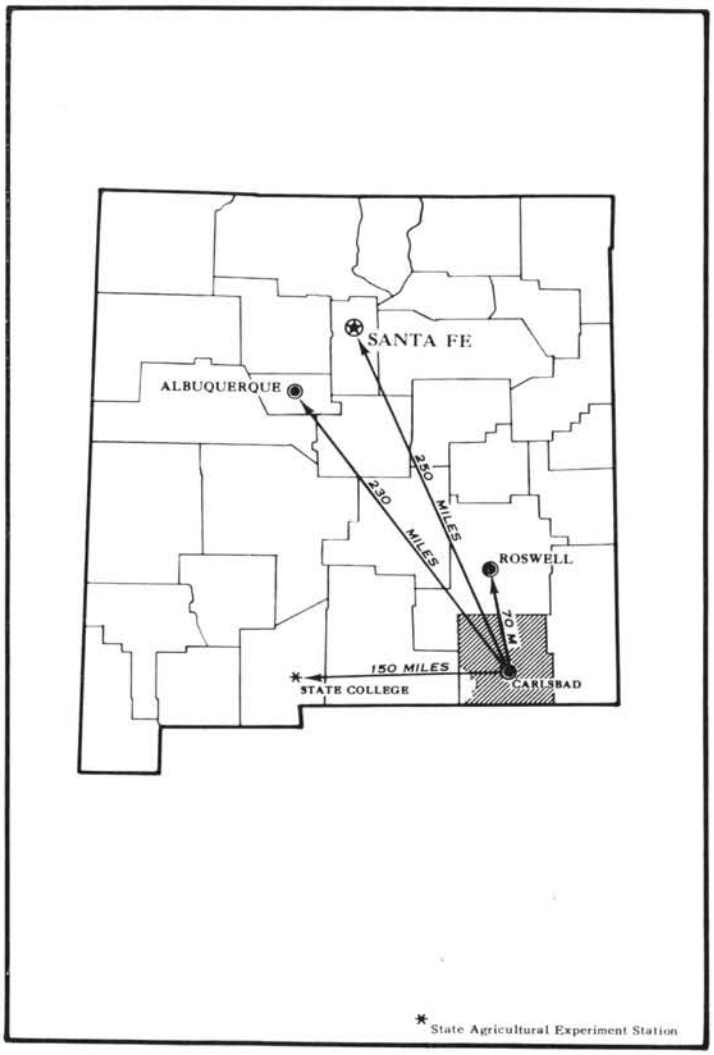

Figure 1.—**Location of Eddy Area in New Mexico.**

is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series (*12*).[2] Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Karro and Largo, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Many soil series contain soils that differ in the texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Karro loam and Karro fine sandy loam are two soil types in the Karro series. The difference in texture of their surface layers is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases, primarily on the basis of difference in slope or degree of erosion, because these are differences that affect management. For example, Karro loam, 0 to 3 percent slopes, is one of several phases of Karro loam.

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

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

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intermingled or occur in such small individual tracts that it is not practical to show them separately on the map. Such a mixture of soils is shown on the map as one mapping unit and is called a soil complex. Ordinarily, a complex is named for the major kinds of soil in it, for example, Largo-Stony land complex, 0 to 25 percent slopes.

Another kind of mapping unit is the undifferentiated group, which consists of two or more soils that may occur together without regularity in pattern or relative proportion. The individual tracts of the component soils could be shown separately on the map, but the differences between the soils are so slight that the separation is not important for the objectives of the soil survey. An example is Simona and Wink fine sandy loams, 0 to 3 percent slopes, eroded.

Some mapping units contain more than one kind of soil in a pattern more open and less intricate than that of a soil complex. Such a mapping unit is called a soil association. A soil association differs from a soil complex in that its component soils could be mapped separately, at ordinary scales such as 4 inches per mile, and would be if practical advantages made the effort worthwhile. A soil association, like a soil complex, is named for the major soils in it, for example, Reagan-Upton association, 0 to 9 percent slopes.

Most surveys include areas where the soil material is so rocky, so shallow, or so frequently worked by wind and water that it cannot be classified by soil series. These areas are shown on the map like other mapping units, but they are given descriptive names, such as Limestone rock land, and are called land types.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in soil surveys. On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under methods of use and management current at the time of this survey.

Soil Survey Intensities

Part of the Eddy Area was mapped at low intensity and part at high intensity (fig. 2).

Rangeland was mapped at low intensity. The soils were examined at moderate to wide intervals. In several places two or more soils were mapped together as a complex, an undifferentiated group, or an association. Each of the multiple mapping units is named for the major soil series occurring in it, and the dominant soil is listed first, for example, Arno-Harkey complex, saline, 0 to 1 percent slopes. If the acreage of an individual soil was large enough, that soil was mapped separately. A wide range of slope was permitted within a mapping unit if there was no major difference in use and management.

The major areas used for irrigated crops were surveyed at high intensity. The soils were examined at

[2] Italicized figures in parentheses refer to Literature Cited, p. 81.

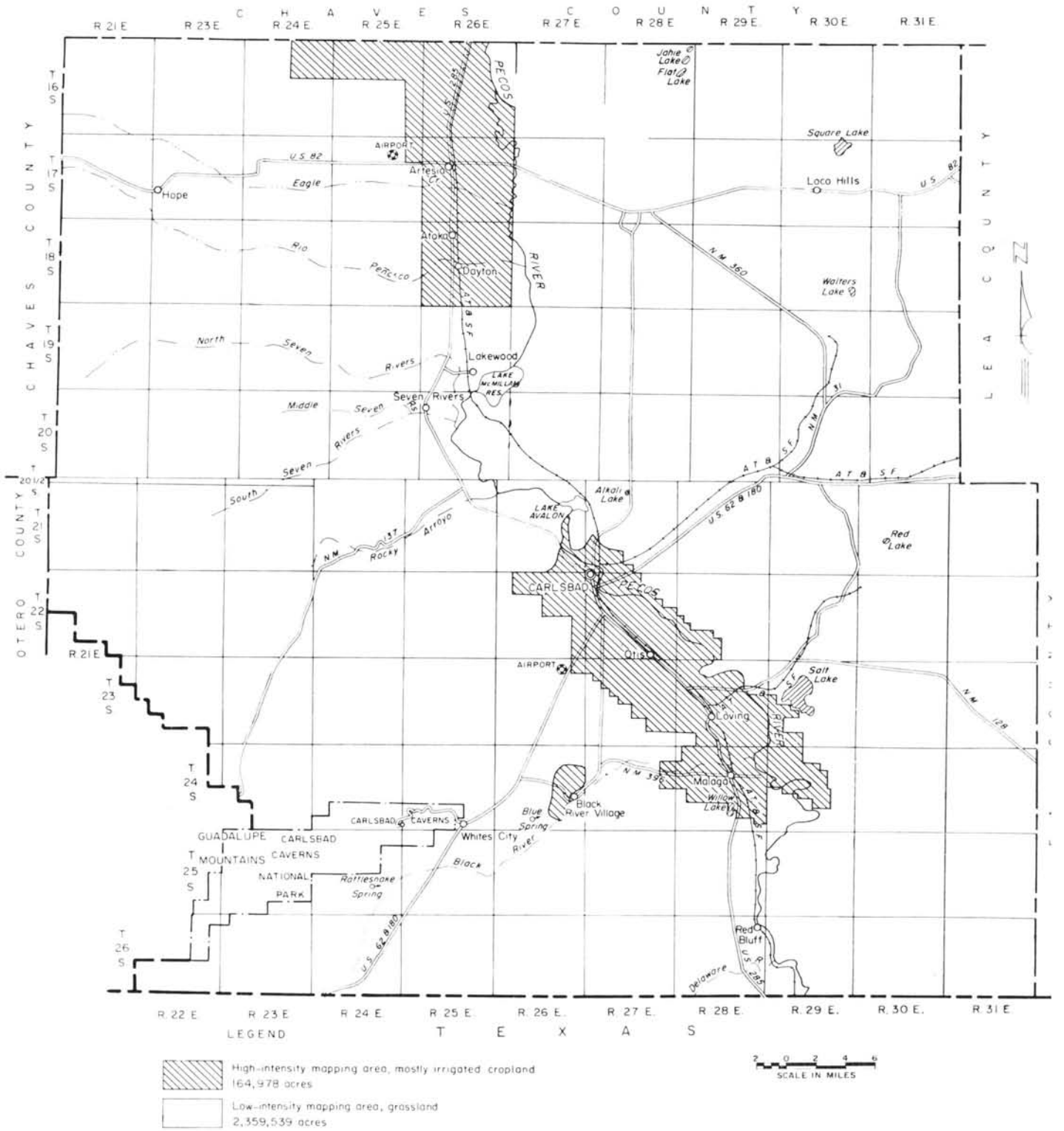

Figure 2.—**Land use and survey intensities in the Eddy Area. The soils mapped at high intensity are used mainly for irrigated crops. The soils mapped at low intensity are used mainly for range.**

closer intervals than those mapped at low intensity and were mapped in more detail and at a larger scale. Most high-intensity mapping units consist of individual soils, rather than of complexes or associations. Slope classes were combined if there was no significant difference in use and management.

General Soil Map

The general soil map at the back of this publication shows, in color, the soil associations in the Eddy Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The seven soil associations in the Eddy Area are discussed in the following pages. The terms for texture used in the title for each of the associations applies to the texture of the surface layer.

1. Limestone rock land-Ector association

Rock land and very shallow, stony and rocky, loamy soils over limestone; on hills and mountains

This association consists of nearly level to very steep, stony soils and of rock land, slides, cliffs, and escarpments (fig. 3). Most of this association is in the western part of the Area. It occupies about 511,000 acres, or approximately 20 percent of the survey Area. Rainfall amounts to about 10 to 18 inches annually, and the mean annual temperature ranges from 58° to 62° F. The frost-free season ranges from 195 to 210 days. Elevations range from 3,200 to 4,800 feet.

Limestone rock land, which makes up about 45 percent of the association, consists of very steep, bare rock and talus slopes where there is only a little soil. It dominates the landscape in the Guadalupe Mountains, Seven Rivers Hills, and Texas Hills.

Ector soils, which make up about 40 percent of the association, are very shallow, stony, and rocky. They developed in residuum weathered from limestone. These soils occur on mesalike ridgetops and on side slopes between drainageways. They are dominant in the low hills in the northwestern part of the Area. Intermittent streams have cut channels at the bottoms of most of the deep, very narrow canyons that occur in these soils.

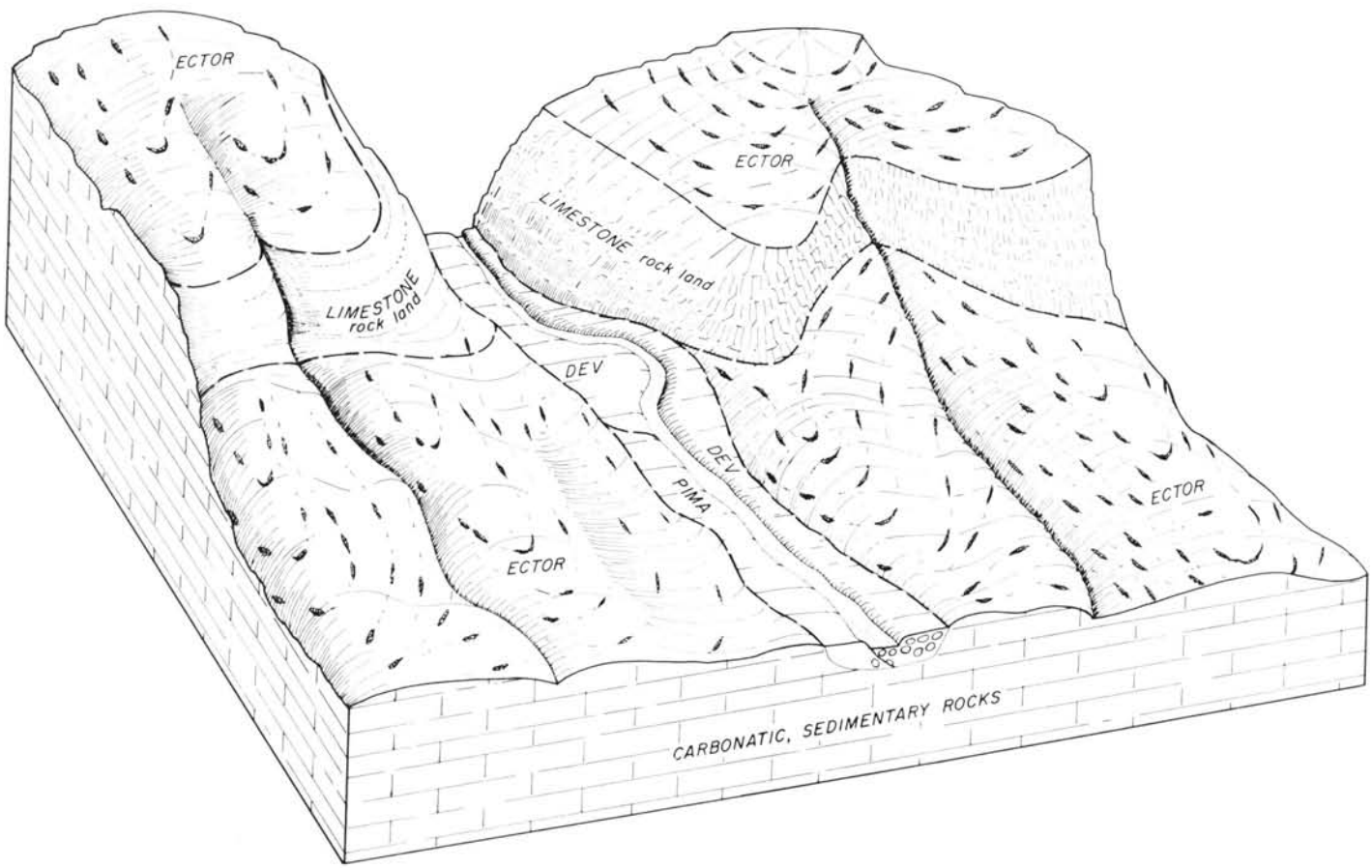

Figure 3.—Typical pattern of rock land and soils in association 1.

Also in this association are small areas of Dev and Pima soils. These soils, which developed in mixed alluvium, make up about 15 percent of the association. They occur on flood plains. Near Bogle Flats are a few sinkholes, or playas, in which water stands for short periods after rainfall. Pima soils are deep and calcareous. Dev soils are flooded periodically.

This association is used mainly for grazing. A ranch commonly covers 20 sections or more. The major problems are distribution of stock water and proper use of the range. Livestock ponds are essential because there is little or no perennial surface water and ground water is scarce. Windmills are widely scattered, and water-bearing strata in which wells could be drilled are difficult to locate. There are very few natural springs.

The soils and the plant cover of this association are typical of a semiarid climate. The soils are droughty, and vegetation is sparse. Short and mid grasses, along with sotol, agave, ocotillo, catclaw, sacahuista, and a little juniper make up most of the plant cover. The Pima and Dev soils produce more forage than the Ector soils.

This association is sparsely populated. The landscape is not easily traversed by ordinary means. Only a few good roads pass through. Most follow the broader valleys or ridgetops. Many are trails that lead to ranch headquarters or that come to a dead end in canyons. The Guadalupe Ridge, a part of the Guadalupe Mountains, has many natural caves. Carlsbad Caverns National Park is in this association. Big game is hunted in season.

This association is generally not suited to engineering structures of the kind needed to conserve soil and water. The areas are steep, rocky, and inaccessible. The rock is suitable for use as riprap or as material for pervious blankets or road fill. It can also be crushed for gravel.

Pima soils are a source of material suitable for mixing with other materials in construction of embankment-type ponds in the narrow, V-shaped drainageways that occur in this association. Concrete structures or small earthen dams can also be installed to improve sites where springs occur. Pit tanks can be installed in Pima soils, but few areas of these soils are in a watershed large enough to produce substantial runoff, and, in addition, these soils generally occupy positions on the landscape that are hard to protect.

Dev soils can be used as a source of road fill, but sites must be carefully selected. Drainageways in these areas sometimes accumulate enough water to damage structures and to cause stream channels to shift.

2. *Reagan-Upton association*

Loamy, deep soils and soils that are shallow to caliche; from old alluvium

This association consists of deep to shallow soils (fig. 4) on gently undulating plains and in the broader valleys

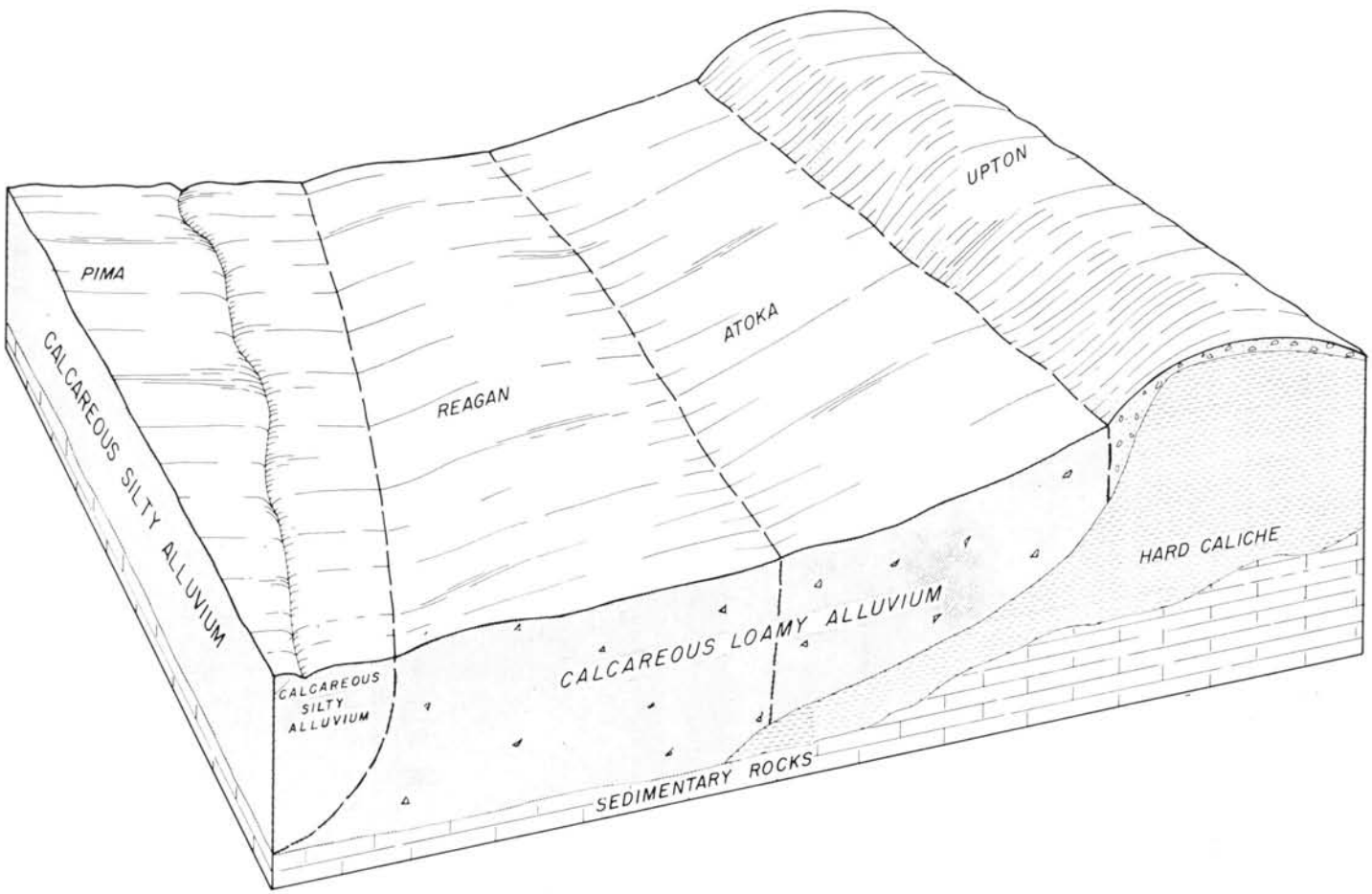

Figure 4.—**Typical pattern of soils in association 2.**

of the hills and mountains, mainly west of the Pecos River and north of the Black River. It occupies about 740,000 acres, or approximately 29 percent of the survey Area. Rainfall amounts to about 10 to 15 inches annually, and the mean annual temperature ranges from 60° to 64° F. The frost-free season ranges from 200 to 220 days. Elevations range from 3,000 to 4,600 feet.

Reagan soils, which make up about 40 percent of the association, generally are deep, moderately dark colored, calcareous, and loamy. Upton soils, which make up about 35 percent of the association, are moderately dark colored. They are shallow or very shallow over hard caliche. They occupy low, elongated ridges on the steeper parts of the landscape. Both Reagan and Upton soils formed mainly in loamy alluvium washed from limestone uplands.

Also in this association are areas of Atoka, Dev, and Pima soils. These soils make up about 25 percent of the association. Atoka soils occur between Reagan and Upton soils. They are moderately dark colored, calcareous, and loamy. They are moderately deep over hard caliche. Dev soils occur in drainageways in the western part of the association, as a complex with Pima soils. They are gravelly or cobbly. Deep gullies are common in the channels of major streams. Pima soils occur on flood plains and are periodically under water. These soils are deep, moderately dark colored, and calcareous. They developed in silty alluvium. Dev and Pima soils, especially in the western part of the association, are subject to serious damage from uncontrolled runoff.

About 88 percent of this association is used for grazing. A ranch commonly covers about 16 to 20 sections. The major problems are distribution of stock water and proper use of the range. Livestock ponds are essential because surface water stands for only a brief time. Ground water is scarce and hard to locate. Pumps driven by windmills supply much of the water for livestock.

The rest of the association is used for irrigated crops. Cotton, alfalfa, sorghum for grain and silage, and small grain are the major crops. Pecans and sugar beets can be grown also. If irrigated, Reagan soils are among the most productive in the survey Area. Areas of Atoka, Pima, and Upton soils are also used for irrigated crops. Most of the irrigated acreage has been leveled to increase the efficiency of irrigation systems. Concrete-lined head ditches and pipelines are common.

The soils of this association are generally dry, except in areas where they are periodically flooded. The vegetation consists of short and mid grasses, tarbush, creosotebush, mesquite, and yucca. The Reagan and Pima soils produce more forage than other soils in this association.

This association is sparsely populated. The landscape can be traversed easily by ordinary means.

Reagan soils, which are deep and free of stones, have properties favorable for engineering installations. They can be leveled, and farm ponds and embankments, dikes and levees, irrigation reservoirs, and pipelines can be installed without difficulty. Permeability is moderate, and the shrink-swell potential is moderate. Atoka soils have engineering properties similar to those of Reagan soils, except that Atoka soils are underlain by indurated caliche at a depth of about 28 inches. Both Reagan and Atoka soils are a fairly good source of topsoil.

Upton soils are not suitable for conservation engineering structures. These soils are underlain by indurated caliche at a depth of only about 9 inches. Certain of the areas are a source of caliche that can be used in road construction.

Pima soils are not suitable for engineering structures, because they have moderate to high shrink-swell potential and fair to poor bearing capacity. Permeability is moderately slow to slow. These soils are flooded periodically unless they are protected. They are a fairly good source of topsoil, but they are erodible and their water intake rate is slow. They can be leveled without difficulty, and pipelines can be buried easily. Dev soils can be used as a source of gravel for concrete.

Although Reagan and Pima soils are suitable for low earthen structures, such structures are subject to cracking and are unstable in areas of Pima soils. Excavated ponds or reservoirs function satisfactorily in places where sediments do not accumulate.

Saline areas of Reagan and Pima soils are not suitable for low earthen structures, and because of the corrosion hazard, are not suitable for pipelines. Salinity must also be considered in planning concrete structures and irrigation systems. Surface crusting is a problem on saline soils.

3. *Reeves-Gypsum land-Cottonwood association*

Loamy soils that are very shallow to moderately deep over gypsum beds, and Gypsum land

This association consists of gently undulating soils on plains and low hills, and of Gypsum land (fig. 5). Most of the association occupies broad areas scattered throughout the central part of the Area. It occupies about 384,000 acres, or approximately 15 percent of the survey Area. Rainfall amounts to about 10 to 14 inches annually, and the mean annual temperature ranges from about 60° to 64° F. The frost-free season ranges from 200 to 220 days. Elevations range from 3,000 to 4,500 feet.

Reeves soils, which make up about 40 percent of the association, are moderately deep, light colored, and loamy. They occur in swales and drainageways.

Gypsum land, which makes up about 30 percent of the association, occurs on the highest parts of the landscape and on breaks near drainageways. There is little or no soil.

Cottonwood soils, which make up about 20 percent of the association, are shallow or very shallow. They occur in slight depressions.

Also in this association are small areas of Karro, Russler, Reagan, Largo, and Ector soils. These soils make up about 10 percent of the association. With the exception of the Ector soils, which developed in residuum weathered from limestone, they developed in alluvium. Karro soils, on high terraces or flats, are deep, limy, and light colored. Russler soils, on uplands in the southeastern part of the association, are shallow to deep, gypsiferous, and reddish colored. They are gently undulating. Reagan soils, in the broader drainageways, are deep, calcareous, light colored, and loamy. There are a few deep gullies in Reagan soils. Largo soils, in drainageways in the northern part of the association, are deep and moderately dark colored. Ector soils occur on limestone knobs or hills scattered throughout the association, but

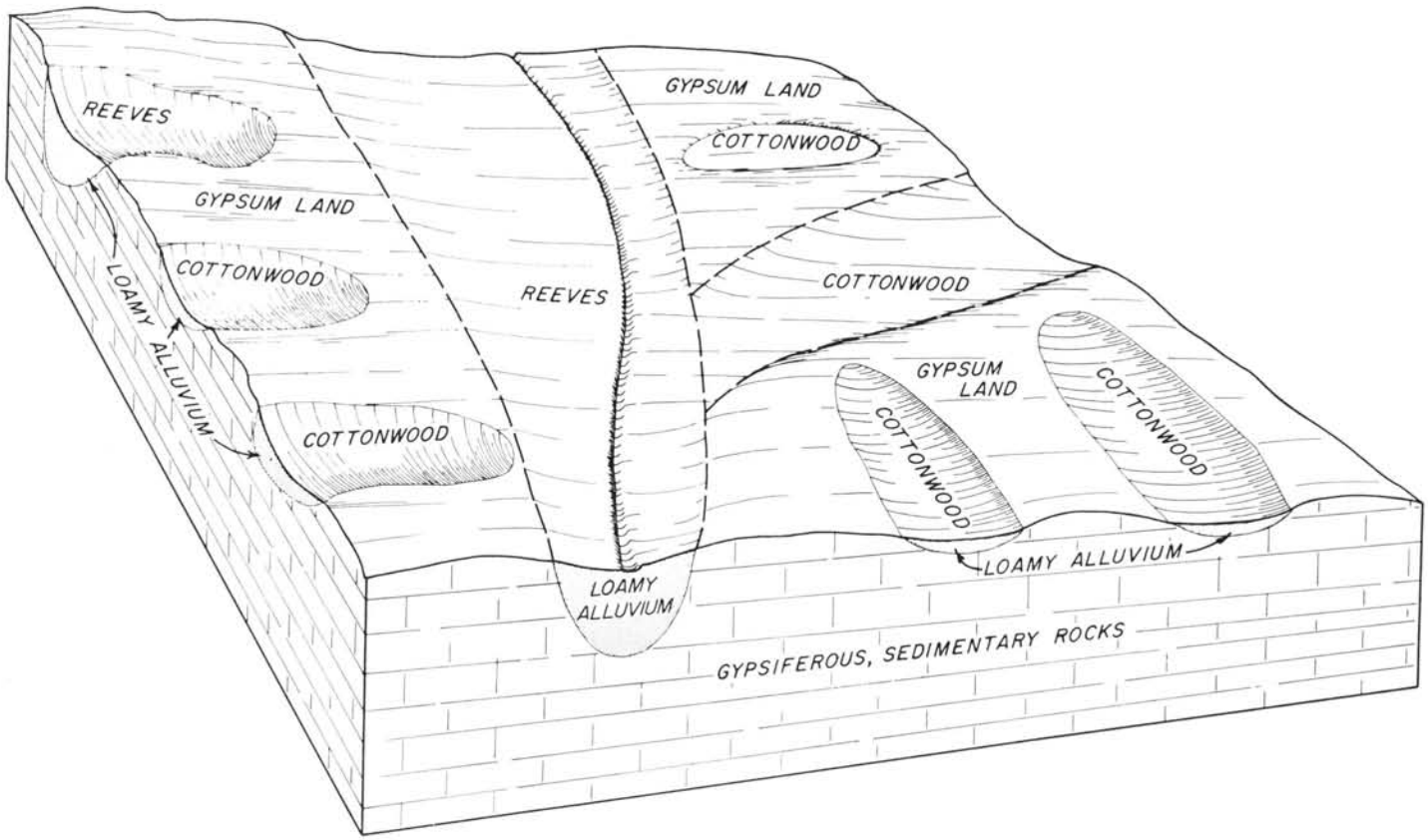

Figure 5.—**Typical pattern of soils and Gypsum land in association 3.**

mainly in the southern part. They are very shallow, stony, and rocky.

About 70 percent of this association is used for grazing. A ranch commonly covers about 20 to 150 sections. The major problems are the poor quality of the water, distribution of stock water, and proper use of the range. Little or no surface water is available, except for short periods after rainfall. There are few natural springs or seeps, and ground water is hard to locate. Pumps driven by windmills supply much of the water for livestock.

The rest of the association is used for irrigated crops. Cotton, alfalfa, and small grain are the major crops. The cultivated soils are those of the Karro, Reeves, Russler, and Reagan series. The areas are near Artesia, Loving, Malaga, and Black River Village.

The climate is hot and dry. The native vegetation consists of a sparse cover of short and mid grasses, coldenia, American tarbush, yucca, and mesquite. The overflow phases of the Largo, Reeves, and Cottonwood soils produce higher yields of forage than other soils in the association. Gypsum land and the other Cottonwood soils produce the lowest yields.

Reeves and Karro soils are a fair to poor source of topsoil. Both the saline and nonsaline phases are suitable for irrigation, but the depth cuts made for leveling must be limited somewhat. Reeves soils have characteristics favorable for conservation engineering practices, but engineering uses are limited by the underlying gypsiferous material. Although these soils are suitable for low earthen structures, onsite investigation is necessary. The Karro soils crust easily because of their high content of lime. They are unstable and are unsuitable for low earthen structures. If pipelines are buried below a depth of 20 to 36 inches in Karro soils, special treatment is required.

Cottonwood and Russler soils and Gypsum land have a high content of gypsum, which makes them unsuitable for use in dikes, embankments, and farm ponds. The gypsiferous material is at a depth of 16 to 48 inches in the Russler soils.

Largo soils are subject to periodic flooding and are highly erodible. They are suitable for low earthen structures. Pipelines can be buried easily. Ector soils are a source of limestone suitable for road construction.

Pipelines and concrete structures must be properly designed to control corrosion and deterioration in areas of Gypsum land, and in Cottonwood, Russler, and Reeves soils.

4. Kimbrough-Stegall association

Loamy soils that are very shallow to moderately deep to caliche; from old alluvium

This association consists of gently undulating soils on plains, escarpments, and slopes (fig. 6) in the northeastern part of the Area. It occupies about 65,000 acres, or about 3 percent of the survey Area. Rainfall amounts to 10 to 16 inches annually, and the mean annual temper-

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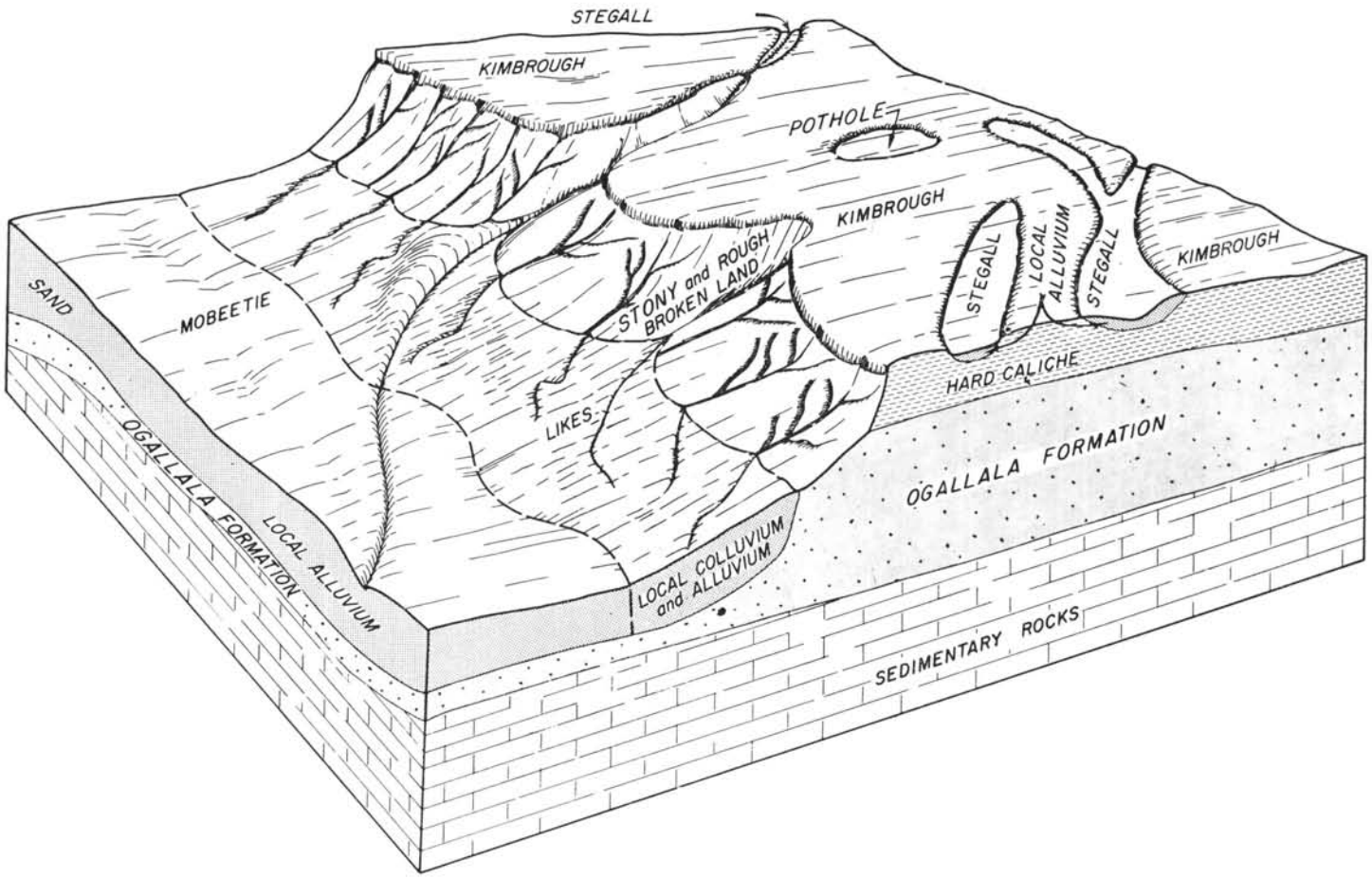

Figure 6.—**Typical pattern of soils in association 4.**

ature ranges from 60° to 64° F. The frost-free season ranges from 195 to 220 days. Elevations range from 3,000 to 4,500 feet.

The major soils occupy karst, or sinkhole, topography. Playas, or potholes, are numerous. Kimbrough soils, which make up about 65 percent of the association, are moderately dark colored and generally very shallow over indurated caliche. They occur on gently undulating uplands. Stegall soils, which make up about 30 percent of the association, are moderately deep and dark colored. They occur in swales and depressions and are subject to periodic flooding.

Also in this association are small areas of Mobeetie and Likes soils and Stony and Rough broken land, which make up about 5 percent of the association. Mobeetie and Likes soils are deep, moderately dark colored, and calcareous. They occur as gently sloping areas below escarpments. Stony and Rough broken land consists of steep areas and escarpments, with little or no soil material on the country rocks.

This association is used for grazing. A ranch commonly covers 20 sections or more. The major problem is proper use of the range. Runoff water collects in playas, but it stands only a short time. Windmills are common.

The climate is hot and dry. The average annual precipitation amounts to slightly more at higher elevations than at lower elevations. The vegetation consists mainly of short and mid grasses, yucca, cactus, creosotebush, catclaw, and mesquite. This association produces a fairly large amount of forage when there is enough rainfall.

This association is sparsely populated. Kimbrough soils are easy to cross by ordinary means, but Mobeetie and Likes soils are somewhat difficult to cross. Stony and Rough broken land has little value for grazing, because it is too rough to be traversed, either by men or animals.

Kimbrough soils and Stony and Rough broken land are a source of indurated caliche that is suitable for use in road construction. Stegall soils are a source of soil material suitable for low earthen structures. Pipelines are difficult to bury in the caliche underlying both Kimbrough and Stegall soils. Stegall soils are shallow and unstable; conservation practices are difficult, and engineering structures are hard to install. Stock ponds can be installed in the larger potholes to help conserve water. The playas can be used as a source of soil material for low earthen structures. They are subject to periodic ponding, which creates hazards to roadbeds and highway alinements.

Mobeetie and Likes soils have a loose, sandy surface layer. They are susceptible to severe wind and water erosion, and gullies are common. These soils are unsuit-

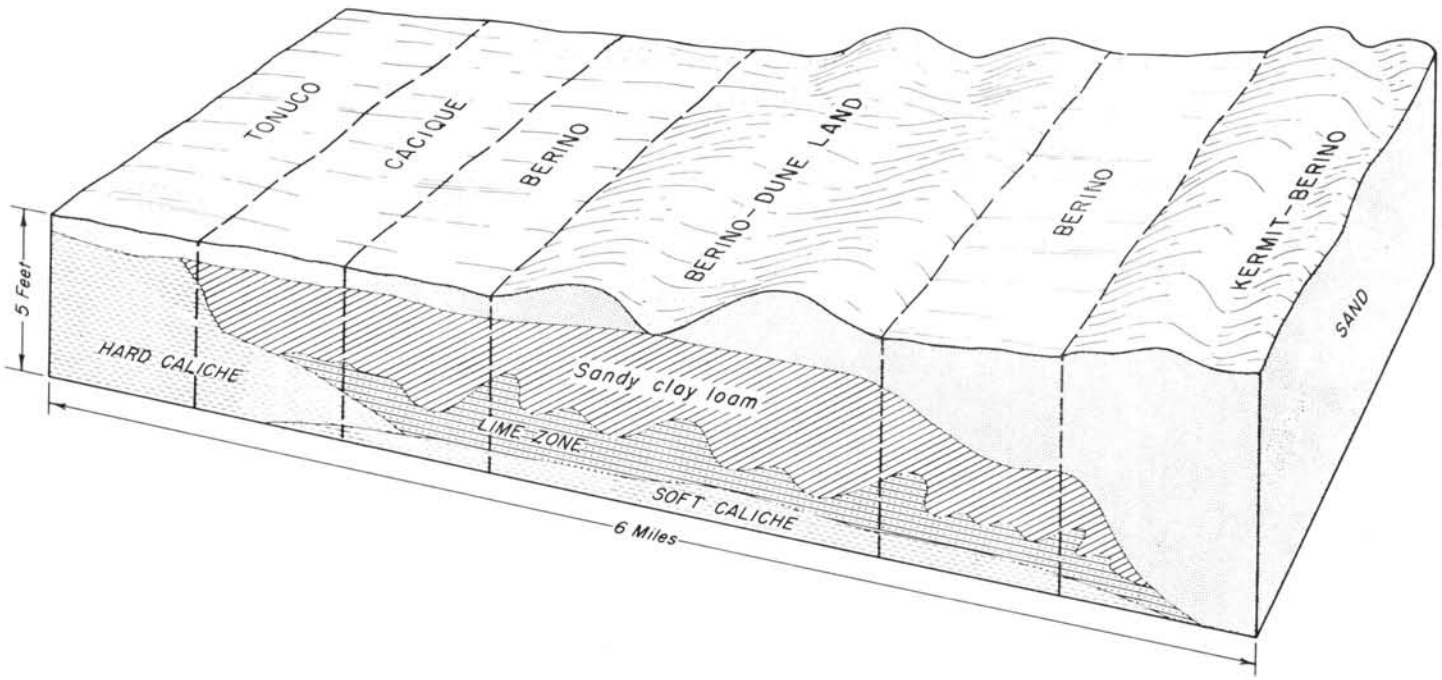

Figure 7.—**Typical pattern of soils in the Kermit-Berino association.**

able for most conservation practices. Pipelines are easily installed, but care is needed to control wind erosion.

5. Kermit-Berino association

Sandy, deep soils from wind-worked mixed sand deposits

This association consists of very sandy soils (fig. 7) on undulating plains and low hills of the "Sand Country" in the eastern part of the Area. It occupies about 415,717 acres, or about 17 percent of the survey Area. Rainfall amounts to about 10 to 14 inches annually, and the mean annual temperature ranges from 60° to 64° F. The frost-free season ranges from 208 to 220 days. Elevations range from 3,000 to 4,200 feet.

The soils of this association developed in noncalcareous, reddish, wind-worked sandy deposits. All the soils are highly susceptible to wind and water erosion, and few of the areas have escaped. They have been winnowed by wind, and their surface layer is billowy and hummocky or sculptured into dunes.

Kermit soils, which make up about 60 percent of the association, are deep, loose, noncalcareous fine sands that occur as trains of dunes elongated by wind. They occupy the highest part of the landscape.

Berino soils, which make up about 30 percent of the association, are deep, noncalcareous, severely eroded soils that have a subsoil of sandy clay loam. Much of the acreage occurs with Dune land.

Also in this association are areas of Pajarito, Wink, Cacique, and Tonuco soils, and of Active dune land. These areas make up about 10 percent of the acreage. All of the included soils are susceptible to wind and water erosion, and a good vegetative cover is needed. Pajarito soils are deep, calcareous, and sandy. They occur in depressions and drainageways, in association with calcareous upland soils. Wink soils are calcareous and sandy. They occur over lacustrine sediments in broad drainageways and filled playas, in association with calcareous upland soils. Cacique soils are shallow to moderately deep, noncalcareous, sandy upland soils. They have a subsoil of sandy clay loam underlain by indurated caliche. Tonuco soils are noncalcareous upland deposits of sand that is shallow over indurated caliche. Active dune land consists of shifting dunes of noncalcareous sand. It is associated with blowout areas.

This association is used for grazing and wildlife habitat. A ranch commonly covers 20 sections or more. The soils that are not severely eroded generally produce high yields of forage if there is enough moisture. Little or no surface water is available, and windmills are common.

The climate is hot and dry. The soils support tall and mid grasses. Sand sage, Havard oak, and mesquite make up most of the vegetation.

This association is sparsely populated. The landscape is difficult to cross by ordinary means because the surface layer is loose and sandy and dunes and gullies are common. Roads have been built by oil companies in parts of the association.

The soils of this association are too sandy to be suitable for earthen structures for impounding or diverting water. The sands are poorly graded and are unsuitable for use in concrete. The Cacique and Tonuco soils are a source of caliche suitable for road construction. Pipelines can easily be buried in Kermit and Berino soils, but care is needed to control erosion.

6. Simona-Pajarito association

Sandy, deep soils and soils that are shallow to caliche; from wind-worked deposits

This association consists mainly of calcareous upland soils and of land types (fig. 8). It occupies about 350,000

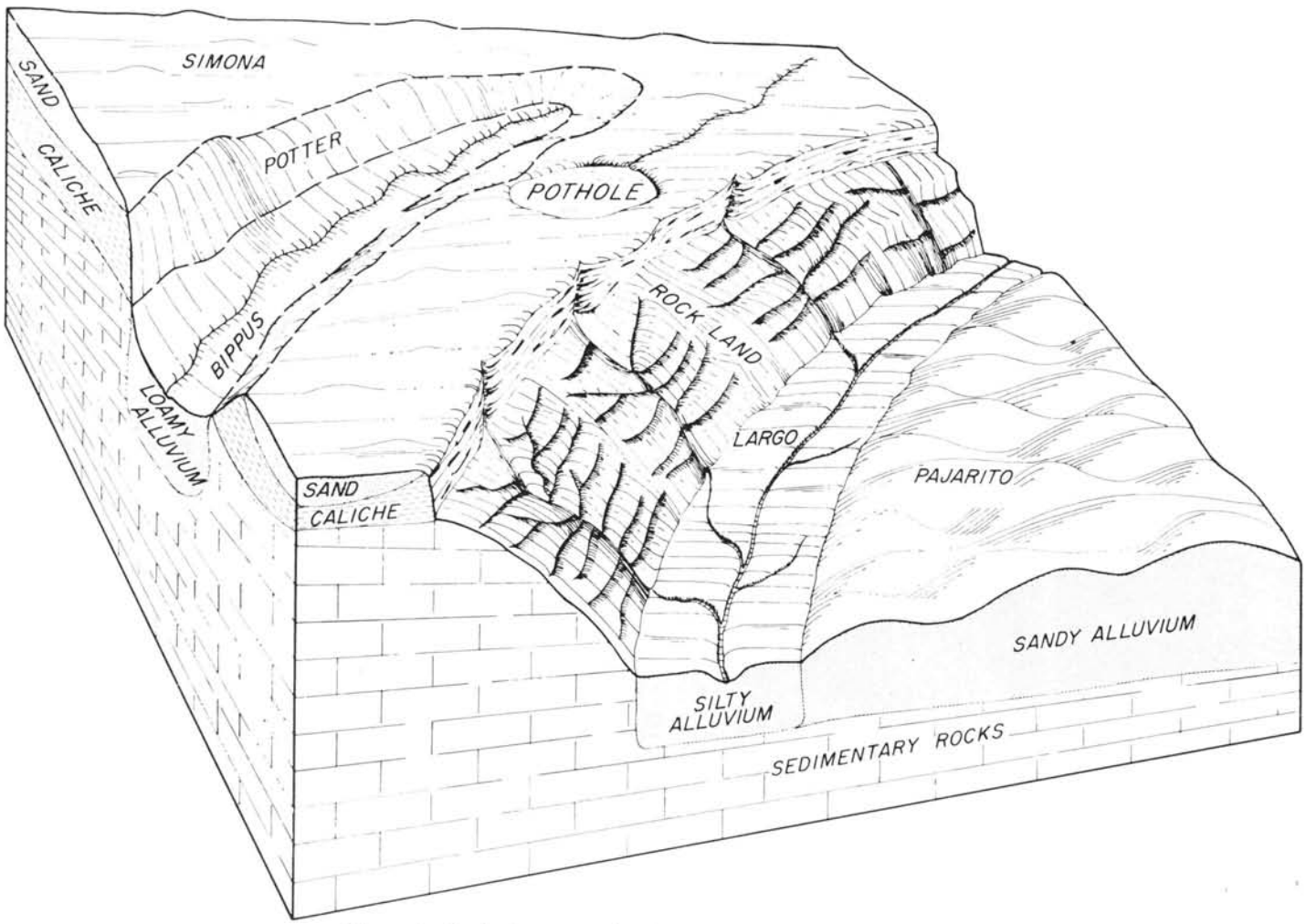

Figure 8.—**Typical pattern of soils and land types in association 6.**

acres, or approximately 14 percent of the survey Area. Most of the association occurs as scattered areas east of the Pecos River, in valleys and on breaks, flats, ridges, and slopes. Rainfall amounts to about 10 to 14 inches annually, and the mean annual temperature ranges from 60° to 64° F. The frost-free season ranges from 208 to 220 days. Elevations range from 3,000 to 4,400 feet.

Simona soils, which make up about 45 percent of the association, generally are moderately dark colored, sandy, upland soils that are shallow over indurated caliche. The parent material consists of material derived from dissected, caliche-capped, exposed red beds on breaks; of wash material in valleys and on flats and slopes; and of shallow, sandy, wind-worked deposits over caliche on upland ridges and plains.

Pajarito soils, which make up about 40 percent of the association, are deep, moderately dark colored, sandy soils that developed in material washed from red beds and deposited in drainageways and on valley slopes.

Also in this association are areas of Bippus, Upton, and Largo soils and of Rock land, Stony land, and Stony and Rough broken land. These areas make up about 15 percent of the association. Bippus soils, which are deep and moderately dark colored, developed in silty alluvium. They occur in drainageways and are subject to flooding. Upton soils, which are very shallow and gravelly over indurated caliche, are moderately dark colored and loamy. They occur on gently sloping to sloping breaks. Largo soils, which are generally deep and moderately dark colored, are loamy soils that developed in material washed from red beds. Rock land occurs in areas where the red beds have been highly dissected. There is little or no soil material. Stony land consists of steep, highly dissected or gullied red-bed material that occurs with Rock land. It has a thin cover of soil mixed with stones. Stony and Rough broken land consists of steep slopes and escarpments that are highly dissected or gullied. The stones on the lower slopes are mixed with soil material.

Small playas are scattered throughout the areas of Bippus soils. These dry lakes hold surface water, but only for short periods. Some of the valleys that have cut into the red-bed material contain fairly large saline lakes that hold water the year around, or at least most of the year. Salt Lake, east of Loving, is a permanent saline lake. Jahie and Flat Lakes are saline lakes that hold water most of the year. Crow Flats and Walters, Square, and Hackberry Lakes hold good water, but only for short periods.

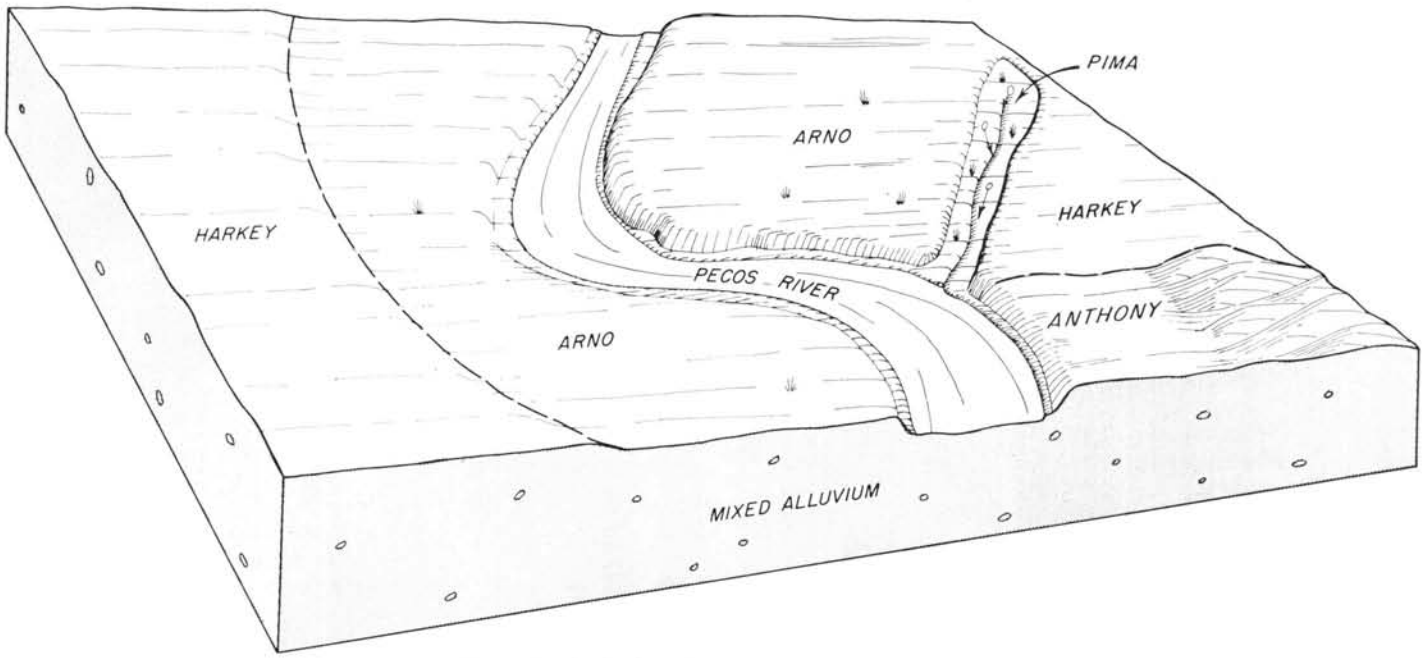

Figure 9.—**Typical pattern of soils in association 7.**

All of this association is used for grazing or wildlife habitat. A ranch commonly covers 24 sections or more. The major problem is the distribution of stock water. The terrain is rough, and the soils are subject to wind and water erosion. Ground water is hard to locate.

The climate is hot and dry. The soils are droughy, and in most places the vegetation is sparse. Short, tall, and mid grasses, mesquite, creosotebush, broom snakeweed, and longleaf ephedra make up most of the vegetation.

This association is sparsely populated. There are only a few good roads. Pajarito and Wink soils and Dune land are susceptible to severe wind erosion, and these areas are difficult to traverse by ordinary means. Nearly all of the potash produced in the Eddy Area comes from this association.

This association is generally unsuitable for conservation engineering structures, because of drifting sand, severe wind erosion, rapid water intake, and shallowness over caliche. Generally, the dry lakes and areas of Bippus and Largo soils can be used as a source of material suitable for earthen structures. Most areas of the sandy soils, such as those of the Simona and Pajarito series, are not suitable for concrete, because the sands are poorly graded. They are unsuitable for water reservoirs, because permeability is rapid.

Simona and Potter soils are a source of caliche suitable for road construction. Stock ponds can be constructed in areas of Bippus soils, but sites must be carefully selected.

7. *Arno-Harkey-Anthony association*

Loamy, deep soils from recent mixed alluvium

This association consists of deep, nearly level soils (fig. 9) on flood plains of the Pecos River. It occupies about 58,800 acres, or approximately 2 percent of the survey Area. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature ranges from 60° to 64° F. The frost-free season ranges from 210 to 220 days. Elevations range from 3,000 to 4,200 feet.

The major soils of this association developed in calcareous alluvium of mixed origin. The degree of salinity of the soils and the depth to the water table are variable.

Arno soils, which make up about 35 percent of the association, are deep, light colored, and saline. In uncultivated areas, gypsum is visible throughout the profile. The water table is usually below a depth of 6 feet throughout the year, but in areas near the backwaters of Lake McMillan, the water table fluctuates with the rise and fall of the water in the lake.

Harkey soils, which make up about 30 percent of the association, are deep, well drained, and moderately dark colored. They occur on low terraces. Some of the areas are saline.

Anthony soils, which make up about 30 percent of the association, are deep, well drained, and light colored. They occur on low terraces. They are easily eroded by wind and water.

Also in this association are small areas of the gray variant of Pima soils. This soil makes up about 5 percent of the association. It is deep, poorly drained, and moderately dark colored. It occurs in narrow drainageways below flowing natural springs or springs that have ceased to flow only in recent years.

A small part of this association is used for irrigated crops. Arno soils are among the least productive in the Eddy Area, and Harkey soils are among the most productive. Arno soils are saline, and surface crusting must be considered in planning irrigation systems. Harkey soils are subject to slight wind and water erosion.

The rest of the association is used for native pasture, recreation, and wildlife habitat. Wildlife refuges, mainly for waterfowl, have been established on Lake McMillan. Reservoirs and ponds along the Pecos River and the Black River provide fishing. The Carlsbad Municipal Lake back of the retention dam in the Pecos River at Carlsbad provides water sports.

The climate is hot and dry. These soils are subject to periodic flooding if they are not protected. The vegetation is affected by salinity, a fluctuating water table, and the texture of the soils. The plant cover consists of alkali sacaton, inland saltgrass, French tamarisk, salt sedge, and seepweed.

Arno soils are unstable, slowly permeable, and subject to flooding unless they are protected. All types of conservation structures need special treatments to control salinity. Pipelines are subject to corrosion. Special designs are needed for concrete structures.

Harkey soils are suitable for all kinds of conservation practices. They are a fair to good source of topsoil if fertilized, but in some areas they are subject to wind erosion if left without plant cover.

Anthony soils are not suitable for conservation structures, because of drifting sand, severe wind erosion, and rapid water intake.

Pima soils have a fluctuating water table. They are subject to periodic flooding if they are not protected or drained. They are unstable in structures and difficult to work. Although they have a high content of organic matter, they are a poor source of topsoil because of their clay content.

Descriptions of the Soils

This section describes the soil series and mapping units of the Eddy Area. The approximate acreage and proportionate extent of each mapping unit are given in tables 1 and 2.

In the pages that follow, a general description of each soil series is given. Each series description has a short narrative description of a representative profile and a much more detailed description of the same profile, from which highly technical interpretations can be made. Following the profile is a brief statement of the range in characteristics of the soils in the series, as mapped in this survey Area. Color names and color symbols given are for dry soil, unless otherwise indicated.

Following the series description, each mapping unit in the series is described individually. For full information on any one mapping unit, it is necessary to read the description of the soil series as well as the description of the mapping unit. Miscellaneous land types, such as Active dune land, are described in alphabetic order along with other mapping units.

After the name of each mapping unit there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. At the end of the description of each mapping unit are listed the capability unit and the range site in which the mapping unit has been placed. The pages where these interpretive groups are described can be learned readily by referring to the "Guide to Mapping Units."

In the Eddy Area, the soils were mapped at two intensities. The composition of the low-intensity mapping units is more variable than that of the high-intensity units but has been controlled well enough to allow interpretations for the expected uses of the soils. The soils mapped at low intensity are identified on the "Guide to Mapping Units" by a symbol consisting of two capital letters. The soils mapped at high intensity are identified by a symbol consisting of a capital letter and a small letter.

For more general information about the soils, the reader can refer to the section "General Soil Map," in which the broad patterns of soils are described. Many of the terms used in the soil descriptions and other parts of the survey are defined in the Glossary.

Active Dune Land

Active dune land (AD) consists of wind-drifted sands that shift and blow freely. This land type is associated with Kermit soils. The areas are 40 to 100 acres in size.

Some of the dunes have become active only in recent years, but others have been rolling and shifting for many years. Blowouts are common in areas where livestock have habitually grazed and trampled, especially around watering areas. Small blowouts quickly grow into larger areas, and active dunes form from the shifting sand. Maintenance of a good vegetative cover is the best way to prevent active dunes from forming. The low rainfall in this Area, however, makes revegetation improbable, once the plant cover is lost. (Dryland capability unit VIIIe–1)

Anthony Series

The Anthony series consists of deep, light-colored, nearly level, calcareous soils that developed in stratified alluvium derived from crystalline and sedimentary rocks. These soils occur on flood plains and low terraces along the Pecos River, generally south of Lake McMillan.

Soils of the Anthony series typically have a surface layer of pale-brown sandy loam about 6 inches thick. The next layer, about 9 inches thick, is light-brown sandy loam. The substratum is pinkish sandy loam, stratified with thin lenses of loamy sand, loam, and silt loam. This layer extends to a depth of more than 60 inches.

These soils are hummocky or billowy and are subject to severe wind erosion if the plant cover is seriously depleted. Permeability is moderately rapid, and the intake rate is rapid. Nearly all of the precipitation that falls soaks into the soil. The water-holding capacity is moderate. The organic-matter content is low or very low, and natural fertility is moderate. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,000 to 3,600 feet.

Anthony soils are used for irrigated crops, native pasture, and wildlife habitat. The vegetation consists mainly of black grama, side-oats grama, little bluestem, blue grama, Javelina, bush muhly, sand muhly, sand dropseed, three-awn, sand sagebrush, broom snakeweed, and mesquite.

TABLE 1.—*Approximate acreage and proportionate extent of the soils surveyed at low intensity*

Soil	Acres	Percent
Active dune land	840	(1)
Anthony sandy loam, 0 to 1 percent slopes, eroded	660	(1)
Arno-Harkey complex, saline, 0 to 1 percent slopes	11, 411	0. 5
Berino loamy fine sand, 0 to 3 percent slopes	12, 397	. 5
Berino complex, 0 to 3 percent slopes, eroded	139, 786	5. 5
Berino-Dune land complex, 0 to 3 percent slopes	20, 650	. 8
Berino-Pajarito complex, 0 to 3 percent slopes, eroded	5, 269	. 2
Cacique loamy sand, 0 to 3 percent slopes, eroded	8, 694	. 3
Cottonwood-Reeves loams, overflow, 0 to 3 percent slopes	10, 078	. 4
Dev-Pima complex, 0 to 3 percent slopes	34, 699	1. 4
Ector stony loam, 0 to 9 percent slopes	197, 150	7. 8
Ector extremely rocky loam, 9 to 25 percent slopes	144, 044	5. 7
Ector-Reagan association, 0 to 9 percent slopes	82, 360	3. 3
Gypsum land	14, 886	. 6
Gypsum land-Cottonwood complex, 0 to 3 percent slopes	67, 394	2. 7
Gypsum land-Reeves complex, 0 to 3 percent slopes, eroded	13, 423	. 5
Karro fine sandy loam, 0 to 3 percent slopes, eroded	3, 706	. 1
Karro loam, 0 to 3 percent slopes	3, 814	. 2
Kermit-Berino fine sands, 0 to 3 percent slopes	198, 076	7. 8
Kimbrough loam, 0 to 3 percent slopes	1, 816	. 1
Kimbrough-Stegall complex, 0 to 3 percent slopes	3, 782	. 1
Kimbrough-Stegall loams, 0 to 3 percent slopes	40, 193	1. 6
Largo loam, 1 to 5 percent slopes	17, 687	. 7
Largo silt loam, overflow, 0 to 1 percent slopes	2, 725	. 1
Largo-Stony land complex, 0 to 25 percent slopes	21, 563	. 9
Likes loamy fine sand, 1 to 5 percent slopes	3, 815	. 2
Limestone rock land	100, 724	4. 0
Mobeetie fine sandy loam, 1 to 5 percent slopes	4, 694	. 2
Pajarito loamy fine sand, 0 to 3 percent slopes, eroded	33, 384	1. 3
Pajarito-Dune land complex, 0 to 3 percent slopes	42, 233	1. 7
Pima silt loam, 0 to 1 percent slopes	33, 246	1. 3
Potter-Simona complex, 5 to 25 percent slopes	18, 581	. 7
Reagan loam, 0 to 3 percent slopes	137, 436	5. 4
Reagan-Upton association, 0 to 9 percent slopes	187, 492	7. 4
Reeves-Gypsum land complex, 0 to 3 percent slopes	184, 386	7. 3
Reeves-Reagan loams, 0 to 3 percent slopes	40, 597	1. 6
Rock land	5, 952	. 2
Russler loam, 1 to 3 percent slopes	3, 633	. 1
Russler-Ector association, 0 to 9 percent slopes	2, 684	. 1
Simona sandy loam, 0 to 3 percent slopes	6, 981	. 3
Simona gravelly fine sandy loam, 0 to 3 percent slopes	45, 884	1. 8
Simona-Bippus complex, 0 to 5 percent slopes	101, 327	4. 0
Simona and Wink fine sandy loams, 0 to 3 percent slopes, eroded	9, 606	. 4
Stony and Rough broken land	11, 794	. 5
Tonuco loamy sand, 0 to 3 percent slopes, eroded	9, 657	. 4
Tonuco loamy fine sand, 0 to 3 percent slopes	36, 737	1. 5
Tonuco loamy fine sand, 0 to 3 percent slopes, eroded	17, 661	. 7
Tonuco-Berino loamy sands, 0 to 5 percent slopes	7, 304	. 3
Upton gravelly loam, 0 to 9 percent slopes	130, 009	5. 2
Upton-Reagan complex, 0 to 9 percent slopes	75, 486	3. 0
Upton-Simona complex, 1 to 15 percent slopes, eroded	15, 800	. 6
Wink loamy fine sand, 0 to 3 percent slopes, eroded	7, 753	. 3
Total	2, 331, 959	92. 3
Sewage lagoon	54	(1)
Water	9, 154	. 4
Intermittent water	639	(1)
City dump	62	(1)
Total	2, 341, 868	92. 7

[1] Less than 0.05 percent.

Typical profile of Anthony sandy loam, 2,140 feet north and 720 feet west of the SE. corner of sec. 17, T. 24 S., R. 29 E.

Ap—0 to 6 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; weak, fine, crumb structure; soft when dry, very friable when moist, nonsticky when wet; very porous; strongly calcareous; mildly alkaline; gradual, smooth boundary.

AC—6 to 15 inches, light-brown (7.5YR 6/3) sandy loam, dark brown (7.5YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard when dry, very friable when moist, nonsticky when wet; very porous; stratified with thin lenses of loam; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1—15 to 20 inches, pinkish-gray (7.5YR 6/2) sandy loam, dark brown (7.5YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2—20 to 60 inches, pink (7.5YR 7/3) stratified loamy sand and sandy loam, brown (7.5YR 5/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; very porous; strongly calcareous; mildly alkaline.

The thickness of the Ap horizon ranges from 5 to 12 inches, and the texture from sandy loam to loamy sand. The color ranges from 7.5YR to 10YR in hue, from 6 to 7 in value, and from 2 to 3 in chroma. It is slightly darker if the soil is irrigated. The color of the soil material between depths of 10 and 40 inches ranges from 10YR to 7.5YR in hue, from 6 to 7 in value, and from 2 to 3 in chroma. This layer is inconsistently thinly layered with moderately coarse textured to medium-textured material. Coarse fragments of rock are scattered throughout the profile.

Anthony soils are associated with soils of the Arno and Harkey series and with the gray variant of the Pima series.

TABLE 2.—*Approximate acreage and proportionate extent of the soils surveyed at high intensity*

Soil	Acres	Percent
Anthony sandy loam, 0 to 1 percent slopes	4, 147	0. 2
Anthony sandy loam, 0 to 1 percent slopes, eroded	4, 713	. 2
Arno-Harkey complex, saline, 0 to 1 percent slopes	4, 899	. 2
Arno silty clay loam, 0 to 1 percent slopes	6, 368	. 3
Atoka loam, 0 to 1 percent slopes	4, 266	. 2
Atoka loam, 1 to 3 percent slopes	2, 371	. 1
Gypsum land-Cottonwood complex, 0 to 3 percent slopes	4, 233	. 2
Harkey sandy loam, 0 to 1 percent slopes	1, 004	. 1
Harkey very fine sandy loam, 0 to 1 percent slopes	12, 830	. 5
Karro loam, 0 to 1 percent slopes	10, 749	. 4
Karro loam, 1 to 3 percent slopes	3, 653	. 1
Karro loam, saline, 0 to 1 percent slopes	2, 763	. 1
Pima silt loam, 0 to 1 percent slopes	7, 605	. 3
Pima silt loam, saline, 0 to 1 percent slopes	422	(1)
Pima clay loam, gray variant, 0 to 1 percent slopes	993	(1)
Reagan loam, 0 to 1 percent slopes	45, 865	1. 8
Reagan loam, 1 to 3 percent slopes	6, 768	. 3
Reagan loam, saline, 0 to 1 percent slopes	959	(1)
Reeves loam, 0 to 1 percent slopes	4, 689	. 2
Reeves loam, 1 to 3 percent slopes	2, 901	. 1
Reeves loam, saline, 0 to 1 percent slopes	2, 679	. 1
Reeves loam, shallow, 0 to 1 percent slopes	5, 139	. 2
Russler loam, 1 to 3 percent slopes	3, 017	. 1
Upton gravelly loam, 0 to 9 percent slopes	34, 561	1. 4
Upton soils, 0 to 1 percent slopes	1, 940	. 1
Upton soils, 1 to 3 percent slopes	3, 115	. 1
Total	182, 649	7. 3

[1] Less than 0.05 percent.

Anthony sandy loam, 0 to 1 percent slopes (Aa).—This soil has the profile described as typical of the Anthony series. It occurs mainly along the Pecos River in the general area of Carlsbad. Included in mapping were areas of Harkey sandy loam, 0 to 1 percent slopes, which make up less than 5 percent of the acreage. Also included were areas of Anthony sandy loam, 1 to 3 percent slopes, which make up about 1,200 acres.

This soil is used for irrigated crops, but cultivated areas are subject to severe wind erosion if they are left bare. Rough tillage, mulching, and use of cover crops are needed. Revegetation is difficult because of high temperatures and erratic rainfall. Seedling damage resulting from high winds can be expected. Careful management of irrigation water is needed to check water erosion and excessive leaching of plant nutrients. This soil is also used for wildlife habitat. (Irrigated capability unit IIe–3; dryland capability unit VIIe–2; Sandy range site)

Anthony sandy loam, 0 to 1 percent slopes, eroded (AE, Ah).—This soil has been eroded by wind, but otherwise its profile is similar to the one described as typical of the series. It occurs along the Pecos River in the general area from Lake McMillan to Malaga. Included in mapping were areas of Harkey and Arno soils, which make up less than 1 percent of the acreage. Most of the acreage was mapped at high intensity. The small acreage mapped at low intensity is less severely eroded than the areas mapped at high intensity.

Dunes 2 to 6 feet high occur in these areas. These dunes are somewhat stabilized by the woody plants around which they have formed. The areas between dunes are nearly bare or are sparsely vegetated.

This soil is used for native pasture and wildlife habitat. Careful management is needed to control wind erosion and to maintain a cover of desirable forage plants. Revegetation is difficult because of high temperatures and erratic rainfall. (Dryland capability unit VIIe–1; Deep Sand range site)

Arno Series

The Arno series consists of deep, moderately well drained, light-colored, nearly level soils that developed in moderately fine textured to fine textured alluvium. These soils occur on flood plains along the Pecos River. They are calcareous and moderately to strongly saline. The water table is usually below a depth of 6 feet throughout the year, but in areas of these soils near the backwaters of Lake McMillan, the water table fluctuates with the rise and fall of the water in the lake. These areas are subject to flooding from the Pecos River and its tributaries, but the floodwaters are not damaging.

Soils of the Arno series typically have a surface layer of light reddish-brown to reddish-brown silty clay loam. Reddish-gray silty clay begins at a depth of about 14 inches. This layer contains finely divided gypsum crystals, which are leached from the surface layer when the soil is irrigated and concentrate at a depth below 24 inches. A layer of reddish-brown silty clay is at a depth of about 34 inches, and it extends to a depth of 60 inches or more.

Runoff is very slow, and the erosion hazard is no more than very slight. Permeability is slow. The water-holding capacity is high. The natural fertility is low. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 210 to 220 days. Elevations range from 3,000 to 4,000 feet.

A limited acreage that has adequate subsurface drainage and is protected from flooding is used for irrigated crops. Only salt-tolerant crops are suitable. Most of the rest of the acreage is used for native pasture. The vegetation is dominantly alkali sacaton, but there are lesser amounts of inland saltgrass, four-wing saltbush, and French tamarisk.

Typical profile of Arno silty clay loam, 2,150 feet west and 700 feet north of the SE. corner of sec. 22, T. 24 S., R. 29 E.

Ap1—0 to 4 inches, light reddish-brown (5YR 6/3) silty clay loam, reddish brown (5YR 4/3) when moist; weak, fine, subangular blocky structure breaking to weak, fine, granular; slightly hard when dry, very friable when moist, sticky and plastic when wet; strongly calcareous; moderately alkaline; gradual, wavy boundary.

Ap2—4 to 9 inches, reddish-brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/2) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; moderately alkaline; clear, smooth boundary.

C1—9 to 14 inches, light reddish-brown (5YR 6/3) silty clay loam, reddish brown (5YR 4/3) when moist; weak, coarse, prismatic structure breaking to weak, medium, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; pressure faces on ped surfaces; strongly calcareous; moderately alkaline; diffuse boundary.

C2cs—14 to 34 inches, reddish-gray (5YR 5/2) silty clay, dark reddish brown (5YR 3/2) when moist; weak, coarse, prismatic structure breaking to weak, fine and medium, angular blocky; extremely hard when dry, very firm when moist, sticky and plastic when wet; pressure faces on ped surfaces; faint, finely divided gypsum crystals and lime in seams and splotches; strongly calcareous; moderately alkaline; diffuse boundary.

C3cs—34 to 60 inches, reddish-brown (5YR 5/3) silty clay, reddish brown (5YR 4/3) when moist; weak, coarse, subangular blocky structure; extremely hard when dry, very firm when moist, sticky and plastic when wet; pressure faces on ped surfaces; faint, finely divided gypsum crystals and lime in seams and splotches, strongly calcareous; moderately alkaline.

The thickness of the A horizon ranges from 4 to 12 inches, and the texture, from clay loam to silty clay. The color ranges from 5YR to 7.5YR in hue, from 5 to 6 in value, and from 2 to 3 in chroma. The C horizon extends to a depth of more than 60 inches. Its color range is nearly that of the surface layer. Finely divided gypsum crystals, ranging from faint to prominent, occur below a depth of about 9 inches. In places thinly stratified fine sandy loam, silt loam, and clay occur at a depth of 20 to 40 inches.

Arno soils are associated with Pima soils, gray variant, and with soils of the Harkey and Anthony series.

Arno silty clay loam, 0 to 1 percent slopes (An).—This soil has the profile described as typical of the Arno series. Included in mapping were areas of Pima clay loam, gray variant, 0 to 1 percent slopes, in swales and drainageways. The included areas make up less than 5 percent of the acreage.

This soil is used for native pasture and for irrigated crops. It is not productive, unless subsoil drainage is adequate and irrigation water is well managed. Salt-tolerant crops, such as cotton, barley, and alfalfa, are suitable. (Irrigated capability unit IVs–1; dryland capability unit VIs–1; Salty Bottomland range site)

Arno-Harkey complex, saline, 0 to 1 percent slopes (AH, Ak).—This complex consists of soils affected by salinity and a fluctuating high water table. Arno silty clay loam, 0 to 1 percent slopes, makes up 40 to 60 percent of the acreage; Harkey very fine sandy loam, saline, 0 to 1 percent slopes, and Anthony soils make up 20 to 30 percent; and Pima clay loam, gray variant, 0 to 1 percent slopes, makes up 10 to 20 percent. This complex occurs on flood plains of the Pecos River and its tributaries. The largest area is north of Lake McMillan. Some areas are within the high-intensity survey, and some are within the low-intensity survey. All the areas that include the Pima soil are within the high-intensity survey.

This complex is flooded periodically. Recent deposits, as much as 3 feet thick, of reddish, clayey sediments overlie the natural soils in areas along the present river channel and in areas adjacent to the backwaters of Lake McMillan. Drainage of the subsoil is restricted by the water table, which fluctuates with the rise and fall of waters in the Pecos River and Lake McMillan. Natural springs occur at the head of drainageways in areas of the Pima soil. Some areas of the Pima soil have a seasonally fluctuating water table.

The soils of this complex are generally moderately to strongly saline, but some areas of Harkey and Anthony soils are only slightly to moderately saline. The vegetation consists mainly of such salt-tolerant plants as alkali sacaton, inland saltgrass, and saltcedar. The soils are suitable for wildlife habitat. (Dryland capability unit VIs–1; Arno soil is in Salty Bottomland range site; Harkey soil is in Salt Flats range site)

Atoka Series

The Atoka series consists of well-drained, moderately dark colored, level to gently sloping soils that developed in moderately deep old alluvium derived from calcareous sedimentary rocks. These soils (fig. 10) occur on uplands along the Pecos River in the general area of Artesia and Carlsbad. They are loamy and calcareous.

Soils of the Atoka series typically have a surface layer of grayish-brown to brown loam about 8 inches thick. The next layer, about 15 inches thick, consists of brown

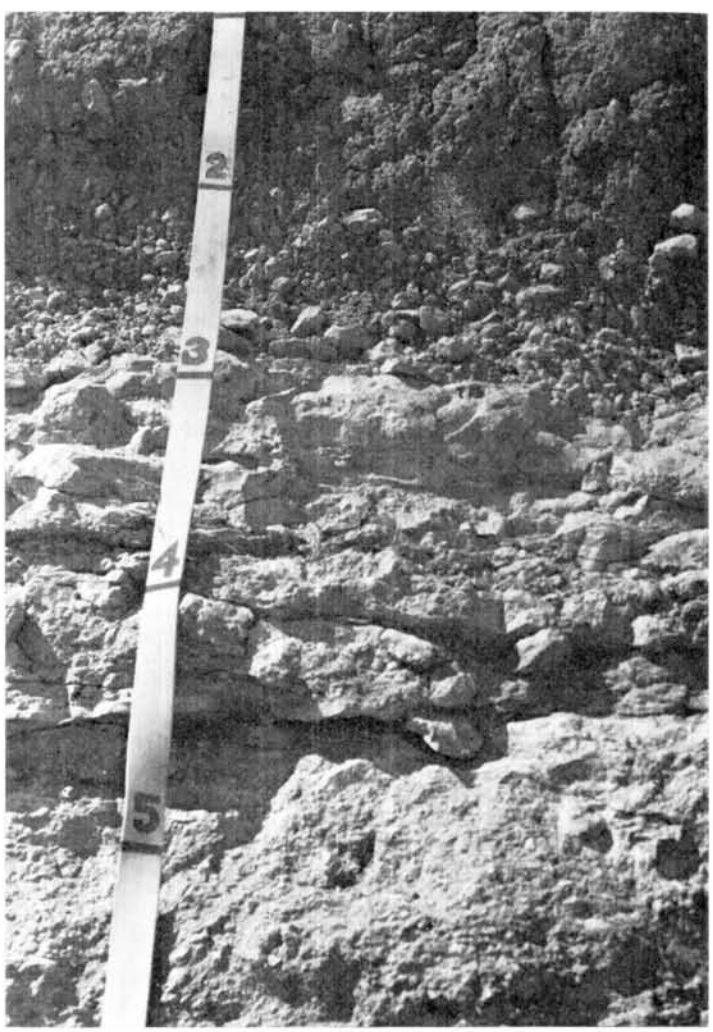

Figure 10.—**Profile of Atoka loam, 0 to 1 percent slopes.**

to dark-brown loam. A layer, about 10 inches thick, that is enriched with calcium carbonate rests on fractured, indurated caliche at a depth below 33 inches.

These soils are uneroded or only slightly eroded. The natural fertility is moderate, and the organic-matter content is low. Permeability is moderate, and the water-holding capacity is moderate. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature ranges from 60° to 64° F. The frost-free season is 210 to 220 days. Elevations range from 3,050 to 4,300 feet.

Atoka soils are used for irrigated crops and native pasture. The vegetation consists of black grama, blue grama, tobosa, side-oats grama, bush muhly, and vine-mesquite.

Typical profile of Atoka loam, 0 to 1 percent slopes, NE¼NW¼SW¼NE¼ sec. 4, T. 23 S., R. 27 E.

A11—0 to 2 inches, grayish-brown (10YR 5/2) very fine sandy loam, dark brown (10YR 3/3) when moist; moderate, thin and very thin, platy structure; soft when dry, friable when moist, nonsticky when wet; common very fine and fine pores; abundant fine and medium roots; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

A12—2 to 8 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; hard when dry, friable when moist; slightly sticky when wet; abundant worm casts; common very fine and fine pores; abundant fine and medium roots; strongly calcareous; mildly alkaline; gradual, smooth boundary.

AC—8 to 15 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard when drp, friable when moist, slightly sticky when wet; abundant worm casts; common very fine and fine pores; plentiful very fine and fine roots; few seams of lime; strongly calcareous; mildly alkaline; gradual, smooth boundary.

C1—15 to 23 inches, dark-brown (10YR 4/3) loam, dark brown (7.5YR 4/4) when moist; very weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky when wet; abundant worm casts; common very fine and fine pores; plentiful very fine and fine roots; few seams of lime; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2ca—23 to 33 inches, light yellowish-brown (10YR 6/4) loam, yellowish brown (10YR 5/4) when moist; very weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky when wet; common, fine to medium, white (10YR 8/2) lime concretions, very pale brown (10YR 8/3) when moist; common very fine and fine pores; few very fine roots; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

C3cam—33 inches, fractured, indurated, gravelly caliche.

The A horizon ranges from 4 to 8 inches in thickness. Its texture is very fine sandy loam, loam, or fine sandy loam. The color of the A horizon ranges from 10YR to 7.5YR in hue, from 5 to 6 in value, and from 2 to 3 in chroma. The C2ca horizon ranges from 9 to 22 inches in thickness. Its texture is generally loam to light clay loam, but in places it is silty clay loam. The depth to indurated caliche or strongly cemented gravel ranges from 20 to 36 inches.

Atoka soils are associated with soils of the Upton and Reagan series.

Atoka loam, 0 to 1 percent slopes (Ao).—This soil has the profile described as typical of the Atoka series. It occurs in broad swales on the plains west of the Pecos River near Artesia and Carlsbad. Included in mapping were areas of Reagan and Upton soils, which make up less than 5 percent of the acreage. Also included were areas of Atoka fine sandy loam.

This soil is used for irrigated crops and native pasture. It is fertile, but the underlying caliche and the moderate water-holding capacity limit the growth of deep-rooted crops. It can be used for shallow-rooted crops. (Irrigated capability unit IIIs–14; dryland capability unit VIs–3; Loamy range site)

Atoka loam, 1 to 3 percent slopes (At).—This soil occurs on the sides of swales on the plains west of the Pecos River. Near Lakewood, about one-third of the acreage is underlain by strongly cemented gravel at a depth of 20 to 36 inches. Included in mapping were areas of Upton soils, which make up less than 5 percent of the acreage, and a small acreage of Atoka fine sandy loam, most of which is in the La Huerta area, near Carlsbad.

This soil is used for irrigated crops and native pasture. It is nearly as productive as Atoka loam, 0 to 1 percent slopes, but it is subject to water erosion unless irrigation water is carefully managed. The water can be more easily controlled if the soil is bench leveled to a grade of 0.2 to 0.3 percent. The water-holding capacity is variable; it ranges from low in shallower areas to moderately high in deeper areas. (Irrigated capability unit IIIe–2; dryland capability unit VIs–3; Loamy range site)

Berino Series

The Berino series consists of deep, noncalcareous, yellowish-red to red, sandy soils that developed in wind-worked material of mixed origin. These soils occur as gently sloping, undulating to hummocky areas in the "Deep Sand Country" east of the Pecos River. These are the most extensive of the deep, sandy soils in the Eddy Area. Roads built by oil companies give access to much of the acreage.

Soils of the Berino series typically have a surface layer of yellowish-red fine sand about 17 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish-red fine sandy loam, and the lower part is red to dark-red sandy clay loam. The underlying material consists of lime-enriched, pink clay loam (soft caliche).

Berino soils are subject to continuing wind and water erosion. If the vegetative cover is seriously depleted, the erosion hazard is severe. The soils are difficult to revegetate once the plant cover is lost, because rainfall is undependable. They lack surface water, except for short periods after the infrequent heavy rains. They retain nearly all the moisture that falls, but the surface layer has low water-holding capacity. Permeability is rapid in the surface layer, but it is moderately slow in the subsoil. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 208 to 220 days. Elevations range from 3,100 to 4,200 feet.

All of the acreage is used for native pasture and wildlife habitat. If there is sufficient moisture, the soils are productive. The vegetation consists of bush muhly, plains bristlegrass, blue grama, mesquite, and Havard oak.

Typical profile of Berino fine sand, 1,100 feet south and 1,280 feet east of the NW. corner of sec. 27, T. 17 S., R. 30 E.

A1—0 to 17 inches, yellowish-red (5YR 4/6) fine sand, yellowish red (5YR 3/6) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; noncalcareous; neutral; abrupt, smooth boundary.

B21t—17 to 23 inches, yellowish-red (5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) when moist; weak, coarse, prismatic structure; very hard when dry, friable when moist, slightly sticky and nonplastic when wet; thin, continuous clay films on all ped surfaces; noncalcareous; neutral; clear, smooth boundary.

B22t—23 to 36 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; moderate, coarse, prismatic structure breaking to weak, medium and coarse, subangular blocky; extremely hard when dry, firm when moist, sticky and plastic when wet; thin, continuous clay films on all ped surfaces; noncalcareous; neutral; clear, wavy boundary.

B3t—36 to 50 inches, dark-red (2.5YR 3/6) light sandy clay loam, dark red (2.5YR 2/6) when moist; weak, coarse, prismatic structure; extremely hard when dry, firm when moist, sticky and plastic when wet; thin, continuous clay films on all ped surfaces; few distinct splotches of lime; noncalcareous; neutral to mildly alkaline; abrupt, wavy boundary.

Cca—50 to 58 inches, pink (5YR 7/3) clay loam (soft caliche), light reddish brown (2.5YR 6/4) when moist; massive; extremely hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; moderately alkaline.

The thickness of the A1 horizon ranges from 8 to 36 inches, and the texture, from fine sand to loamy sand. The color ranges from 5YR to 7.5YR in hue, from 4 to 5 in value, and from 4 to 6 in chroma. The color of the B2t and B3t horizons ranges from 2.5YR to 5YR in hue, from 3 to 5 in value, and from 4 to 8 in chroma. The depth to the Cca horizon ranges from 36 to 60 inches. In some places indurated caliche occurs at a depth of 36 to 60 inches and the Cca horizon is very thin or is lacking entirely.

Berino soils are associated with Cacique, Pajarito, Wink, Kermit, and Tonuco soils.

Berino loamy fine sand, 0 to 3 percent slopes (BA).—Except for the texture and thickness of the surface layer, this soil has a profile similar to that described as typical of the Berino series. It occurs on long, smooth slopes in the uplands in the eastern part of the survey Area. Included in mapping were areas of Berino complex, 0 to 3 percent slopes, eroded, and Pajarito loamy fine sand, 0 to 3 percent slopes, eroded. The included areas make up less than 15 percent of the acreage.

The surface layer is noncalcareous, yellowish-red loamy fine sand about 12 inches thick. In some areas the surface layer is fine sandy loam or fine sand. The subsoil consists of noncalcareous clay loam 22 to 45 inches thick. The depth to a distinct layer of lime accumulation ranges from 36 to about 60 inches. Permeability is moderately slow in the subsoil.

This soil is slightly to moderately eroded, and the hazard of further erosion is severe if the vegetative cover is seriously depleted. It is well suited to pasture if there is enough moisture. (Dryland capability unit VIIe–2; Sandy range site)

Berino complex, 0 to 3 percent slopes, eroded (BB).—This complex consists mostly of the Berino soil described as having the profile typical of the series. It occurs, in association with Pajarito soils, as the smoother areas in swales and depressions between the dunes of Kermit soils. Included in mapping were small areas of each of the following soils: Cacique loamy sand, 0 to 3 percent slopes, eroded; Pajarito loamy fine sand, 0 to 3 percent slopes, eroded; Wink loamy fine sand, 0 to 3 percent slopes, eroded; and Kermit fine sand. In places the included soils occur in association with each other, but in other places they occur individually. They make up less than 20 percent of the acreage.

The soils in this complex have been altered by wind erosion. Their surface layer, 9 to 36 inches thick, is hummocky to billowy. The hummocks range from 1 to 3 feet in height. A few areas are barren, and in these places the subsoil of sandy clay loam is exposed or is near the surface.

These soils are generally stabilized by Havard oak, mesquite, and other vegetation. They are used for grassland and are productive if there is enough moisture. The hazard of wind erosion is severe if the plant cover is seriously depleted. (Dryland capability unit VIIe–1; Deep Sand range site)

Berino-Dune land complex, 0 to 3 percent slopes (BD).—This complex consists of deep, sandy soils and of Dune land (fig. 11). Berino soils make up about 40 to 50 percent of the acreage, and Dune land makes up 35 to 50 percent. Except that the surface layer has been severely eroded by wind, the Berino soil in this complex has a profile similar to that described as typical of the series. In places the subsoil of sandy clay loam is exposed. Included in mapping were small areas of Kermit fine sand; Cacique loamy sand, hummocky, 0 to 3 percent slopes, eroded; and Active dune land. The included areas make up less than 15 percent of the acreage.

Rounded dunes of fine sand, 3 to 8 feet high and generally 8 to 30 feet wide at the base, are characteristic of this complex. These dunes have formed around woody plants, such as mesquite, and each windstorm either adds sand or takes some away. The surface layer of the soil is thicker in areas adjacent to the dunes.

This complex is used mainly for range. Wind erosion has damaged the soils so seriously that the yield of desirable vegetation is limited. There is little or no vegetation in areas where the subsoil is exposed or where the surface layer is thin. (Dryland capability unit VIIe–1; Deep Sand range site)

Berino-Pajarito complex, 0 to 3 percent slopes, eroded (BP).—This complex is made up of the same soils as Berino complex, 0 to 3 percent slopes, eroded, but in different proportions. Berino soils make up about 40 to 50 percent of the acreage, and Pajarito soils, a like amount. Included in mapping were areas of Kermit fine sand; Wink loamy fine sand, hummocky, 0 to 3 percent slopes, eroded; and Active dune land. The included soils make up less than 15 percent of the acreage.

The soils of this complex are highly susceptible to wind erosion. Good management is needed to maintain enough vegetation to check erosion.

Nearly all of the acreage is used for native pasture and wildlife habitat. The soils are productive if there is enough moisture. (Dryland capability unit VIIe–1; Deep Sand range site)

Bippus Series

The Bippus series consists of deep, moderately dark colored, well-drained, calcareous soils that developed in

Figure 11.—**An area of Berino-Dune land complex, 0 to 3 percent slopes.**

alluvium. These soils occur mainly on flood plains of intermittent streams in the southeastern part of the survey Area, but smaller areas are scattered throughout the eastern part. In the Eddy Area, Bippus soils are mapped only with Simona soils.

Soils of the Bippus series typically have a surface layer that is about 21 inches thick. The uppermost few inches consists of grayish-brown sandy loam. This material overlies dark grayish-brown silty clay loam. Beneath the surface layer is a transitional layer of dark-brown to brown silty clay loam about 16 inches thick. The substratum, about 11 inches thick, is brown clay loam enriched by calcium carbonate. It rests on weakly cemented caliche at a depth of about 4 feet. The surface layer is thinner near the center of wide potholes or drainageways, and the texture is silty clay loam.

Bippus soils are uneroded or are only slightly eroded. They are subject to periodic flooding, and there is some deposition of sandy material at the edges of the flood plain. Runoff is medium. Permeability is moderately slow, and the water-holding capacity is high. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,100 to 3,500 feet.

Bippus soils are used for range and wildlife habitat. They are among the most productive soils in the Area if there is enough moisture. The vegetation consists mainly of sacaton, alkali sacaton, vine-mesquite, tobosa, blue grama, buffalograss, burrograss, and mesquite. Good management is needed to maintain desirable forage species and to lessen the hazard of water erosion. Revegetation is difficult because of the high temperatures and the low, erratic rainfall.

A typical profile of Bippus silty clay loam in a drainageway on the west side of State Route 31, about 990 feet west and 1,650 feet south of the NE. corner of sec. 3, T. 21 S., R. 30 E.

A11—0 to 3 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant fine and very fine roots; many very fine pores; slightly calcareous; mildly alkaline; abrupt boundary.

A12—3 to 21 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure breaking to moderate, medium, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; plentiful fine, medium, and coarse roots; common fine, very fine, and coarse pores; slightly calcareous; mildly alkaline; gradual boundary.

AC—21 to 37 inches, dark-brown to brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) when moist; weak, coarse, prismatic structure breaking to coarse, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; many fine and very fine roots; common very fine pores; strongly calcareous; moderately alkaline; gradual boundary.

C1ca—37 to 48 inches, brown (7.5 YR 5/3) clay loam, dark brown (7.5YR 4/3) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; few fine and very fine roots; common fine and

very fine pores; many, fine to medium, soft, distinct, lime concretions; strongly calcareous; moderately alkaline; gradual boundary.

C2ca—48 to 60 inches, weakly cemented caliche.

The A11 horizon ranges from 1 to 8 inches in thickness. The color ranges from 10YR to 7.5YR in hue and from 4 to 5 in value. The A12 horizon ranges from 12 to 24 inches in thickness. The color ranges from 10YR to 7.5YR in hue and from 3 to 5 in value. The AC horizon ranges from 12 to 20 inches in thickness. The color ranges from 7.5YR to 5YR in hue, from 3 to 4 in value, and from 2 to 4 in chroma. The C1ca horizon ranges from 8 to 11 inches in thickness. The color ranges from 10YR to 7.5YR in hue, from 4 to 5 in value, and from 2 to 3 in chroma. The texture is silty clay loam or clay loam. The depth to weakly cemented caliche is more than 36 inches.

Bippus soils are associated with Simona soils.

Cacique Series

The Cacique series consists of yellowish-red to red, noncalcareous soils that are shallow to moderately deep over indurated caliche. These soils developed in a thin mantle of eolian sand of mixed origin. They occur as scattered areas on plains along the western edge of the "Deep Sand Country" in the eastern part of the Eddy Area. They are nearly level to gently sloping.

Soils of the Cacique series (fig. 12) typically have a surface layer of yellowish-red loamy sand about 5 inches thick. The subsoil, about 19 inches thick, is noncalcareous. The upper part consists of yellowish-red sandy loam, and the lower part of red sandy clay loam. Indurated caliche underlies the subsoil at a depth of about 24 inches.

Permeability is rapid in the surface layer and moderate in the subsoil. The water-holding capacity is moderately low. The soils are subject to severe wind erosion if the vegetative cover is seriously depleted. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 208 to 220 days. Elevations range from 3,100 to 4,200 feet.

Wind erosion has severely altered the surface layer of these soils. Hummocks of fine sand, 1 to 3 feet high, have formed around woody plants. The soils between the hummocks are mostly barren. They have a thin surface layer of loamy fine sand or fine sand. In places the subsoil of sandy loam or sandy clay loam is exposed.

Cacique soils are used for native pasture. The vegetation consists of grama and other short grasses and of mesquite and other woody plants.

Typical profile of Cacique loamy sand that has a slope of about 1 percent; 2,190 feet south and 660 feet west of the northeast corner of sec. 25, T. 21 S., R. 29 E.

A1—0 to 5 inches, yellowish-red (5YR 5/6) loamy sand, yellowish red (5YR 4/6) when moist; weak, coarse, subangular blocky structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; neutral; clear, wavy boundary.

B1t—5 to 17 inches, yellowish-red (5YR 5/6) sandy loam, yellowish red (5YR 4/6) when moist; weak, coarse, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; few medium pores; thin, patchy clay films on vertical ped surfaces; noncalcareous; neutral; clear, wavy boundary.

B2t—17 to 24 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; weak to moderate, coarse, prismatic structure breaking to weak, coarse, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; many fine and medium pores; thin, patchy clay films on the vertical sides of peds and thin, continuous clay films in the pores; noncalcareous; neutral; abrupt, wavy boundary.

Ccam—24 inches, indurated caliche, fractured and platy.

The color of the A and B horizons ranges from 5YR to 2.5YR in hue, from 3 to 5 in value, and from 5 to 6 in chroma. The B2t horizon ranges from 6 to 19 inches in thickness. The texture of that horizon ranges from sandy loam and light sandy clay loam in the upper part to sandy clay loam in the lower part. In places a thin B3ca horizon occurs above the indurated caliche. The depth to fractured, platy, indurated caliche ranges from 12 to 36 inches.

Cacique soils are associated with Berino and Tonuco soils.

Cacique loamy sand, 0 to 3 percent slopes, eroded (CA).—This soil occurs as patches 40 to 320 acres in size along the western edge of the "Deep Sand Country" east of the Pecos River. Included in mapping were small areas of Berino complex, 0 to 3 percent slopes, eroded, and Berino loamy fine sand, 0 to 3 percent slopes. Also included were small sand dunes that are somewhat stabilized by mesquite and severely eroded areas where caliche is exposed. The included areas make up less than 15 percent of the acreage.

This soil is susceptible to severe wind erosion if the vegetative cover is seriously depleted. Water erosion is

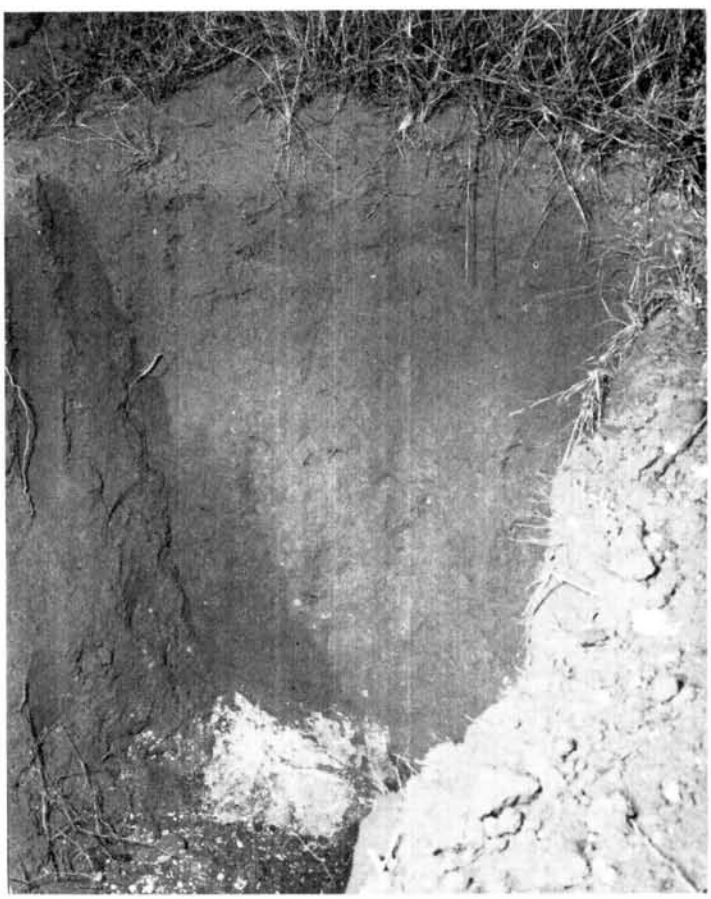

Figure 12.—**Profile of Cacique loamy sand. Note the indurated caliche that underlies the subsoil.**

a lesser problem, because most of the rainfall soaks into the soil rapidly.

This soil is used for native pasture. (Dryland capability unit VIIe–2; Sandy range site)

Cottonwood Series

The Cottonwood series consists of well-drained, calcareous, light-colored soils that are shallow or very shallow over beds of gypsum or alabaster. These soils occur on uplands throughout the central part of the survey Area. They are nearly level to gently sloping. In the Eddy Area, Cottonwood soils are mapped only with Reeves soils and with Gypsum land.

Soils of the Cottonwood series typically have a surface layer of light-gray to light brownish-gray loam. They are underlain by gypsiferous material at a depth of about 9 inches.

These soils are subject to severe erosion if the vegetative cover is lost. Revegetation is extremely difficult because rainfall is undependable. Surface water is lacking, except for short periods after the infrequent heavy rains. The surface layer is moderately permeable, and the underlying gypsiferous material is slowly permeable. The surface crusts over upon drying. The water-holding capacity is very low to low. The rooting zone is restricted by the underlying gypsiferous material. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 220 days. Elevations range from 3,000 to 3,800 feet.

Cottonwood soils are used only for native pasture. The vegetation consists mainly of gyp grama, black grama, alkali sacaton, gyp grass, coldenia, and American tarbush.

Typical profile of Cottonwood loam, 3 miles NW. of Loving, 150 feet SE. of NW. corner of NE¼ sec. 13, T. 23 S., R. 27 E.

A11—0 to 1 inch, light-gray (10YR 7/2) loam, brown (10YR 5/3) when moist; strong, very thin to thin, platy structure; soft when dry, very friable when moist, nonsticky when wet; discontinuous horizon; spots of organic matter as much as 1/4 inch thick between A11 and A12 horizons; slightly to strongly calcareous; neutral to mildly alkaline; abrupt, smooth boundary.

A12—1 to 5 inches, light brownish-gray (10YR 6/2) loam, brown (10YR 5/2) when moist; massive; soft when dry, friable when moist, nonsticky when wet; common prominent lime mycelia; slightly to strongly calcareous; neutral to mildly alkaline; gradual, smooth boundary.

C1—5 to 9 inches, light brownish-gray (10YR 6/2) loam, dark brown (10YR 4/3) when moist; massive; soft when dry, friable when moist, nonsticky when wet; common prominent lime mycelia; slightly to strongly calcareous; neutral to mildly alkaline; abrupt, wavy boundary.

C2cs—9 to 36 inches, white (10YR 8/2) gypsum, very pale brown (10YR 7/3) when moist; massive; alternately soft and very hard when dry, nonsticky when wet; contains semi-indurated lenses; horizon covered by discontinuous silica shell 1/16 to 1/4 inch thick; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C3cs—36 to 60 inches, very pale brown (10YR 7/4) gypsum, brownish yellow (10YR 6/6) when moist, intermingled with white (10YR 8/2) gypsum, light gray (10YR 7/2) when moist; massive; soft when dry, nonsticky when wet; strongly calcareous; moderately alkaline.

The thickness of the A horizon ranges from 4 to 10 inches, and the texture, from loam to loamy fine sand. The color ranges from 10YR to 5YR in hue, from 6 to 7 in value, and from 2 to 4 in chroma. The underlying gypsiferous material ranges from soft, loamy material to hard rock. Its color ranges from 10YR 8/2 to 5YR 5/6.

Cottonwood soils are associated with soils of the Reagan and Reeves series and with Gypsum land.

Cottonwood-Reeves loams, overflow, 0 to 3 percent slopes (CR).—In this complex Cottonwood soils make up 50 to 70 percent of the acreage, and Reeves soils, 30 to 50 percent. The Cottonwood soils occur above the Reeves soils on the sides of swales. They are the shallower and less productive of the two.

These soils are well drained but are subject to periodic flooding. The vegetation is alkali sacaton, scattered saltcedar, and inland saltgrass.

These are the most productive of the soils affected by gypsum, because they receive added moisture from floodwaters. They are susceptible to water erosion if the plant cover is seriously depleted, and good management is needed to maintain an adequate cover of vegetation. All of the acreage is used for native pasture and wildlife habitat. (Dryland capability unit VIs–1; Salty Bottomland range site)

Dev Series

The Dev series consists of nearly level, moderately dark colored, gravelly soils that developed in alluvium. These soils are underlain by very gravelly and cobbly material many feet thick. They occur on flood plains of intermittent streams, adjacent to hills and mountains. Most of the acreage is in the western part of the survey Area. In the Eddy Area, Dev soils are mapped only with Pima soils.

Soils of the Dev series typically have a surface layer of grayish-brown gravelly loam about 3 inches thick. The next layer is grayish-brown gravelly loam. Loamy soil material begins at a depth of about 15 inches. It is mixed with gravel and cobblestones, which make up 60 to 90 percent of the soil mass.

These soils are subject to water erosion. They are flooded periodically by runoff from higher lying soils. Repeated deposition of soil material has altered the vegetative cover somewhat. Permeability is moderate above the very gravelly material, but the gravel restricts the root zone. The water-holding capacity is low. Natural fertility is low. Rainfall amounts to 10 to 16 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,400 to 4,600 feet.

Dev soils are used for native pasture. The vegetation consists mainly of alkali sacaton, vine-mesquite, blue grama, tobosa, and buffalograss. Scattered desert willow and Apache-plume grow in the drainageways.

Typical profile of Dev gravelly loam, on a 1 percent slope, 100 feet west and 50 feet north of the SE. corner of sec. 17, T. 18 S., R. 21 E.

A1—0 to 3 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure to weak, fine, sub-

angular blocky; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; abundant fine and medium roots; strongly calcareous; mildly alkaline; abrupt boundary.

AC—3 to 15 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; soft when dry, friable when moist, slightly sticky and nonplastic when wet; abundant fine and medium roots; common fine and very fine pores; strongly calcareous; mildly alkaline; gradual boundary.

C—15 to 60 inches, very gravelly loam; weak threads or films of lime below a depth of 2 feet; coarse fragments make up 60 to 90 percent of the horizon.

The thickness of the A1 horizon ranges from 1 to 4 inches, and the gravel content, from 30 to 70 percent. The color is within the 10YR hue but ranges from 4 to 5 in value. The AC horizon ranges from 10 to 14 inches or more in thickness. Its texture is similar to that of the surface layer. The color of the AC horizon is within the 10YR hue but ranges from 2 to 3 in chroma. A few seams of lime occur in the very gravelly and cobbly material at a depth below 2 feet.

Dev soils are associated with Pima soils.

Dev-Pima complex, 0 to 3 percent slopes (DP).—The Dev and Pima soils of this complex have the profile described as typical of their respective series. Dev gravelly loam makes up about 50 to 65 percent of the acreage, and Pima silt loam makes up about 25 to 35 percent. Included in mapping were small areas of alluvial soils. The included areas make up less than 15 percent of the acreage.

This complex is used for native pasture. In places the soils have been damaged by deposition of cobblestones and gravel and the vegetation has been altered by water erosion. Good management of the watershed and adjacent higher lying soils is needed to check runoff after heavy rains. (Dryland capability unit VIe–1; Bottomland range site)

Dune Land

Dune land consists of mounds of wind-drifted sand that has accumulated around vegetation. This land type is nearly level to gently sloping and undulating. It occurs in the "Deep Sand Country" east of the Pecos River. Dunes cover about 60 percent of the surface. They range from a few inches in height to about 6 feet. In the Eddy Area, Dune land is mapped only as a complex with Berino and Pajarito soils. The soil material was probably similar to that of those soils before it was so severely altered by wind erosion.

The dunes are partly stabilized by vegetation, mainly mesquite and scattered short and tall grasses and annuals. The areas between dunes are nearly barren. They are subject to continued severe erosion by both wind and water. Small blowouts are common.

Dune land is difficult to traverse by ordinary means. There is little or no water. Use is limited to grazing and wildlife habitat.

Ector Series

The Ector series consists of very shallow to shallow, well-drained, calcareous, stony and extremely rocky soils that are underlain by limestone. They generally occur as nearly level to gently sloping areas on ridges or mesa tops and on steep side slopes of mountains and hills. Most of the acreage is in the western part of the Area.

Soils of the Ector series typically have a surface layer of grayish-brown stony loam about 1 inch thick. The next layer, about 5 inches thick, consists of dark-brown stony loam. The underlying limestone is exposed in many places.

These soils are subject to water erosion if the vegetative cover is destroyed, but the many stones and rock outcrops help to stabilize them in nearly level to gently sloping areas. There is little or no surface water, except for brief periods after the infrequent heavy rains. Runoff is rapid after the soils become saturated. Permeability is moderate, and the water-holding capacity is very low to low. Rainfall amounts to 10 to 18 inches annually, and the mean annual temperature is 58° to 62° F. The frost-free season is 195 to 210 days. Elevations range from 3,300 to 4,800 feet.

Ector soils are used for native pasture and wildlife habitat. They are productive if there is enough moisture. The vegetation consists mainly of black grama, blue grama, hairy grama, beargrass, tobosa, sotol, agave, ocotillo, snakeweed, tarbush, and yucca. Juniper grows at the higher elevations.

Typical profile of Ector stony loam, on a 3 percent slope, 120 feet west of the quarter corner between sections 6 and 7, in sec. 7, T. 22 S., R. 26 E.

A1—0 to 1 inch, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, thin, platy structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

AC—1 to 6 inches, dark-brown (7.5YR 4/2) stony loam, dark brown (7.5YR 3/2) when moist; moderate, medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; mildly alkaline; abrupt, irregular boundary.

R—6 inches, light-colored limestone bedrock.

The thickness of the A1 horizon ranges from 1 to 4 inches. The color ranges from 10YR to 7.5YR in hue, from 5 to 6 in value, and from 2 to 4 in chroma. The AC horizon is slightly darker or slightly lighter colored than the surface layer in places. It ranges from 2 to 14 inches in thickness. The depth to bedrock ranges from 1 to 18 inches.

Ector soils are associated with Reagan and Russler soils and with Limestone rock land.

Ector stony loam, 0 to 9 percent slopes (EC).—This soil has the profile (fig. 13) described as typical of the series. It is extensive in the hills and mountains in the western part of the Area. Included in mapping were areas of shallow to moderately deep soils in swales and the deeper drainageways. These soils make up less than 10 percent of the acreage. Limestone crops out in places. Small potholes, generally less than 2 acres in size, occur in the Bogle Flats area. The potholes make up less than 1 percent of the acreage. They are significant stock-watering places after the periodic heavy rains.

This is a fertile soil, but it is limited by shallowness over limestone bedrock and the density of stones and rock outcrops. The water-holding capacity is generally very low. The erosion hazard is severe if the vegetative cover is seriously depleted by overgrazing or trampling.

This soil is used for native pasture and wildlife habitat. Good management is needed to check erosion.

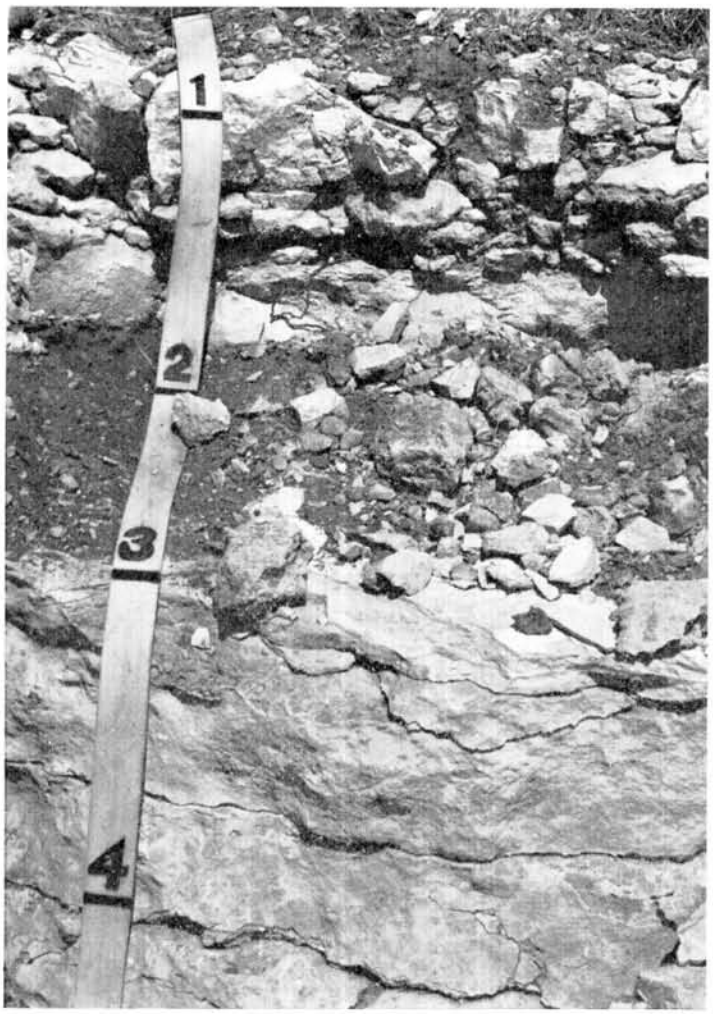

Figure 13.—**Profile of Ector stony loam, 0 to 9 percent slopes.**

Reestablishment of native grasses is difficult because rainfall is undependable. (Dryland capability unit VIIs–5; Limestone Hills range site)

Ector extremely rocky loam, 9 to 25 percent slopes (EE).—This soil occurs on rolling to hilly uplands. It is extensive in the western part of the Area. Exposed bedrock and catsteps cover 20 to 50 percent of the surface. The rock outcrops keep the soil relatively stable. Vertical and horizontal cracks in the bedrock are numerous. Included in mapping were pockets of Ector stony loam, 0 to 9 percent slopes, between the rock outcrops. Also included were rocky areas where vertical cliffs are common. The included areas make up less than 15 percent of the acreage.

This soil absorbs water readily, but the water-holding capacity is very low to low. Runoff is rapid after the soil becomes saturated. Surface water is generally lacking, but there are a few seeps and low-yielding springs in canyons.

This soil is suited to native pasture and wildlife habitat. Good management is needed to maintain a cover of vegetation that will adequately control water erosion. Revegetation is difficult because rainfall is undependable. (Dryland capability unit VIIs–5; Limestone Hills range site)

Ector-Reagan association, 0 to 9 percent slopes (ER).—This soil association occurs in a regular pattern along the contact zone between limestone uplands and lower lying, broad alluvial plains or fans. It is in the western part of the survey Area. Ector stony loam, 0 to 9 percent slopes, makes up about 50 to 80 percent of the acreage, and Reagan loam, 0 to 3 percent slopes, about 15 to 40 percent. Included in mapping were areas of Upton gravelly loam, 0 to 9 percent slopes, and of Pima silt loam, 0 to 1 percent slopes. The included areas make up less than 10 percent of the acreage.

The Ector soil is the least productive of these soils. The Reagan soil produces more forage than the other soils, but it is subject to water erosion if the vegetative cover is seriously depleted. Runoff is rapid from the Ector soil after heavy rainfall, and good management is needed to check erosion. Revegetation is difficult because rainfall is undependable.

All the acreage is used for native pasture and wildlife habitat. (Ector soil is in dryland capability unit VIIs–5 and Limestone Hills range site; Reagan soil is in dryland capability unit VIs–4 and Loamy range site)

Gypsum Land

Gypsum land (GA) consists of very steep and steep, broken, or eroded exposures of gypsiferous rocks and earths and very shallow soils. It is difficult to cross by ordinary means. Most of the acreage is near the Texas State line along breaks leading to the Black River, and in the vicinity of the eastern side of Lake McMillan. The areas are associated with Cottonwood and Reeves soils. Included in mapping were areas of Cottonwood loam, 0 to 3 percent slopes. The included areas make up less than 15 percent of the acreage.

The gypsiferous materials range from white, chalky earths to hard, light-colored, crystalline gypsum rocks. There are pockets of soil material as much as 10 inches thick. Fine to coarse gypsum crystals are common on the surface of barren areas.

Surface runoff is rapid to very rapid. The water-holding capacity is very low. The soil material is well drained, but very droughty and saline. Plant roots are limited by the salinity of the gypsiferous material close to the surface. The vegetation consists of a sparse cover of gyp grama, soaptree yucca, gyp grass, coldenia, and broom snakeweed. Good management is needed to maintain a cover of vegetation.

Gypsum land is used for wildlife habitat and for limited grazing. Forage production on this land type is among the lowest in the survey Area. (Dryland capability unit VIIs–2; Gyp Hills range site)

Gypsum land-Cottonwood complex, 0 to 3 percent slopes (GC, Gs).—This complex (fig. 14) consists of barren, gypsiferous rocks and very shallow soils. Gypsum land makes up about 50 to 70 percent of the acreage, and Cottonwood loam, about 20 to 40 percent. Sinkholes are common, but they do not contain water. This complex occurs on uplands in the central part of the survey Area. Most of the acreage was mapped at low intensity. Some areas of limestone outcrop near Lake McMillan and

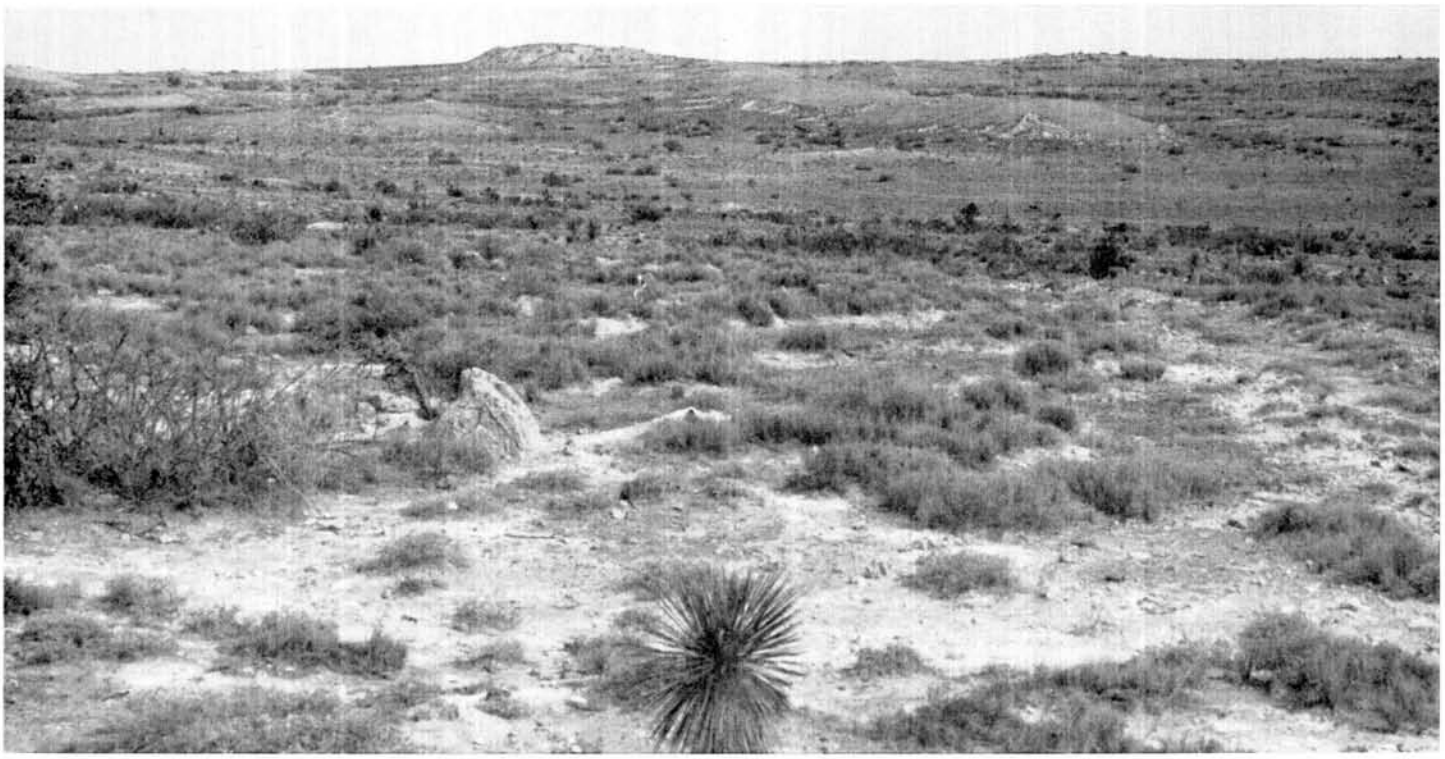

Figure 14.—An area of Gypsum land-Cottonwood complex, 0 to 3 percent slopes.

northeast of Artesia were included in the low-intensity survey. The areas within the high-intensity survey include areas of Reeves loam, 0 to 3 percent slopes. The included areas make up less than 10 percent of the acreage.

The Cottonwood soil in this complex has the profile described for the Cottonwood series.

This complex is used for native pasture and wildlife habitat. Good management is needed to prevent overgrazing and to check erosion. Revegetation is difficult because rainfall is undependable. (Dryland capability unit VIIs–3; Gyp Flats range site)

Gypsum land-Reeves complex, 0 to 3 percent slopes, eroded (GR).—Gypsum land makes up about 50 to 60 percent of this complex, and Reeves sandy loam, about 30 to 40 percent. Included in mapping were areas of Reagan loam, 0 to 3 percent slopes, and of Pajarito-Dune land complex, 0 to 3 percent slopes. The included areas make up less than 10 percent of the acreage.

The Reeves soil in this complex consists of sandy loam to a depth of about 14 inches.

Windblown sand from adjoining sandy soils has greatly altered the surface of these areas. Low sand dunes or hummocks less than 3 feet in height have formed around mesquite bushes and other woody plants. Many areas between hummocks are nearly barren.

These soils are very droughty. The water-holding capacity is low to very low. Permeability is rapid in the surface layer of the soils and in the low dunes.

This complex is used for native pasture and wildlife habitat. Good management is needed to check wind erosion. Revegetation is difficult because rainfall is undependable. Forage production is among the lowest in the survey Area. (Gypsum land is in dryland capability unit VIIs–3 and Gyp Flats range site; Reeves soil is in dryland capability unit VIe–2 and Sandy range site)

Harkey Series

The Harkey series consists of deep, well-drained, strongly calcareous, moderately dark colored soils that developed in mixed alluvium. These soils occur on low terraces on flood plains of major streams. They are naturally free of salts, except in areas adjacent to Lake McMillan and the Pecos River. In these areas the water table is at a depth of less than 5 feet part of the year.

In cultivated areas, soils of the Harkey series typically have a surface layer of brown very fine sandy loam 9 inches thick. In uncultivated areas, this layer is slightly lighter colored and contains less organic matter. The next layer, to a depth of more than 50 inches, is brown loam or very fine sandy loam.

These soils are uneroded or only slightly eroded. They are moderately fertile and have a low content of organic matter. Permeability is moderate, and the water-holding capacity is high. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 210 to 220 days. Elevations range from 3,000 to 3,400 feet.

Harkey soils are used for irrigated crops, native pasture, and wildlife habitat. The vegetation consists mainly of black grama, blue grama, tobosa, and vine-mesquite.

In areas affected by salts and that have a fluctuating water table, the vegetation is mainly alkali sacaton, inland saltgrass, four-wing saltbush, and saltcedar.

Typical profile of Harkey very fine sandy loam, 150 feet northeast of the SW. corner of NW¼SE¼ sec. 24, T. 22 S., R. 27 E.

Ap—0 to 9 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

AC—9 to 14 inches, light-brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 4/4) when moist; very weak, coarse, prismatic structure to massive; slightly hard when dry, very friable when moist, nonsticky when wet; few, fine, prominent seams of lime; few fine crystals of gypsum or salts, these most abundant in plowpan; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1—14 to 30 inches, brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 4/4) when moist; very coarse, prismatic structure; soft when dry, very friable when moist, nonsticky when wet; few, fine, prominent seams of lime; few fine crystals of gypsum or salts; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

C2—30 to 37 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, nonsticky when wet; few, fine to medium, distinct mottles of lime; strongly calcareous; mildly alkaline; clear, smooth boundary.

C3—37 to 51 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; massive; soft when dry, very friable when moist, nonsticky when wet; strongly calcareous; gradual, smooth boundary.

C4—51 to 87 inches, brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist; strongly calcareous; moderately alkaline.

The thickness of the Ap horizon ranges from 7 to 10 inches. The color ranges from 10YR to 7.5YR in hue, from 5 to 6 in value, and from 3 to 6 in chroma. The texture includes very fine sandy loam, loam, and sandy loam. The thickness of the AC horizon ranges from 5 to 13 inches. The color is lighter than that of the surface horizon. The texture is dominantly loam to light clay loam but includes very fine sandy loam. In places there are strata, generally less than 6 inches thick, of material ranging from sandy loam to light sandy clay loam. A few coarse fragments occur in some profiles.

Harkey soils are associated with Anthony and Arno soils and with the gray variant of Pima soils.

Harkey sandy loam, 0 to 1 percent slopes (Ha).—Except for the texture of the surface layer, this soil has a profile similar to that described as typical of the series. It occurs on low terraces along the Pecos River, mainly in the Carlsbad area. Included in mapping were areas of Anthony sandy loam, 0 to 1 percent slopes, which make up less than 5 percent of the acreage, and a small area of Harkey sandy loam, 1 to 3 percent slopes.

This soil is less productive than Harkey very fine sandy loam, 0 to 1 percent slopes. It is subject to moderate wind and water erosion, and careful management of both soil and irrigation water is needed. The water-holding capacity is moderate in the surface layer, but it is high in the subsoil and substratum. The water-intake rate is moderately rapid.

This soil is used for irrigated crops, native pasture, and wildlife habitat. (Irrigated capability unit IIe–4; dryland capability unit VIIe–2; Sandy range site)

Harkey very fine sandy loam, 0 to 1 percent slopes (Hk).—This soil has the profile described as typical of the series. It occurs on low terraces of the Pecos, Penasco, and Black Rivers. Included in mapping were areas of Anthony and Arno soils and of Pima clay loam, gray variant, 0 to 1 percent slopes. The included areas make up less than 5 percent of the acreage.

This soil is used for irrigated crops, native pasture, and wildlife habitat. It is suited to all the crops grown in the Area. (Irrigated capability unit IIs–2; dryland capability unit VIs–4; Loamy range site)

Karro Series

The Karro series consists of light-colored, strongly calcareous, loamy soils that developed in deep, old alluvium derived from calcareous, sedimentary rocks. These soils are enriched by lime absorbed from ground water or left by runoff from adjacent limy uplands.

Soils of the Karro series typically have a surface layer of light brownish-gray loam about 10 inches thick. The next layer, about 10 inches thick, consists of very pale brown loam. The substratum is very pale brown and pink clay loam that extends to a depth of more than 60 inches. Calcium carbonate has accumulated at a depth of about 46 inches.

Karro soils are nearly level. They occur on uplands near Artesia, Malaga, and Black River Village. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 210 to 220 days. Elevations range from 3,000 to 3,800 feet.

These soils are highly susceptible to wind erosion if the plant cover is seriously depleted or if cultivated areas are left bare. The surface crusts readily, and the crust impedes seedling emergence. Permeability is moderate. The water-holding capacity is high. The organic-matter content is low.

Karro soils are used for native pasture, irrigated crops, and wildlife habitat. The vegetation consists mainly of blue grama, tobosa, sand dropseed, three-awn, broom snakeweed, and yucca. Chlorosis, a yellowing of leaves caused by an iron deficiency that inhibits growth, affects many kinds of plants grown on these soils, especially grain sorghum, cotton, bermudagrass, and cottonwood trees. A zinc deficiency affects alfalfa.

Typical profile of Karro loam, near the center of the eastern half of NW¼SE¼ sec. 7, T. 24 S., R. 28 E.

Ap—0 to 10 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; common very fine and fine pores; plentiful very fine, fine, and medium roots; strongly calcareous; moderately alkaline; clear boundary.

AC—10 to 20 inches, very pale brown (10YR 7/3) loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; common very fine and fine pores; plentiful very fine and fine roots; few prominent seams of lime; strongly calcareous; moderately alkaline; clear boundary.

C1—20 to 46 inches, very pale brown (10YR 7/3) clay loam, light yellowish brown (10YR 6/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; common very fine

and fine pores; plentiful very fine and fine roots; seams of lime; strongly calcareous; moderately alkaline; gradual boundary.

C2ca—46 to 60 inches, pink (7.5YR 8/4) clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard when dry, friable when moist, sticky when wet; common very fine and fine pores; few very fine roots; disseminated lime; strongly calcareous; moderately alkaline; gradual boundary.

C3ca—60 to 90 inches, pink (7.5YR 8/4) clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard when dry, friable when moist, sticky when wet; common very fine and fine pores; distinct disseminated lime; strongly calcareous; moderately alkaline; gradual boundary.

The thickness of the Ap horizon ranges from 6 to 12 inches. The texture is loam or fine sandy loam in the uppermost few inches and loam in the lower part. The color of the A and AC horizons is within the 10YR hue. It ranges from 6 to 7 in value and from 2 to 3 in chroma. The thickness of the C1 horizon ranges from 12 to 26 inches. The color is within the 10YR hue. It ranges from 6 to 7 in value and from 3 to 4 in chroma. The texture ranges from loam to clay loam. The color of the Cca horizon ranges from 10YR to 7.5YR in hue, from 6 to 8 in value, and from 3 to 4 in chroma. The texture ranges from loam to clay loam. This horizon is slightly hard to very hard and marly when dry.

Karro soils are associated with Reeves soils.

Karro fine sandy loam, 0 to 3 percent slopes, eroded (KA).—The surface layer of this soil has been eroded by wind. Except for the texture of the surface layer, the profile is similar to the one described as typical of the series. In places the subsoil of dry, hard loam is exposed. Included in mapping were areas of Reagan and Russler soils, which make up less than 5 percent of the acreage. Also included were areas of deep, sandy, windblown soils, which make up less than 10 percent of the acreage.

Rounded hummocks of loamy fine sand or fine sandy loam, 1 to 3 feet high and generally 4 to 10 feet wide at the base, are characteristic of this soil. These hummocks have formed around woody plants, such as mesquite and creosotebush, and each windstorm either adds sand or takes some away. The areas between hummocks, which are nearly bare of vegetation, make up about 60 to 75 percent of the acreage. Desert pavement is thinly scattered between the hummocks. The surface layer of the soil is thicker adjacent to the hummocks.

The water-intake rate is rapid, and permeability is moderate. The water-holding capacity is moderate in the surface layer, but it is high in the subsoil.

This soil is used for native pasture and wildlife habitat. The reestablishment of desirable native species is difficult because rainfall is scanty and unpredictable. (Dryland capability unit VIIe–2; Sandy range site)

Karro loam, 0 to 3 percent slopes (Kl).—This soil has a high content of lime. Included in mapping were small areas of Reeves soils, which make up less than 15 percent of the acreage.

This soil is highly susceptible to wind and water erosion if the vegetative cover is seriously depleted. The water-holding capacity is high, and permeability is moderate.

This soil is used for native pasture and wildlife habitat. The reestablishment of desirable species of forage is difficult because rainfall is scanty and unpredictable. (Dryland capability unit VIIe–2; Sandy range site)

Karro loam, 0 to 1 percent slopes (Kr).—This soil has the profile described as typical of the series. Included in mapping were areas of Reeves soils, which make up less than 5 percent of the acreage.

This soil is moderately fertile, but productivity is restricted by the high content of lime. Most of the acreage is irrigated, and nearly all of the irrigated acreage has been leveled to a grade of less than 0.3 percent. Deep-rooted crops are suitable. Small areas are used for native pasture and wildlife habitat. (Irrigated capability unit IIs–13; dryland capability unit VIIe–2; Sandy range site)

Karro loam, 1 to 3 percent slopes (Ku).—This soil is adjacent to Karro loam, 0 to 1 percent slopes. It is on relatively short side slopes along drainageways. Included in mapping were areas of Karro loam, 0 to 1 percent slopes, and of Reeves loam, 1 to 3 percent slopes, which make up less than 5 percent of the acreage.

This soil is susceptible to water erosion. It is used mainly for irrigated crops. Most of it has been bench leveled to grades of 0.2 to 0.3 percent. The surface layer has been severely cut or filled in the leveling operation. Small areas of this soil are used for native pasture and wildlife habitat. (Irrigated capability unit IIe–2; dryland capability unit VIIe–2; Sandy range site)

Karro loam, saline, 0 to 1 percent slopes (Kv).—Except for its greater content of salt, this soil has a profile similar to that described as typical of the series. Seepage from adjoining uplands or impeded surface drainage has brought about moderate to strong salinity. Included in mapping were areas of Reeves loam, saline, 0 to 1 percent slopes, which make up less than 5 percent of the acreage.

This soil is highly susceptible to wind erosion when the seedbed is being prepared. It is cloddy when plowed. The surface crusts readily, and the crust impedes emergence of seedlings.

This soil is used for irrigated crops, native pasture, and wildlife habitat. (Irrigated capability unit IIIs–6; dryland capability unit VIs–2; Salt Flats range site)

Kermit Series

The Kermit series consists of deep, light-colored, noncalcareous, excessively drained loose sands. The surface is undulating to billowy, and stabilized dunes rise 3 to 15 feet or more. Most of the fine particles have been winnowed out and blown away. The soil material resists weathering, and the areas have a uniform appearance. In the Eddy Area, Kermit soils are mapped only with Berino soils. They occur throughout the eastern part of the Area.

Soils of the Kermit series typically have a surface layer of yellowish-red fine sand about 7 inches thick. Below this is yellowish red fine sand to a depth of more than 5 feet.

Kermit soils are slightly to moderately eroded. Permeability is very rapid, and the water-holding capacity is low. The organic-matter content is low. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 210 to 220 days. Elevations range from 3,100 to 3,500 feet.

Kermit soils are used for native pasture and wildlife habitat. They are productive if there is enough moisture. Revegetation is difficult once the plant cover is lost, because rainfall is undependable. Surface water is lacking. These soils are difficult to cross by ordinary means.

Typical profile of Kermit fine sand, near the center of sec. 1, T. 21 S., R. 29 E.

A1—0 to 7 inches, yellowish-red (5YR 5/6) fine sand, reddish brown (5YR 4/4) when moist; single grain; loose when dry and moist, nonsticky when wet; noncalcareous; neutral; clear, smooth boundary.

C—7 to 60 inches, yellowish-red (5YR 5/6) fine sand, reddish brown (5YR 4/4) when moist; single grain; loose when dry and moist, nonsticky when wet; noncalcareous; neutral.

The A1 horizon ranges from 1 to 8 inches in thickness. Its color ranges from 10YR to 5YR in hue, from 5 to 6 in value, and from 3 to 6 in chroma. The C horizon ranges from 3 to more than 5 feet in thickness. Its color is slightly lighter than that of the surface layer.

Kermit soils are associated with Berino soils.

Kermit-Berino fine sands, 0 to 3 percent slopes (KM).—The Kermit and Berino soils of this complex have the profile described as typical of their respective series. Kermit fine sand makes up about 40 to 60 percent of the acreage, and Berino fine sand, 30 to 40 percent. Included in mapping were areas of Active dune land and Dune land. These areas make up less than 20 percent of the acreage.

All of the acreage is used for native pasture and wildlife habitat. The soils are productive if there is enough moisture. They are highly susceptible to wind erosion, and good management is needed to maintain a cover of vegetation. (Dryland capability unit VIIe–3; Kermit soil is in Sand Hills range site; Berino soil is in Deep Sand range site)

Kimbrough Series

The Kimbrough series consists of moderately dark colored, well-drained, noncalcareous to weakly calcareous soils that are shallow or very shallow over fractured, platy, indurated caliche. These soils occur on the High Plains, in the northeastern part of the survey Area. They are nearly level to gently sloping.

Soils of the Kimbrough series typically have a surface layer of dark grayish-brown to dark-brown loam about 7 inches thick. The next layer, about 2 inches thick, consists of brown loam enriched with calcium carbonate. Fractured, platy, indurated caliche begins at a depth below about 9 inches.

These soils are uneroded or only slightly eroded. Permeability is moderate, and the water-holding capacity is very low. Runoff is slow. The organic-matter content is moderate. Rainfall amounts to 10 to 16 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 195 to 210 days. Elevations range from 4,200 to 4,500 feet.

Kimbrough soils are fertile. They are used for native pasture and wildlife habitat. The vegetation is mainly black grama, blue grama, side-oats grama, tobosa, broom snakeweed, and mesquite. Oilfields have been extensively developed in these areas.

Typical profile of Kimbrough loam, 60 feet south and 40 feet west of the quarter corner between sections 13 and 24, in sec. 24, T. 16 S., R. 31 E.

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure to moderate, fine, granular; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; neutral; abrupt, smooth boundary.

A12—3 to 7 inches, dark-brown (7.5YR 4/3) loam, dark brown (7.5YR 3/2) when moist; weak, medium to fine, subangular blocky structure; very hard when dry, friable when moist, sticky and slightly plastic when wet; slightly calcareous; mildly alkaline; abrupt, smooth boundary.

C1ca—7 to 9 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

C2cam—9 inches, white, fractured, platy, indurated caliche.

The combined thickness of the A11 and A12 horizons ranges from 2 to 10 inches. The color ranges from 10YR to 7.5YR in hue, from 4 to 5 in value, and from 2 to 3 in chroma. The Cca horizon does not occur in all profiles. If it is present, it is as much as 5 inches thick. Its color is lighter in value and higher in chroma than that of the A11 horizon. The depth to fractured, layered, indurated caliche ranges from 2 to 15 inches. Large fragments of indurated caliche occur in some profiles.

Kimbrough soils are associated with Stegall and Potter soils.

Kimbrough loam, 0 to 3 percent slopes (KO).—This soil has the profile described as typical of the Kimbrough series. It occurs on uplands in the northeastern part of the Area. Included in mapping were areas of Stegall clay loam, 0 to 1 percent slopes, and small playas. The included soils make up less than 15 percent of the acreage.

Permeability is moderate, and the water-holding capacity is very low. Runoff is slow.

This soil is fertile, but it is droughty and its usefulness is limited by shallowness over caliche. It is used for native pasture. (Dryland capability unit VIIs–1; Shallow range site)

Kimbrough-Stegall complex, 0 to 3 percent slopes (KS).—The Kimbrough and Stegall soils of this complex have the profile described as typical of their respective series. Kimbrough loam makes up 75 to 85 percent of the acreage, and Stegall clay loam, 15 to 25 percent. Small playas, or sinkholes, dot the area. In most places there are about two sinkholes in each section. Included in mapping were areas of moderately deep loams and deep clay loams in swales and sinkholes. The included areas make up less than 15 percent of the acreage.

The Kimbrough soil occupies the higher part of the landscape. It is less productive than the Stegall soil.

The Stegall soil occurs in swales and depressions. It is subject to periodic flooding and is easily eroded by water if the vegetative cover is seriously depleted. Reestablishment of desirable forage species is difficult, because temperatures are high and rainfall is undependable.

This complex is used for native pasture and wildlife habitat. The sinkholes fill up with water after heavy rains and are a source of stock water for brief periods. (Kimbrough soil is in dryland capability unit VIIs–1

and Shallow range site; Stegall soil is in dryland capability unit VIs–4 and Clayey range site)

Kimbrough-Stegall loams, 0 to 3 percent slopes (KT).—The Kimbrough soil of this complex has the profile described as typical of the series. Kimbrough loam makes up about 60 to 80 percent of the acreage, and Stegall loam, 15 to 35 percent. Small playas, or sinkholes, dot the area. In most places there are about two sinkholes in each section. Included in mapping were areas of moderately deep loams and deep silty clay loams and areas of Simona soils. The included soils make up less than 10 percent of the acreage.

The Kimbrough soil occupies the higher part of the landscape. It is less productive than the Stegall soil.

The Stegall soil occurs in swales and depressions. It has a surface layer of brown to dark-brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part is dark-brown to brown clay loam, and the lower part is reddish-brown sandy clay loam that is enriched by calcium carbonate. The underlying caliche is fractured, platy, and indurated.

The Stegall soil is subject to periodic flooding. It is easily eroded by water if the vegetative cover is seriously depleted. Reestablishment of desirable forage species is difficult because temperatures are high and rainfall is undependable.

This complex is used for native pasture and wildlife habitat. The sinkholes fill up with water after heavy rains and are a source of stock water for brief periods. (Kimbrough soil is in dryland capability unit VIIs–1 and Shallow range site; Stegall soil is in dryland capability unit VIs–4 and Bottomland range site)

Largo Series

The Largo series consists of deep, reddish-brown, calcareous, gently sloping soils that developed in alluvium derived from upland sedimentary material. These soils occur on alluvial fans. They are scattered throughout the eastern part of the Area.

Soils of the Largo series typically are reddish brown to a depth of more than 60 inches. The uppermost part is loam about 4 inches thick, the middle part is silt loam to a depth of about 47 inches, and the lower part is loam.

These soils have been slightly eroded by water. Deep, V-shaped gullies are common in the drainageways. Permeability is moderate, and the water-holding capacity is high. Runoff is medium. The organic-matter content is low, and fertility is moderate. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,000 to 4,200 feet.

Largo soils are used for native pasture and wildlife habitat. The vegetation consists of black grama, blue grama, side-oats grama, tobosa, vine-mesquite, and creosotebush.

Typical profile of Largo loam, 1,730 feet north and 75 feet west of the SE. corner of sec. 29, T. 16 S., R. 28 E.

A1—0 to 4 inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) when moist; weak, medium, platy structure in the uppermost 1 inch grading to weak, medium and fine, subangular blocky; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine pores; plentiful fine and medium roots; common faint seams of lime and few soft concretions; strongly calcareous; mildly alkaline; abrupt boundary.

AC—4 to 20 inches, reddish-brown (5YR 5/3) silt loam, reddish brown (5YR 4/3) when moist; weak, coarse, prismatic structure breaking to weak, coarse, subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; many fine and medium pores; many very fine and fine roots; common faint seams of lime and few soft concretions; few limestone pebbles; strongly calcareous; mildly alkaline; gradual boundary.

C1—20 to 47 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) when moist; weak, coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many fine and medium pores; few very fine roots; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

IIC2—47 to 65 inches +, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; about 5 percent gravel; strongly calcareous; mildly alkaline.

The thickness of the A1 horizon ranges from 3 to 6 inches. The color ranges from 5YR to 7.5YR in hue, from 5 to 6 in value, and from 3 to 6 in chroma. The texture includes very fine sandy loam, loam, and silt loam. The thickness of the AC horizon ranges from 4 to 20 inches. In places the color is higher in value and chroma than that of the A1 horizon. The texture ranges from very fine sandy loam to silt loam. The color of the C horizon ranges from 5YR to 2.5YR in hue, from 5 to 7 in value, and from 3 to 6 in chroma. The texture ranges from silt loam to loam and silty clay loam. This horizon contains thin strata of fine sandy loam and sandy clay loam, mixed with coarse fragments of caliche, sandstone, limestone, shale, and siltstone. In some profiles, gravel is scattered throughout and makes up about 5 percent of the soil mass.

Largo soils are associated with Stony land.

Largo loam, 1 to 5 percent slopes (LA).—This soil has the profile described as typical of the series. It occurs on upland alluvial fans in the eastern part of the Area. Included in mapping were areas of Largo silt loam, overflow, 0 to 1 percent slopes, and areas of Pajarito soils. The included areas make up less than 15 percent of the acreage.

This soil is slightly eroded. It is subject to water erosion if the vegetative cover is depleted, and good management is needed. In most of the drainageways, a large V-shaped gully occurs midway in the channel.

This soil is used for native pasture and wildlife habitat. It is fertile, and there are no root restrictions. (Dryland capability unit VIe–1; Loamy range site)

Largo silt loam, overflow, 0 to 1 percent slopes (LG).—This soil occurs on bottom lands throughout the central part of the Area. The surface layer consists of reddish-brown silt loam about 6 inches thick. The next layer, which extends to a depth of more than 60 inches, is stratified reddish-brown silt loam and silty clay loam. Included in mapping were areas of Largo loam, 1 to 5 percent slopes, and of Pajarito soils. The included areas make up less than 15 percent of the acreage.

This soil is subject to water erosion if the vegetative cover is depleted. Permeability is moderately slow below the surface layer.

This soil is used for native pasture and wildlife habitat. It is fertile, and there are no root restrictions. (Dryland capability unit VIe–1; Bottomland range site)

Largo-Stony land complex, 0 to 25 percent slopes (LN).—The Largo soil in this complex has the profile described as typical of the series. Largo loam, 1 to 5 percent slopes, makes up 30 to 50 percent of the acreage, and Stony land, 30 to 50 percent. Included in mapping were areas of other soils in approximately the following percentages: Largo silt, loam, overflow, 0 to 1 percent slopes, and other soils in small, intermittent lakes, less than 2 percent; Simona soils on ridgetops, about 15 percent; and small, scattered areas of severely eroded Pajarito soils, less than 3 percent.

The Largo soil occurs on gently sloping alluvial fans in valleys. It is subject to water erosion. Runoff is slow.

Stony land occurs in the general vicinity of Dog Canyon Draw and along the eastern side of Lake McMillan. It consists of steep, extremely dissected or gullied areas on ridges, breaks, and hillsides. Highly fractured, thin-bedded limestone, sandstone, siltstone, shale, and gypsiferous rock are exposed. There is little or no soil material. Stony land is droughty, and runoff is rapid. It produces little forage.

This complex is used for native pasture and wildlife habitat. (Largo soil is in dryland capability unit VIs–4 and Loamy range site; Stony land is in dryland capability unit VIIs–4 and Hills and Breaks range site)

Likes Series

The Likes series consists of gently sloping, somewhat excessively drained, moderately dark colored, calcareous soils that developed in deep alluvial and colluvial material derived from High Plains sediments. These soils occur on fans below escarpments and breaks in the northeastern part of the Area.

Likes soils typically have a surface layer of brown loamy fine sand about 12 inches thick. The underlying material, to a depth of 60 inches or more, is pale-brown loamy fine sand that has been enriched by calcium carbonate.

These soils are highly susceptible to wind and water erosion. Rills and gullies and low hummocks of sand are common. Erosion is more severe if the vegetative cover is depleted. Runoff from adjoining uplands is rapid. Permeability is rapid, and the water-intake rate is high. Nearly all the moisture that falls soaks in, but the water-holding capacity is low. Rainfall amounts to 10 to 15 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,300 to 4,200 feet.

Likes soils are used for native pasture and wildlife habitat. They are productive if the moisture supply is sufficient. Revegetation is extremely difficult because rainfall is undependable. Surface water is lacking, except for brief periods after the infrequent heavy rains. The vegetation consists of side-oats grama, black grama, sand bluestem, three-awn, broom snakeweed, mesquite, and yucca.

Typical profile of Likes loamy fine sand, 1,980 feet west of the NE. corner of sec. 36, T. 16 S., R. 31 E.

A1—0 to 12 inches, brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; very porous; noncalcareous to slightly calcareous; neutral to mildly alkaline; few, fine, soft and hard concretions of lime; clear boundary.

C1ca—12 to 24 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) when moist; weak, medium, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; very porous; few lime concretions, ¼ to ½ inch in size; strongly calcareous; mildly alkaline; gradual boundary.

C2ca—24 to 60 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; very porous; many fine and coarse lime concretions; strongly calcareous; mildly alkaline.

The thickness of the A1 horizon ranges from 10 to 18 inches. The color ranges from 10YR to 7.5YR in hue, from 4 to 6 in value, and from 2 to 3 in chroma. The texture of both the A1 and Cca horizons ranges from loamy fine sand to fine sand.

Likes soils are associated with Mobeetie soils and with Stony and Rough broken land.

Likes loamy fine sand, 1 to 5 percent slopes (LS).—This soil has the profile described as typical of the Likes series. Included in mapping were small areas of Mobeetie fine sandy loam, 1 to 5 percent slopes. The Mobeetie soil makes up less than 15 percent of the acreage.

This soil is slightly to moderately eroded. Rills and gullies are common, and the surface is billowy. Hummocks range from 1 to 3 feet in height in some places. In most areas the surface layer is stabilized by mesquite and other woody plants. The hazard of wind erosion is severe if the vegetative cover is depleted.

This soil is used for native pasture and wildlife habitat. It is productive if there is enough moisture. (Dryland capability unit VIIe–1; Deep Sand range site)

Limestone Rock Land

Limestone rock land (LT) occurs as areas 160 to 2,000 acres or more in size, along primary and secondary drainageways in the western part of the survey Area. It consists of steep to very steep canyon walls and escarpments. The bedrock is mainly thin-bedded limestone, but there is some sandstone, siltstone, and shale. The rocks have been highly dissected by stream erosion. Natural caves occur in places. Outcrops cover 60 to 90 percent of the surface. Small accumulations of mixed alluvial and colluvial debris occur at the base of slopes and at the bottom of narrow valleys. Most drainageways are intermittent stream channels. The soil material, wherever it occurs, is stony or rocky loam. Little or none clings to the slopes. Included in mapping were areas of Ector soils, with which this land type is associated. Ector soils make up less than 15 percent of the acreage.

Runoff is rapid to very rapid, and the water-holding capacity is very low. There is little or no surface water.

Limestone rock land is used for wildlife habitat and for limited grazing. The vegetation consists mainly of grama grasses, sotol, agave, cactus, ocotillo, and algerita. Scattered juniper, pinyon, and mahogany grow at the higher elevations, where rainfall is slightly more plentiful. Plant roots are restricted to the soil material between rocks and to small pockets of soil on slopes. The areas are difficult to cross by ordinary means. (Dryland capability unit VIIs–5; Limestone Hills range site)

Mobeetie Series

The Mobeetie series consists of deep, well-drained, moderately dark colored, strongly calcareous soils that developed in fine sandy loam alluvium. These soils are gently sloping. They occur on alluvial fans below the High Plains escarpment in the northeastern part of the survey Area.

Soils of the Mobeetie series typically have a surface layer of brown fine sandy loam about 5 inches thick. The subsoil and substratum are nearly the same color and texture as the surface layer. They extend to a depth of more than 60 inches. The depth to the zone of maximum accumulation of lime varies, but it is generally 15 inches or more.

Runoff is slow. Permeability is moderately rapid, and the water-holding capacity is moderately high. Most areas are slightly to moderately eroded. A few deep gullies have formed as a result of runoff from higher lying soils. Rainfall amounts to 10 to 15 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,300 to 4,200 feet.

All the acreage is used for native pasture. The vegetation consists of short grasses, mesquite, and other woody species.

Typical profile of Mobeetie fine sandy loam, 1,235 feet south and 740 feet west of the NE. corner of sec. 26, T. 16 S., R. 31 E.

A1—0 to 5 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, platy structure in the uppermost inch, abruptly changing to weak, coarse, subangular blocky structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; mildly alkaline; clear, smooth boundary.

B2—5 to 15 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist; nonsticky and nonplastic when wet; strongly calcareous; mildly alkaline; gradual, smooth boundary.

B3—15 to 35 inches, dark grayish-brown (10YR 4/2) fine sandy loam, dark brown (10YR 3/3) when moist; weak, very coarse, subangular blocky structure to nearly massive; hard when dry, very friable when moist, slightly sticky and nonplastic when wet; common, faint, fine veins and splotches of lime; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—35 to 50 inches, grayish-brown (10YR 5/2) fine sandy loam, dark brown to brown (10YR 4/3) when moist; massive; very hard when dry, very friable when moist, slightly sticky and nonplastic when wet; common, fine, faint mycelia and splotches of lime; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—50 to 86 inches, light-brown (7.5YR 6/3) fine sandy loam; massive; very hard when dry, very friable when moist, slightly sticky and nonplastic when wet; common, fine, faint mycelia and splotches of lime; very strongly calcareous; moderately alkaline.

The thickness of the A1 and B2 horizons, together, ranges from 8 to 20 inches. The color is light brownish gray to brown. It ranges from 10YR to 7.5YR in hue, from 5 to 6 in value, and from 2 to 4 in chroma. The texture ranges from sandy loam to fine sandy loam. The depth to the B3 horizon ranges from 8 to 20 inches.

Mobeetie soils are associated with Likes soils.

Mobeetie fine sandy loam, 1 to 5 percent slopes (MO).—This soil has the profile described as typical of the Mobeetie series. Included in mapping were areas of Simona, Likes, Pajarito, and Berino soils. The included areas make up less than 30 percent of the acreage.

This soil is subject to severe wind and water erosion if the vegetation has been depleted. A few deep, narrow gullies have formed where runoff from the highlands has eroded the soil on slopes adjoining the High Plains escarpment.

This soil is used for native pasture. Its use is limited by insufficient water. Most of the precipitation that falls soaks in. (Dryland capability unit VIIe–2; Sandy range site)

Pajarito Series

The Pajarito series consists of deep, well-drained, moderately dark colored, weakly calcareous to noncalcareous soils that developed in wind-worked material and alluvium derived from mixed, sandy sediments of the uplands. These soils occur in drainageways or depressions scattered throughout the eastern part of the survey Area.

Soils of the Pajarito series typically have a surface layer of brown loamy fine sand about 9 inches thick. The subsoil is brown fine sandy loam about 27 inches thick. The underlying material consists of caliche and pockets of fine sandy loam soil material.

These soils are subject to continuing wind and water erosion. If the vegetative cover is seriously depleted, the erosion hazard is severe. The soils are difficult to revegetate once the plant cover is lost, because rainfall is undependable. They lack surface water, except for the runoff that collects after the infrequent heavy rains. Nearly all the moisture that falls soaks in. Permeability is moderately rapid, and the water-holding capacity is moderate. Rainfall amounts to 10 to 15 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,000 to 4,200 feet.

All the acreage is used for native pasture and wildlife habitat. The soils are productive if there is enough moisture. The vegetation consists mainly of four-wing saltbush, dropseeds, sand bluestem, black grama, mesquite, broom snakeweed, and sand sage.

Typical profile of a Pajarito loamy fine sand, 300 feet south and 300 feet west of north quarter corner of sec. 28, T. 17 S., R. 31 E.

A1—0 to 9 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; massive to weak, medium, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous to slightly calcareous; mildly alkaline; clear, smooth boundary.

B21—9 to 18 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; moderately alkaline; gradual, wavy boundary.

B22—18 to 36 inches, brown (7.5YR 5/4) when dry or moist fine sandy loam; weak, coarse, prismatic structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few fragments

of caliche ½ inch in diameter; strongly calcareous; moderately alkaline; clear, wavy boundary.

C—36 to 72 inches, brown (7.5YR 5/4) when dry or moist fine sandy loam; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; 2 percent of this horizon is lime-cemented concretions; strongly calcareous; moderately alkaline.

The thickness of the A horizon ranges from 4 to 20 inches. The color ranges from 7.5YR to 2.5YR in hue, from 4 to 6 in value, and from 3 to 6 in chroma. The texture ranges from loamy fine sand to fine sand in areas where the surface has been reworked by wind. The texture of the B horizon ranges from loamy fine sand to fine sandy loam. In places the color of the lower part of the B horizon is higher in value and chroma than that of the surface layer. The C horizon extends to a depth of more than 46 inches.

Pajarito soils are associated with Largo soils and with Stony and Rough broken land.

Pajarito loamy fine sand, 0 to 3 percent slopes, eroded (PA).—This soil occupies the smoother, sandy areas in drainageways or large depressions below escarpments. Included in mapping were small areas of Berino and Wink soils, which make up less than 15 percent of the acreage.

This soil has an overblown surface layer of yellowish-red, slightly calcareous loamy fine sand. This layer is underlain by yellowish-red, calcareous loamy fine sand about 13 inches thick. Beneath this is yellowish-red to reddish-yellow fine sandy loam that extends to a depth of more than 60 inches.

Wind erosion has altered this soil. The surface layer, 6 to 12 inches thick, is hummocky to billowy. The hummocks range from 1 to 3 feet in height.

Most of this soil has been stabilized by mesquite, sand sage, and other vegetation. All the acreage is used for native pasture. The soil is productive if there is enough moisture. The hazard of wind erosion is severe if the plant cover is seriously depleted. (Dryland capability unit VIIe–1; Deep Sand range site)

Pajarito-Dune land complex, 0 to 3 percent slopes (PD).—This complex consists of deep, sandy soils and of Dune land. Pajarito soils make up about 30 to 60 percent of the acreage, and Dune land, about 30 to 60 percent. Except that the surface layer has been eroded by wind, the Pajarito soil has a profile similar to that described as typical of the series. Included in mapping were small areas of Largo soils and of Rock land, which make up less than 10 percent of the acreage.

In places the surface layer of the Pajarito soil has been removed by erosion, and the dry, slightly hard subsoil of fine sandy loam is exposed. The surface layer is thicker adjacent to the low, rounded sand dunes that are characteristic of this complex. The dunes consist of fine sand. They are 3 to 6 feet high and generally 8 to 25 feet wide at the base.

Erosion is active in these areas during windstorms. The dunes have formed around woody plants, such as mesquite, and each windstorm either adds sand or takes some away. Little or no vegetation grows in the areas where the subsoil is exposed or where the surface layer is very thin.

This complex is used for native pasture and wildlife habitat. The soils have been damaged so severely by wind erosion, however, that they produce only a limited amount of desirable forage. (Dryland capability unit VIIe–1; Deep Sand range site)

Pima Series

The Pima series consists of deep, well-drained, moderately dark colored, calcareous soils that developed in alluvium derived from limestone. These soils occur on flood plains of narrow drainageways. Most of the acreage is in the northwestern part of the survey Area, but a smaller acreage is in the southeastern part, west of the Black River.

Soils of the Pima series typically are light brownish-gray silt loam in the upper 3 inches. Below this is brown or light-brown silty clay loam that extends to a depth of 60 inches or more.

These soils are subject to periodic flooding, and the floodwaters leave a small amount of deposition. Gullies form if the plant cover is seriously depleted. Irrigated areas need protection.

Runoff is slow. Permeability is moderately slow in the subsoil. The water-holding capacity is high. The effective rooting depth is more than 60 inches. Rainfall amounts to 10 to 16 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 195 to 210 days. Elevations range from 3,200 to 4,200 feet.

Pima soils are used for irrigated crops, native pasture, and wildlife habitat. They are fertile and are among the most productive in the Area, both of irrigated crops and native pasture. The native vegetation consists mostly of sacaton, alkali sacaton, buffalograss, burrograss, and mesquite.

Typical profile of Pima silt loam, 30 feet east and 10 feet south of the NW. corner of sec. 14, T. 17 S., R. 23 E.

A11—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure in uppermost 1 inch, then moderate, fine, subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; very few, fine, interstitial pores; many fine fibrous roots; strongly calcareous; mildly alkaline; clear boundary.

A12—3 to 11 inches, brown (7.5YR 5/3) light silty clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure and moderate, very fine, subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; many fine pores; common, fine, rounded worm and insect casts; ped surfaces are smooth; few very fine seams of white lime in old root channels; strongly calcareous; mildly alkaline; clear boundary.

AC—11 to 20 inches, brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; many fine pores; common, fine, rounded worm and insect casts; strongly calcareous; mildly alkaline; gradual boundary.

C—20 to 60 inches, light-brown (7.5YR 6/4) silty clay loam, dark brown (7.5YR 4/4) when moist; weak, medium and coarse, subangular blocky structure that grades to structureless in the lower part; hard when dry, firm when moist, sticky and plastic when wet; few fine and few coarse root channels; few fine roots; many very fine seams of white lime; strongly calcareous; mildly alkaline.

The thickness of the A and AC horizons ranges from 20 to 40 inches. The texture includes silt loam, loam, and silty clay loam. The color is within the 10YR and 7.5YR hues.

It ranges from 4 to 6 in value and from 2 to 3 in chroma. The C horizon, which is more than 40 inches thick, is slightly lighter in color than the A horizon. Its texture ranges from silty clay loam to loam, and it is somewhat stratified in places. Calcium carbonate segregations occur below a depth of 20 inches in places. Buried soils are common.

Pima soils are associated with Dev, Reagan, Ector, and Upton soils.

Pima silt loam, 0 to 1 percent slopes (PM, Pe).—This soil has the profile described as typical of the series. It occurs on flood plains of drainageways west of the Pecos River. Included in mapping were areas of Reagan and Dev soils, which make up less than 5 percent of the acreage. Most of this soil is in the low-intensity survey, but some is within the high-intensity survey. The areas mapped at low intensity are contiguous to drainageways. The slope is as much as 3 percent in the upper reaches of some of the streams. Included in the low-intensity survey are some areas where the surface layer is loam or clay loam.

This soil is fertile. It is subject to periodic flooding, but the floodwaters are not damaging. It is used for irrigated crops, native pasture, and wildlife habitat. All the crops grown in the survey Area are suitable. The rooting depth is more than 60 inches. (Irrigated capability unit IIs–1; dryland capability unit VIs–4; Bottomland range site)

Pima silt loam, saline, 0 to 1 percent slopes (Pn).—This soil is moderately to strongly saline, but otherwise its profile is similar to that described as typical of the series. It has become saline either through the application of poor-quality irrigation water or through seepage from irrigation canals and lateral drains. Included in mapping were areas of Pima silt loam, 0 to 1 percent slopes, and areas of Reagan soils. The included areas make up less than 5 percent of the acreage.

This soil is used for irrigated crops, native pasture, and wildlife habitat. The accumulation of toxic salts has lowered crop yields, and only salt-tolerant crops can be grown successfully. (Irrigated capability unit IIIs–6; dryland capability unit VIs–2; Salt Flats range site)

Pima clay loam, gray variant, 0 to 1 percent slopes (Pv).—This soil is grayer than Pima silt loam, 0 to 1 percent slopes, and it is mottled and stratified. It occurs in drainageways below flowing natural springs or springs that have ceased to flow only in recent years or whose waters have been diverted for irrigation purposes. Most areas are on flood plains of the Pecos River and near Black River Village. A few tracts in the Artesia bog area north of Lake McMillan are in their natural state. A few small areas are saline, because they receive seepage from adjacent Arno soils. Included in mapping were small acreages of silt loam and loam, which show recent deposition from overflow. Unclassified soils at the edges of the channel make up less than 5 percent of the acreage.

This soil normally has a surface layer of grayish-brown, friable clay loam to loam, about 2 inches thick, that has moderate granular structure. This layer is underlain by a layer of bleached, dark-gray, friable clay loam, about 6 inches thick, that has moderate, medium, prismatic structure. This material rests on a buried soil. The IIC horizon is dark-gray to gray light clay to clay, about 24 inches thick, that has moderate, prismatic structure. The lower part is gleyed and has distinct to prominent iron mottlings. The IIIC horizon, extending to a depth of more than 60 inches, is gray to white clay loam enriched with calcium carbonate. It has many distinct concretions of lime and many iron mottlings. The upper part of the soil has prismatic structure, but the lower part is massive.

This soil is fertile, but it needs protection from a high water table, salts, and periodic overflow. It is easily eroded by floodwaters if it is not protected. Permeability is slow in the subsoil, and the water-holding capacity is high. Runoff is slow.

This soil is associated primarily with Arno and Harkey soils. It occupies a lower position on the landscape than those soils. It is used for irrigated crops, native pasture, and wildlife habitat. The native vegetation consists mainly of sacaton, alkali sacaton, and vine-mesquite. (Irrigated capability unit IIs–1; dryland capability unit VIe–1; Bottomland range site)

Potter Series

The Potter series consists of moderately dark colored gravelly loams that are very shallow over caliche. These soils occur on sloping edges of ridges and on steep breaks to drainageways in the northeastern and southeastern parts of the survey Area. They developed in old alluvium derived from mixed materials. They are underlain by fractured, platy, indurated caliche. In the Eddy Area, Potter soils are mapped only with Simona soils.

Soils of the Potter series typically have a surface layer of brown gravelly loam about 4 inches thick. This layer is underlain by brown gravelly loam about 6 inches thick. Fractured, layered, indurated caliche occurs at a depth of about 10 inches.

These soils are slightly to moderately eroded. Caliche is commonly exposed along the top of breaks. Runoff is medium to rapid. The water-holding capacity is very low. Permeability is moderate. The organic-matter content is low. Roots are restricted by shallowness over caliche. Rainfall amounts to 10 to 16 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 195 to 210 days. Elevations range from 3,200 to 3,800 feet.

These soils are used for native pasture, for wildlife habitat, and as a source of roadbuilding material. The native vegetation consists mainly of black grama, sideoats grama, blue grama, tobosa, three-awn, creosotebush, and tarbush.

Typical profile of Potter gravelly loam, 0.2 mile south of the north quarter corner of sec. 32, T. 17 S., R. 29 E.

A1—0 to 4 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; soft when dry, friable when moist, slightly sticky and nonplastic when wet; common fine pores; strongly calcareous; mildly alkaline; clear, wavy boundary.

AC—4 to 10 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; soft when dry, friable when moist, slightly sticky and nonplastic when wet; 70 percent is hard, fragmentary caliche; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

Ccam—10 inches, fractured, layered, indurated caliche.

The thickness of the A horizon ranges from 2 to 12 inches. The color ranges from 10YR to 5YR in hue, from 5 to 6 in

value, and from 2 to 4 in chroma. The depth to caliche ranges from 2 to 12 inches. Coarse fragments make up more than 15 percent of the soil mass.

Potter soils are associated with Simona soils and with Stony and Rough broken land.

Potter-Simona complex, 5 to 25 percent slopes (PS).—The Potter and Simona soils of this complex have the profile described as typical of their respective series. Potter gravelly loam makes up about 80 percent of the acreage. The rest is made up of Simona gravelly fine sandy loam, 0 to 3 percent slopes, which occurs at the tops of ridges, and Stony and Rough broken land, which occurs on the steep slopes.

The soils of this complex are susceptible to wind and water erosion. Good management is needed to maintain a plant cover adequate to control erosion. The soils are droughty and difficult to revegetate.

This complex is used for native pasture and wildlife habitat, and as a source of caliche suitable for roadbuilding. (Potter soil is in dryland capability unit VIIs–1 and Shallow range site; Simona soil is in dryland capability unit VIIe–2 and Sandy range site)

Reagan Series

The Reagan series consists of deep, well-drained, moderately dark colored, calcareous loams that developed in old alluvium derived from calcareous, sedimentary rocks of the uplands. These soils occur on plains west of the Pecos River. They are nearly level to gently sloping.

Soils of the Reagan series typically have a surface layer of brown loam about 8 inches thick. Light-brown loam and heavy loam, about 24 inches thick, underlies the surface layer. The next layers, which extend to a depth of more than 60 inches, are enriched with calcium carbonate.

These soils are uneroded or only slightly eroded. They are moderately fertile. Runoff is slow. Permeability is moderate, and the water-holding capacity is high. The organic-matter content is low. In most places roots are not restricted, but in some places caliche or gypsum occurs below a depth of 4 feet. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 220 days. Elevations range from 3,000 to 4,400 feet.

Reagan soils are used for irrigated crops, native pasture, and wildlife habitat. These are among the most productive irrigated soils in the Area. The vegetation consists mainly of black grama, blue grama, side-oats grama, vine-mesquite, tobosa, burrograss, broom snakeweed, and mesquite.

Typical profile of Reagan loam, NW¼NW¼ sec. 27, T. 22 S., R. 27 E.

Ap—0 to 8 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; abundant very fine and fine roots; many very fine and fine pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

C1—8 to 19 inches, light-brown (7.5YR 6/3) loam, dark brown (7.5YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky when wet; abundant very fine and fine roots; many very fine and fine pores; few, fine, prominent seams of lime; very strongly calcareous; mildly alkaline; gradual boundary.

C2—19 to 32 inches, light-brown (7.5YR 6/3) heavy loam, brown (7.5YR 4/4) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky when wet; plentiful very fine and fine roots; common very fine and fine pores; few, medium, prominent, soft concretions of lime; very strongly calcareous; mildly alkaline; gradual boundary.

C3ca—32 to 44 inches, light-brown (7.5YR 6/3) light clay loam, brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist, slightly sticky when wet; plentiful very fine and fine roots; common very fine and fine pores; many, medium, faint mottlings of lime; very strongly calcareous; moderately alkaline; clear boundary.

C4ca—44 to 54 inches, light-brown (7.5YR 6/3) light clay loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; few very fine and fine roots; common very fine and fine pores; distinct mottlings of lime; very strongly calcareous; moderately alkaline; clear boundary.

C5ca—54 to 67 inches, light-brown (7.5YR 6/3) light clay loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; few very fine and fine roots; common very fine and fine pores; distinct mottlings of lime; very strongly calcareous; moderately alkaline; gradual boundary.

C6—67 to 82 inches, light-brown (7.5YR 6/3) heavy loam, brown (7.5YR 4/4) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky when wet; common very fine and fine pores; very strongly calcareous; moderately alkaline.

The thickness of the A horizon ranges from 6 to 12 inches. The color ranges from 10YR to 7.5YR in hue, from 5 to 6 in value, and from 2 to 3 in chroma. The texture is loam, silt loam, or light clay loam. The C1 horizon is as much as 13 inches thick, but it does not occur in all profiles. The color is as much as one unit higher in value and chroma. The texture is loam or light clay loam. The C2 horizon is as much as 14 inches thick, but it does not occur in all profiles. The color and texture are similar to those of the C1 horizon. The Cca horizon extends to a depth of 40 to 60 inches or more below the surface. The color ranges from 10YR to 7.5YR in hue, from 6 to 7 in value, and from 3 to 4 in chroma. The texture ranges from loam to light clay loam. Gypsiferous earths or soft caliche occurs below a depth of 48 inches in some places.

Reagan soils are associated with Upton, Atoka, and Pima soils.

Reagan loam, 0 to 1 percent slopes (Rc).—This soil has the profile described as typical of the series. It occurs on plains west of the Pecos River in the irrigated areas near Artesia and Carlsbad. Included in mapping were small areas of Reagan loam, saline, 0 to 1 percent slopes, where water from canals seeps into the gypsiferous substratum. Also included were small areas of Upton gravelly loam, 0 to 3 percent slopes, which occur on ridges. The included areas make up less than 5 percent of the acreage.

This soil is susceptible to wind erosion, especially when the seedbed is being prepared and the soil is bare. Seedling damage caused by high winds is common.

This soil is used mainly for irrigated crops and wildlife habitat. It is among the most productive of the irrigated soils, and in most places it has been bench leveled to grades of 0.2 to 0.3 percent. Cotton (fig. 15) and most other crops grown in the Area are suitable. Pecan trees need more than 48 inches of unrestricted rooting zone, and, although the effective rooting zone

extends beyond this depth in most places, care should be taken to select areas of deep soils for pecans. A small acreage of this soil is used for native pasture. (Irrigated capability unit IIs–2; dryland capability unit VIs–4; Loamy range site)

Reagan loam, 0 to 3 percent slopes (RA).—This soil occurs on plains and in valleys west of the Pecos River. Included in mapping were areas of Upton and Atoka soils. Upton soils make up less than 15 percent of the acreage. Atoka soils, which were mapped only at high intensity, make up 10 to 16 percent of the acreage.

This soil is uneroded or only slightly eroded. Good management is needed to maintain an adequate plant cover and to control erosion. Revegetation is difficult if the native vegetation is seriously depleted, because rainfall is undependable.

All the acreage is used for native pasture (fig. 16) and wildlife habitat. The vegetation consists of black grama, blue grama, side-oats grama, bush muhly, tobosa, vine-mesquite, tarbush, yucca, creosotebush, and mesquite. (Dryland capability unit VIs–4; Loamy range site)

Reagan loam, 1 to 3 percent slopes (Rd).—Except for the difference in slope, this soil has a profile similar to that described as typical of the series. Included in mapping were small areas that have become saline because they are subject to seepage from canals. Also included were areas of Upton soils. The included soils make up less than 5 percent of the acreage.

This soil is susceptible to wind erosion when the seedbed is being prepared and the surface is bare. Seedling damage caused by high winds is common. Slight surface crusting impedes emergence of seedlings in areas where the high-lime zone is exposed.

Figure 15.—**Cotton on Reagan loam, 0 to 1 percent slopes. The plants are about 10 weeks old.**

This soil is used for irrigated crops, native pasture, and wildlife habitat. Most of it has been bench leveled to grades of 0.2 to 0.3 percent. The surface layer is light colored to moderately dark colored in places because the leveling has exposed a high-lime zone. In other places the high-lime zone is at a depth of 60 inches or more. Chlorosis, or yellowing of leaves, causes reduced yields in places. Its severity varies with the amount of lime in the surface soil. (Irrigated capability unit IIe–1; dryland capability unit VIs–4; Loamy range site)

Figure 16.—**Native pasture on Reagan loam, 0 to 3 percent slopes. The soil has been chiseled on the contour to conserve water.**

Reagan loam, saline, 0 to 1 percent slopes (Rf).—This soil occurs as scattered areas near Artesia and Carlsbad. Except for the greater content of salt, it has a profile similar to that described as typical of the series. Reprecipitated gypsum in the form of fine crystals occurs as splotches or veins. A zone of gypsum, which makes up an estimated 15 to 30 percent of the horizon, occurs at a depth of 40 to 60 inches. Impeded surface drainage and seepage from canals and adjoining soils that are underlain by gypsiferous material have brought about moderate to strong salinity. The salt content of the plow layer varies from 0.2 to about 0.35 percent. Included in mapping were areas of Reagan loam, 0 to 1 percent slopes, and areas of Reeves loam, saline, 0 to 1 percent slopes. The included areas make up less than 5 percent of the acreage.

This soil is susceptible to wind erosion when the seedbed is being prepared and the soil is bare. The surface layer is cloddy when plowed. It crusts easily, and seedling emergence is impeded.

This soil is used for irrigated crops, native pasture, and wildlife habitat. It is not so productive as Reagan loam, 0 to 1 percent slopes. Only salt-tolerant crops can be grown successfully. (Irrigated capability unit IIIs–6; dryland capability unit VIs–2; Salt Flats range site)

Reagan-Upton association, 0 to 9 percent slopes (RE).—This soil association occurs in a regular pattern on plains and hills west of the Pecos River. Reagan loam, 0 to 3 percent slopes, makes up 60 to 85 percent of the acreage, and Upton gravelly loam, 0 to 9 percent slopes, makes up 15 to 40 percent. The Reagan soil occurs on nearly level to gently sloping plains. The Upton soil occurs on nearly level to sloping ridges and hills. Included in mapping were areas of Atoka and Pima soils, which make up less than 20 percent of the acreage. The Atoka soils were mapped only at high intensity.

This association is used for native pasture and wildlife habitat. Revegetation is difficult once the plant cover is lost, because of high temperatures and undependable rainfall. Careful management is needed to maintain a cover of desirable forage plants and to control erosion. (Reagan soil is in dryland capability unit VIs–4 and Loamy range site; Upton soil is in dryland capability unit VIIs–1 and Shallow range site)

Reeves Series

The Reeves series consists of light-colored, well-drained, calcareous soils that are shallow to moderately deep over gypsiferous earths or rocks. These soils developed in old alluvium derived from sedimentary rocks. They are nearly level to gently sloping. The areas are on uplands throughout the central part of the survey Area.

Soils of the Reeves series typically have a plow layer of pale-brown heavy loam about 8 inches thick. The next layer, about 7 inches thick, is pale-brown light clay loam. This layer overlies very pale brown clay loam, about 8 inches thick, that is enriched by calcium carbonate. Below this is a layer of white clay loam, about 9 inches thick, that is heavily enriched by gypsum and calcium carbonate. Hard, gypsiferous bedrock is at a depth of 32 inches.

These soils are uneroded or only slightly eroded. Runoff is slow. Permeability is moderate, and the water-holding capacity is low to moderate. The intake rate is moderate. The organic-matter content is low, and fertility is moderate. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 220 days. Elevations range from 3,000 to 4,300 feet.

Reeves soils are used for irrigated crops, native pasture, and wildlife habitat. The vegetation consists mainly of black grama, blue grama, side-oats grama, vine-mesquite, tobosa, burrograss, broom snakeweed, and mesquite. Chlorosis develops in irrigated crops grown on the shallow phase of these soils.

Typical profile of Reeves loam, 800 feet east and 100 feet south of the NW. corner of sec. 24, T. 23 S., R. 27 E.

Ap—0 to 8 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; common very fine and fine pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

AC—8 to 15 inches, pale-brown (10YR 6/3) light clay loam, light yellowish brown (10YR 6/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine pores; few, fine, prominent lime mycelia; strongly calcareous; mildly alkaline; gradual, smooth boundary.

C1ca—15 to 23 inches, very pale brown (10YR 8/3) clay loam, light yellowish brown (10YR 6/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common very fine pores; many, fine to medium, distinct splotches of lime; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

C2cs—23 to 32 inches, white (10YR 8/1) light clay loam, light yellowish brown (10YR 6/4) when moist; massive; very hard when dry, friable when moist, sticky and plastic when wet; many fine crystals of gypsum; strongly calcareous; mildly alkaline; abrupt boundary.

R—32 inches +, hard, gypsiferous rock.

The thickness of the Ap horizon ranges from 6 to 12 inches. An A1 horizon, 4 to 6 inches thick, occurs in undisturbed areas. The color of the A horizon ranges from 10YR to 7.5YR in hue, from 5 to 7 in value, and from 2 to 3 in chroma. The texture is mainly loam and light clay loam, but there are a few areas of sandy loam. The AC horizon is as much as 10 inches thick. The texture includes loam and light clay loam. The Cca horizon is as much as 12 inches thick, but it is not present in all profiles. The color of this horizon ranges from 10YR to 7.5YR in hue, from 6 to 8 in value, and from 2 to 4 in chroma. The texture includes loam and clay loam. The depth to a Ccs or R horizon ranges from 10 to 36 inches. The texture of the Ccs horizon includes loam and light clay loam.

Reeves soils are associated with Cottonwood and Reagan soils and with Gypsum land.

Typical profile of Reeves loam, shallow, about 1 mile southwest of Malaga, NE¼SW¼SW¼ sec. 15, T. 24 S., R. 28 E.

Ap1—0 to 3 inches, light brownish-gray (10YR 6/2) loam, dark brown (10YR 4/3) when moist; uppermost ½ inch has very weak, thin, platy structure; slightly hard when dry, friable when moist, nonsticky when wet; abundant very fine and fine roots; many very fine and fine pores; strongly calcareous; clear, wavy boundary.

Ap2—3 to 8 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky when

wet; abundant very fine and fine roots; many very fine and fine pores; few, fine, distinct seams of lime, gypsum, and salts; material from this horizon has been mixed with overlying and underlying material; strongly calcareous; clear, wavy boundary.

C1—8 to 18 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; plentiful very fine and fine roots; many very fine and fine pores; few, fine, prominent seams of lime, gypsum, and salts; strongly calcareous; abrupt, wavy boundary.

C2cs—18 to 31 inches, white (10YR 8/2), fine, crystalline, gypsiferous earths, very pale brown (10YR 8/3) when moist; massive; hard to very hard when dry, firm to very firm when moist; few very fine roots; many very fine pores; strongly calcareous; gradual, wavy boundary.

C3cs—31 to 66 inches, pinkish-white (7.5YR 8/2), fine, crystalline, gypsiferous earths, pinkish gray (7.5YR 7/2) when moist, intermixed with light-brown (7.5YR 6/4) silty clay, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist; many very fine pores; strongly calcareous.

Reeves loam, 0 to 1 percent slopes (Rl).—This soil has the profile described as typical of the series. It occurs in the general vicinity of Artesia, Loving, and Malaga. Included in mapping were small areas of Cottonwood and Karro soils. Cottonwood soils make up about 5 to 10 percent of the acreage, and Karro soils, about 10 to 25 percent.

This soil is susceptible to wind erosion, especially after preparation of the seedbed. Seedling damage from high winds is common. The surface crusts at times, and the crust inhibits seedling emergence.

This soil is used mainly for irrigated crops, but a small acreage is used for native pasture. Most of it has been bench leveled to grades of 0.2 to 0.3 percent. The rooting zone is restricted by the underlying gypsiferous material. The depth to this material varies greatly from place to place, especially in areas where the soil has been leveled. Chlorosis, or yellowing of the leaves, can be expected in severely leveled areas. (Irrigated capability unit IIIs–14; dryland capability unit VIs–3; Loamy range site)

Reeves loam, 1 to 3 percent slopes (Rn).—Except for the slope, this soil has a profile similar to that described as typical of the series. Included in mapping were small areas of Cottonwood and Karro soils. The Cottonwood soil makes up as much as 10 percent of the acreage, and the Karro soil, as much as 25 percent.

This soil is susceptible to wind erosion, especially after preparation of the seedbed. Seedling damage from high winds is common. Surface crusting inhibits seedling emergence.

This soil is used for irrigated crops and native pasture. It is less productive than Reeves loam, 0 to 1 percent slopes. Most of the irrigated acreage has been bench leveled to grades of 0.2 to 0.3 percent. Severe cuts and fills have substantially altered the surface layer. The depth to the underlying gypsiferous material varies from place to place, but it is generally 20 to 36 inches. (Irrigated capability unit IIIe–2; dryland capability unit VIs–3; Loamy range site)

Reeves loam, saline, 0 to 1 percent slopes (Rr).—This soil occurs in the general vicinity of Loving, Malaga, Black River Village, and Artesia. Except for the greater content of salt, it has a profile similar to that described as typical of the series. Reprecipitated gypsum in the form of fine crystals occurs in splotches or seams above the gypsiferous substratum. The salt content of the plow layer ranges from about 0.2 to 0.3 percent. The depth of the soil material varies from place to place, but it is generally about 20 to 36 inches. These areas were mapped at high intensity. Included in mapping were areas of Karro loam, saline, 0 to 1 percent slopes, which make up 10 to 25 percent of the acreage. Also included were areas of Cottonwood soils; of Reeves loam, shallow, 0 to 1 percent slopes; and of Reeves loam, 0 to 1 percent slopes. These soils make up less than 5 percent of the acreage.

This soil is subject to wind erosion, especially after seedbed preparation. Seedling damage from high winds is common. The surface crusts readily, and the crust inhibits seedling emergence.

This soil is used for irrigated crops, native pasture, and wildlife habitat. Only salt-tolerant crops can be grown successfully. Chlorosis is common. The salinity of the soil and the gypsiferous substratum necessitate special treatment or design for structures, either above- or below-ground. Good management of irrigation water is necessary to reduce the salinity of the soil. (Irrigated capability unit IIIs–6; dryland capability unit VIs–2; Salt Flats range site)

Reeves loam, shallow, 0 to 1 percent slopes (Rt).—This soil occurs throughout the central part of the survey Area, but mainly near Artesia, Loving, and Malaga. It has the profile described as typical of the shallow phase of the series. Included in mapping were small, scattered areas of the following: Cottonwood soils; Reeves loam, 0 to 1 percent slopes; and Reeves loam, saline, 0 to 1 percent slopes. The included soils make up 10 to 25 percent of the acreage.

This soil is susceptible to wind erosion, especially when the seedbed is being prepared. Seedling damage caused by high winds is common. The surface crusts at times, and the crust inhibits seedling emergence. The water-holding capacity is low. The organic-matter content is low. Shallowness restricts the effective rooting depth.

This soil is used for irrigated pasture, native pasture, and irrigated crops. It is among the least productive of the irrigated soils in the Area. Only salt-tolerant, shallow-rooted crops are suitable. Chlorosis is common. Good management of irrigation water is needed to keep the soil from becoming saline. Special treatment or design is needed for surface or buried structures. (Irrigated capability unit IVs–3; dryland capability unit VIs–3; Loamy range site)

Reeves-Gypsum land complex, 0 to 3 percent slopes (RG).—This complex occurs on plains throughout the central part of the survey Area. Reeves loam, 0 to 1 percent slopes, which makes up 35 to 45 percent of the acreage, occurs in pockets, swales, and drainageways. Except that it occurs in undisturbed areas, its profile is similar to that described as typical of the series. Gypsum land, which makes up 15 to 25 percent of the acreage, occurs on the higher parts of the landscape. It is the land type described in Gypsum land-Cottonwood complex, 0 to 3 percent slopes. Included in mapping were areas of Cottonwood soils which make up 15 to 25 percent of the

acreage, and areas of Reagan and Largo soils, which make up 5 to 15 percent.

This complex is used for native pasture and wildlife habitat. The soils are not easily eroded. Good range management is needed to maintain a cover of desirable forage. Reestablishment of the native vegetation is difficult because temperatures are high and rainfall is undependable. Surface water is lacking. Ground water is hard to locate and, in places, is of poor quality. (Reeves soil is in dryland capability unit VIs–3 and Loamy range site; Gypsum land is in dryland capability unit VIIs–3 and Gyp Flats range site)

Reeves-Reagan loams, 0 to 3 percent slopes (RM).—This complex occurs on uplands, as tracts 3 to 6 miles wide. It is in the south-central part of the survey Area, near the Texas State line, and in the northeastern part. Reeves loam, which makes up about 35 to 45 percent of the acreage, has a profile similar to that described as typical of the series, except that the surface has not been disturbed. It occurs in pockets, swales, and along drainageways. Reagan loam, 0 to 3 percent slopes, which makes up about 25 to 30 percent of the acreage, occurs mainly at or near the center of swales and drainageways. Included in mapping were areas of Upton soils, which make up 15 to 20 percent of the acreage. Also included were areas of Gypsum land-Cottonwood complex, 0 to 3 percent slopes, which make up less than 20 percent of the acreage.

This complex is used for native pasture and wildlife habitat. The soils are uneroded or only slightly eroded. Good range management is needed to maintain a cover of desirable forage. Reestablishment of the native vegetation is difficult because temperatures are high and rainfall is undependable. There is little or no surface water. Ground water is hard to locate and, in places, is of poor quality. (Reeves loam is in dryland capability unit VIs–3 and Loamy range site; Reagan loam is in dryland capability unit VIs–4 and Loamy range site)

Rock Land

Rock land (RO) consists of steep to vertical, caliche-capped escarpments of highly dissected, fractured, reddish-colored sandstone, siltstone, shale, limestone, and thin-bedded, gypsiferous rocks. It occurs east of the Pecos River and is associated with escarpments at the edges of the "Shallow Sand Country." Included in mapping were areas of Potter soils on breaks, which make up less than 10 percent of the acreage. Simona soils occur on the plain above this land type, and Pajarito soils, on the slopes below.

The soil material is generally a gravelly fine sandy loam that overlies fractured, indurated caliche. It is shallower than that of Stony and Rough broken land and is more rocky. Loose gravel and stones are commonly scattered on the steep, angular to rounded slopes. The regolith (the mantle of loose soil material, sediments, and broken rock that overlies solid rock) varies in thickness from almost nothing on the steep slopes to about 10 inches along the edges of the escarpments and in small areas where remnants of old landforms remain.

Rock land is suitable for wildlife habitat and recreational and esthetic uses. The vegetation consists of a sparse cover of grama grasses, broom snakeweed, tarbush, and mesquite. Surface water is lacking, but runoff from these areas provides water for lower lying areas. The areas are difficult to cross by ordinary means. (Dryland capability unit VIIIs–1)

Russler Series

The Russler series consists of moderately dark colored, well-drained, saline soils that developed in old gypsiferous alluvium. These soils are shallow to deep over soft gypsiferous earths or rocks. They occur on uplands near Willow Lake, north and south of Malaga, and south of the Delaware River.

Soils of the Russler series typically have a surface layer of brown loam about 11 inches thick. The subsoil is brown clay loam to a depth of about 34 inches. The lower 11 inches of the subsoil is reddish-brown clay loam. The substratum is reddish-brown gypsiferous material that contains many concretions of lime and finely divided crystals of gypsum. The depth to the substratum is about 45 inches.

These soils are susceptible to wind and water erosion, and most areas are slightly to moderately eroded. Runoff is slow to medium. The intake rate is slow. Permeability is moderately slow, and the water-holding capacity is low to moderate. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 210 to 220 days. Elevations range from 3,000 to 3,800 feet.

Russler soils are used for irrigated crops, native pasture, and wildlife habitat. Salinity severely limits their use for irrigated crops and affects the design or treatment of structures built on or below the surface. Only salt-tolerant crops can be grown in irrigated areas. Chlorosis is common. The vegetation consists mainly of black grama, blue grama, side-oats grama, vine-mesquite, alkali sacaton, tobosa, burrograss, broom snakeweed, and mesquite.

Typical profile of Russler loam, NW¼SE¼ sec. 35, T. 23 S., R. 28 E.

Ap—0 to 11 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, sticky when wet; abundant very fine and fine roots; many very fine and fine pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

B21ca—11 to 19 inches, brown (7.5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; medium, angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; many very fine and fine pores; smooth ped surfaces; distinct seams of lime; strongly calcareous; mildly alkaline; gradual boundary.

B22ca—19 to 34 inches, brown (7.5YR 5/4) clay loam, reddish brown (5YR 4/3) when moist; medium to coarse, angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; many very fine and fine pores; smooth ped surfaces; common, soft concretions of lime; strongly calcareous; mildly alkaline; gradual boundary.

B23ca—34 to 45 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; medium, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; many very fine and fine pores;

smooth ped surfaces; lime is less prominent than in the B22ca horizon; strongly calcareous; mildly alkaline; gradual boundary.

IIC1cs—45 to 52 inches, reddish-brown (5YR 5/3) gypsiferous earths, reddish brown (5YR 4/4) when moist; medium, angular blocky structure; hard when dry, friable to firm when moist, sticky when wet; many very fine and fine pores; smooth ped surfaces; prominent, finely divided crystals of gypsum; strongly calcareous; mildly alkaline; gradual boundary.

IIC2cs—52 inches, segregated gypsum crystals and gypsiferous earths in separate clumps, but mixed throughout; strongly calcareous; mildly alkaline; gradual boundary.

An A1 horizon, 3 to 5 inches thick, occurs in undisturbed areas. The color ranges from 5YR to 10YR in hue, from 5 to 6 in value, and from 2 to 4 in chroma. A layer of fine sand or fine sandy loam, ¼ inch to 3 inches thick, is commonly at the surface in noncultivated areas. In areas that have been plowed, the texture of the surface layer includes sandy clay loam. The color of the A horizon darkens under irrigated cultivation. The texture is typically loam, but it is sandy clay loam or clay loam in places.

The B21ca horizon is 6 to 12 inches thick. The color is as much as one unit lower in value and as much as one unit higher in chroma than that of the A1 horizon. The texture is heavy loam or clay loam. The B22ca horizon ranges from 7 to 24 inches in thickness. The color ranges from 2.5YR to 7.5YR in hue, from 4 to 6 in value, and from 2 to 4 in chroma. The texture is clay loam or silty clay loam. In most places finely divided crystals of gypsum occur in the B23ca horizon. This horizon is as much as 25 inches thick, but it does not occur in all profiles. The IIC horizon is generally soft, gypsiferous rock that contains finely divided crystals of gypsum. The depth to this horizon ranges from 16 to 48 inches.

Russler soils are associated with Cottonwood, Karro, and Reeves soils.

Russler loam, 1 to 3 percent slopes (RS, Rv).—This soil has the profile described as typical of the series. It occurs as scattered areas on gently undulating uplands north and south of Malaga. Included in mapping were areas of Cottonwood, Reeves, and Reagan soils. Some areas are within the high-intensity survey, and some are within the low-intensity survey. The acreage is about equally divided. The principal difference between the areas mapped at high intensity and those mapped at low intensity is that the included soils make up more of the acreage in the low-intensity survey. As much as 15 percent of the acreage in the low-intensity survey consists of the included soils.

This soil is unstable and is susceptible to wind and water erosion, especially when the seedbed is being prepared and the soil is bare. The surface crusts readily, and the crust impedes seedling emergence. Seedlings are damaged by high winds.

This soil is used for irrigated crops, native pasture, and wildlife habitat. The irrigated acreage has been bench leveled to grades of 0.2 to 0.3 percent. The depth to the gypsiferous substratum varies widely from place to place, and care is needed in leveling to avoid exposing the gypsiferous material. Special designs or treatments are necessary for all surface or subsurface structures. Only salt-tolerant crops are suitable. Roots are restricted by shallowness to the underlying gypsum. Chlorosis is common. (Irrigated capability unit IIIs–14; dryland capability unit VIs–3; Clayey range site)

Russler-Ector association, 0 to 9 percent slopes (RU).—This soil association occurs in a regular pattern in the south-central part of the survey Area, near the Texas State line. It occupies a gently undulating plain where small limestone knobs and hills dot the landscape. Russler loam makes up about 60 percent of the acreage, and Ector stony loam, about 25 percent. Included in mapping were small areas of unclassified, deep, moderately dark colored silt loams in small depressions or on flood plains along narrow drainageways. Also included were areas of Gypsum land-Cottonwood complex, 0 to 3 percent slopes. The included soils make up less than 15 percent of the acreage.

The Russler soil, which is nearly level to gently sloping, occurs on uplands. It is slightly eroded and is susceptible to further erosion if the plant cover is seriously depleted. It has a high content of gypsum in the substratum, which makes necessary special treatment or design of surface and subsurface structures.

The Ector soil, which has the profile described as typical of the series, occurs on small knobs or hills. It is uneroded or only slightly eroded.

This association is used for native pasture and wildlife habitat. Reestablishment of vegetation is difficult once the plant cover is lost, because temperatures are high and rainfall is undependable. Good management of the range is needed to maintain a cover of desirable forage. Surface water is lacking, except for short periods after heavy rainfall. Ground water is hard to locate and is usually scanty and of poor quality. (Russler soil is in dryland capability unit VIs–3 and Clayey range site; Ector soil is in dryland capability unit VIIs–5 and Limestone Hills range site)

Simona Series

The Simona series consists of well-drained, moderately dark colored soils that are calcareous and moderately coarse textured. These soils are shallow over indurated caliche. They occur on uplands scattered throughout the eastern part of the survey Area. They have been worked by wind and are nearly level to gently sloping.

Soils of the Simona series typically have a surface layer of brown fine sandy loam about 2 inches thick. The next layer is light-brown gravelly fine sandy loam about 17 inches thick. Below this is fractured, platy, indurated caliche.

These soils are subject to severe wind erosion if the plant cover is seriously depleted. Runoff is slow. Permeability is moderately rapid, and the water-holding capacity is low. Nearly all the precipitation that falls soaks into the soil. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 210 to 220 days. Elevations range from 3,000 to 4,200 feet.

All the acreage is used for native pasture and wildlife habitat. The soils are productive if there is enough moisture. Surface water is lacking except for brief periods after the infrequent heavy rains, when water collects in the few potholes, or dry lakes. The vegetation consists mainly of black grama, side-oats grama, little bluestem, blue grama, Javelina, sand muhly, sand dropseed, threeawn, sand sagebrush, broom snakeweed, and mesquite.

Typical profile of Simona gravelly fine sandy loam, 2,200 feet west and 1,400 feet north of the SE. corner of sec. 15, T. 22 S., R. 28 E.

A1—0 to 2 inches, brown (7.5YR 5/3) gravelly fine sandy loam, dark brown (7.5YR 4/3) when moist; weak, thin, platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; very porous; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

AC—2 to 11 inches, light-brown (7.5YR 6/3) gravelly fine sandy loam, dark brown (7.5YR 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; very porous; strongly calcareous; mildly alkaline; clear, wavy boundary.

C1—11 to 19 inches, light-brown (7.5YR 6/3) gravelly fine sandy loam, brown (7.5YR 5/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; very porous; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

IIC2cam—19 inches, fractured, platy, indurated caliche.

The combined thickness of the A1 and AC horizons ranges from 10 to 24 inches. The color ranges from 10YR to 7.5YR in hue, from 4 to 6 in value, and from 2 to 3 in chroma. The texture of these horizons includes fine sandy loam to loamy sand. Numerous coarse fragments of caliche occur in some, but not all, profiles. The color of the AC horizon is as much as one unit higher in value than that of the A1 horizon. The C1 horizon does not occur in all profiles. The depth to caliche ranges from 10 to 24 inches.

Simona soils are associated with Bippus, Wink, Potter, and Upton soils.

Simona sandy loam, 0 to 3 percent slopes (SA).—This soil occurs in slight depressions on uplands east of the Pecos River.

This soil has a surface layer of brown sandy loam about 6 inches thick, which is underlain by a layer of brown fine sandy loam, about 10 inches thick. Below this is a layer, about 4 inches thick, of brown fine sandy loam that has been enriched by calcium carbonate. The underlying caliche is fractured and platy.

This soil is slightly eroded. It is highly susceptible to wind erosion if the vegetative cover is seriously depleted.

All the acreage is used for native pasture and wildlife habitat. It is productive if there is enough moisture. Surface water is lacking, except for brief periods when runoff collects in the few playas. Good management of the range is needed to maintain a cover of desirable forage and to control erosion. Revegetation is difficult because temperatures are high and rainfall is undependable. (Dryland capability unit VIIe–2; Sandy range site)

Simona gravelly fine sandy loam, 0 to 3 percent slopes (SG).—This soil has the profile described as typical of the series. It occurs on plains east of the Pecos River. Included in mapping were small areas of Simona sandy loam, 0 to 3 percent slopes, in pockets and swales, and unclassified soils in small playas. The included soils make up less than 15 percent of the acreage.

This soil has been slightly eroded by wind. Hummocks, 6 to 12 inches high, have formed. They are somewhat stabilized by woody plants.

Runoff is slow; it occurs only when the soil is saturated by prolonged rainfall. At such times, which are infrequent, water collects and stands in small playas for brief periods.

This soil is used for native pasture and wildlife habitat. It is productive if there is enough moisture. Roots are restricted by the underlying caliche. (Dryland capability unit VIIe–2; Sandy range site)

Simona-Bippus complex, 0 to 5 percent slopes (SM).—The Simona and Bippus soils of this complex have the profile described as typical of their respective series. Simona gravelly fine sandy loam, 0 to 3 percent slopes, makes up about 40 to 50 percent of the acreage, and Bippus silty clay loam, about 15 to 25 percent. Unclassified soils that have a strong zone of lime below a depth of 30 inches make up the rest. This complex occurs in drainageways and depressions and on sloping uplands throughout the eastern part of the survey Area.

The Simona soil is nearly level to gently sloping. It occurs on uplands above the Bippus soil. The Bippus soil occurs on flood plains along intermittent drainageways and in depressions. It is subject to periodic flooding.

All of this complex is used for native pasture and wildlife habitat. Good management is needed to control wind and water erosion. If there is enough moisture, the Bippus soil is among the most productive of the range soils of the survey Area. (Simona soil is in dryland capability unit VIIe–2 and Sandy range site; Bippus soil is in dryland capability unit VIe–1 and Bottomland range site)

Simona and Wink fine sandy loams, 0 to 3 percent slopes, eroded (SN).—This undifferentiated unit occurs as widely scattered areas east of the Pecos River. It occupies narrow, intermittent drainageways and dry lakes. Simona and Wink soils occur in about equal proportions. Except that the surface layer of the Simona soil has been eroded by wind, these soils have the profile described as typical of their respective series. Included in mapping were areas of Dune land and of deep, sandy, alluvial soils. The included areas make up less than 15 percent of the acreage.

The Simona soil is nearly level to gently sloping. It occurs in a slightly higher position on the landscape than the Wink soil. Runoff occurs at times, after the soil has become saturated from prolonged rainfall, which is infrequent.

The Wink soil occurs along drainageways leading to small playas and in broad depressions. All the precipitation that falls soaks in. If there is enough moisture, this soil is productive.

These soils are subject to continued wind erosion. Hummocks of sand, 1 to 3 feet high, are somewhat stabilized by woody plants. The areas between hummocks are nearly barren or are only sparsely vegetated.

All the acreage is used for native pasture and wildlife habitat. Good management is needed to maintain a cover of desirable forage and to control wind erosion. Reestablishment of vegetation is difficult once the plant cover is lost, because temperatures are high and rainfall is undependable. The range is generally in poor condition. Surface water is lacking, except for infrequent, very brief periods after prolonged rainfall, when the Simona soil becomes saturated and runoff occurs. (Simona soil is in dryland capability unit VIIe–2 and Sandy range site; Wink soil is in dryland capability unit VIIe–1 and Deep Sand range site)

Stegall Series

The Stegall series consists of dark-colored, well-drained, noncalcareous soils that developed in alluvium derived from sediments of the High Plains. These soils are moderately deep over indurated caliche. They occur in swales and depressions that generally lead to small playas or sinkholes. They are nearly level and are subject to periodic flooding. They occupy upland areas in the northeastern part of the survey Area. In the Eddy Area, Stegall soils are mapped only as a complex with Kimbrough soils.

Soils of the Stegall series typically have a surface layer of dark-brown clay loam about 4 inches thick. The subsoil is dark-brown to dark yellowish-brown heavy clay loam about 18 inches thick. It is slightly calcareous in the lower part. Fractured, platy, indurated caliche is at a depth of about 22 inches.

These soils are uneroded or only slightly eroded. They are fertile, and their organic-matter content is moderate. The water-holding capacity is moderate, and permeability of the subsoil is moderately slow. Runoff is slow. Roots are restricted by caliche. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,000 to 4,100 feet.

All the acreage is used for native pasture and wildlife habitat. The vegetation consists mainly of alkali sacaton, blue grama, tobosa, buffalograss, and mesquite.

Typical profile of Stegall clay loam, 460 feet west and 170 feet south of the NE. corner of sec. 24, T. 16 S., R. 31 E.

A1—0 to 4 inches, dark-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) when moist; weak, medium, platy structure to moderate, fine, granular; hard when dry, firm when moist, sticky and plastic when wet; common very fine and fine pores; noncalcareous; neutral; abrupt, smooth boundary.

B21t—4 to 10 inches, dark-brown (10YR 3/3) heavy clay loam, very dark brown (10YR 2/2) when moist; strong, medium, subangular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; thin clay films on ped surfaces; common very fine and fine pores; noncalcareous; neutral; clear, smooth boundary.

B22t—10 to 18 inches, dark yellowish-brown (10YR 3/4) heavy clay loam, dark yellowish brown (10YR 2/4) when moist; strong, medium, subangular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; thin clay films on ped surfaces; common very fine and fine pores; noncalcareous; neutral; clear, smooth boundary.

B3—18 to 22 inches, dark-brown (10YR 4/3) heavy clay loam, dark brown (10YR 3/3) when moist; moderate to strong, medium, subangular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; common very fine and fine pores; slightly calcareous; neutral to mildly alkaline; abrupt, wavy boundary.

Ccam—22 inches, white, fractured, indurated caliche.

The thickness of the A1 horizon ranges from 4 to 8 inches. The color ranges from 10YR to 7.5YR in hue, from 3 to 5 in value, and from 2 to 3 in chroma. The texture includes loam and clay loam. The thickness of the B2t horizon ranges from 10 to 18 inches. The texture includes heavy loam and heavy clay loam. The lower part is calcareous in places. The B3 horizon is discontinuous and is calcareous in places. The color of this horizon is at least one unit higher in value than that of the A1 horizon. The depth to caliche ranges from 18 to 40 inches.

Stegall soils are associated with Kimbrough soils.

Stony and Rough Broken Land

Stony and Rough broken land (SR) occurs on sloping to steep ridges and breaks of red-bed rocks. This land type occurs east of the Pecos River, as elongated tracts 80 to 640 acres in size. It consists of ridgetops of thin-bedded, indurated to weakly cemented caliche overlying fractured, weakly cemented layers of sandstone, siltstone, shale, and gypsiferous rocks and earths. These areas include part of the High Plains escarpment, known locally as "the Caprock." Stony and Rough broken land makes up 30 to 50 percent of the acreage. Simona, Potter, and other soils make up the rest. A low, vertical escarpment commonly occurs at or near the top of slopes. Such an escarpment separates Potter soils from Stony and Rough broken land.

The soils range in thickness from a few inches to about 20 inches in pockets near the base of slopes. At the tops of the slopes, the texture of the surface layer is gravelly loam. On the side slopes, cobblestones and stones are mixed with very shallow, loamy soil material. V-shaped gullies are common in drainageways.

The water-holding capacity is very low. Surface runoff is rapid, and the soil material is washed away nearly as fast as it forms.

This land type is used principally for native pasture and wildlife habitat. It supports a sparse cover of grama grasses, broom snakeweed, and tarbush. (Dryland capability unit VIIs–4; Hills and Breaks range site)

Stony Land

Stony land occurs in the general vicinity of Dog Canyon Draw and along the east side of Lake McMillan. It consists of steep, extremely dissected or gullied areas where red beds are exposed. The red beds consist mainly of thin-bedded, fractured sandstone, siltstone, and shale, but partly of limestone and gypsiferous rocks. There is little or no soil. In the Eddy Area, Stony land is mapped only as a complex with Largo soils.

This land type has severe limitations and has little value other than for wildlife habitat and light grazing by livestock. The vegetation is very sparse. It consists of black grama, side-oats grama, three-awn, broom snakeweed, mesquite, American tarbush, and annuals.

Tonuco Series

The Tonuco series consists of moderately dark colored, noncalcareous soils that have been worked by wind. These soils are coarse textured, excessively drained, and shallow over caliche. They are nearly level to gently sloping. They occur on scattered ridges throughout the "Shallow Sand Country" east of the Pecos River.

Soils of the Tonuco series typically have a surface layer of brown loamy fine sand about 5 inches thick. The next layer, about 10 inches thick, is reddish-brown loamy fine sand. Fractured, platy, indurated caliche is at a depth of about 15 inches.

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Tonuco soils are subject to severe wind erosion if the vegetative cover is seriously depleted. Runoff is very slow. Permeability is rapid. Nearly all of the rainfall soaks in. The water-holding capacity is very low, and the soils are droughty. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,000 to 4,100 feet. Surface water is lacking.

All the acreage is used for native pasture and wildlife habitat. The vegetation consists of black grama, side-oats grama, little bluestem, blue grama, Javelina, sand muhly, sand dropseed, three-awn, sand sagebrush, broom snakeweed, and mesquite.

Typical profile of Tonuco loamy fine sand, 2,800 feet south and 1,550 feet west of the NW. corner of sec. 20, T. 18 S., R. 28 E.

A1—0 to 5 inches, brown (7.5YR 4/3) loamy fine sand, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure, except the uppermost 1 to 2 inches, which has weak, platy structure; soft when dry, very friable when moist, nonsticky when wet; very porous; few, small, hard fragments of caliche; noncalcareous; neutral; clear boundary.

AC—5 to 15 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) when moist; weak, coarse, subangular blocky structure grading to structureless in the lower part; slightly hard when dry, very friable when moist, nonsticky when wet; very porous; few to common, small, hard fragments of caliche; noncalcareous; neutral; abrupt boundary.

IICcam—15 inches, white, fractured, layered, indurated caliche; material from the AC horizon occurs in the cracks.

The thickness of the A1 horizon ranges from 3 to 6 inches. The color ranges from 7.5YR to 5YR in hue, from 4 to 6 in value, and from 3 to 4 in chroma. The texture of the A1 and AC horizons includes loamy sand and loamy fine sand. Thin layers of fine sand occur in winnowed areas. The depth to indurated caliche ranges from 6 to 20 inches.

Tonuco soils are associated with Berino, Cacique, Kermit, and Simona soils.

Tonuco loamy sand, 0 to 3 percent slopes, eroded (TC).—Except for depth and the texture of the surface layer, this soil has a profile similar to that described as typical of the series. It occurs as scattered areas on undulating plains east of the Pecos River. Included in mapping were small areas of Tonuco loamy fine sand, 0 to 3 percent slopes; Tonuco loamy fine sand, 0 to 3 percent slopes, eroded; and Dune land. The included soils make up less than 20 percent of the acreage.

The surface layer is reddish-brown, noncalcareous loamy sand about 7 inches thick. The underlying indurated caliche is fractured and platy.

This soil has been moderately to severely eroded by wind. Hummocks of sand, 1 to 3 feet high, cover about 20 to 40 percent of the surface. Blowouts where caliche is exposed are common. Roots are restricted by shallowness over caliche. Runoff is very slow; it occurs only on rare occasions when the soils have become saturated after prolonged rainfall.

All the acreage is used for native pasture and wildlife habitat. Good management is needed to maintain a cover of desirable forage and to control wind erosion. Revegetation is difficult because temperatures are high and rainfall is undependable. (Dryland capability unit VIIe–2; Sandy range site)

Tonuco loamy fine sand, 0 to 3 percent slopes (TF).—This soil occurs on ridges and in swales of uplands east of the Pecos River. It has the profile described as typical of the series. Included in mapping were small areas of Tonuco loamy sand, 0 to 3 percent slopes, eroded, and of Dune land. These areas make up less than 15 percent of the acreage.

This soil has been slightly eroded by wind. If the vegetative cover is seriously depleted, the hazard of further erosion is severe.

All the acreage is used for native pasture and wildlife habitat. The root zone is restricted by the depth to caliche. This soil needs good range management that controls wind erosion and maintains a cover of desirable forage. Revegetation is difficult because temperatures are high and rainfall is undependable. (Dryland capability unit VIIe–2; Sandy range site)

Tonuco loamy fine sand, 0 to 3 percent slopes, eroded (TN).—This soil occurs on ridges and in swales on uplands east of the Pecos River. It has been moderately to severely eroded by wind, but otherwise the profile is similar to that described as typical of the series. Included in mapping were areas of Tonuco loamy sand, 0 to 3 percent slopes, eroded, and of Dune land. These areas make up less than 15 percent of the acreage.

The upper part of this soil consists of dark-brown loamy fine sand about 14 inches thick. The next layer is dark-brown to brown, slightly calcareous gravelly loamy fine sand 5 inches thick. Fractured, platy, indurated caliche begins at a depth of about 19 inches. Hummocks of sand, 1 to 3 feet high, cover about 20 to 30 percent of the surface. The hummocks are somewhat stabilized by woody plants. The areas between the hummocks are nearly barren or sparsely vegetated.

All the acreage is used for native pasture and wildlife habitat. Good management is needed to maintain a cover of desirable vegetation and to control wind erosion. Revegetation is difficult because temperatures are high and rainfall is undependable. (Dryland capability unit VIIe–2; Sandy range site)

Tonuco-Berino loamy sands, 0 to 5 percent slopes (TO).—This complex occurs on nearly level to sloping, undulating plains and in drainageways east of the Pecos River in the vicinity of Lake Avalon and Carlsbad. Tonuco soils make up about 45 to 75 percent of the acreage. They have a profile similar to that of Tonuco loamy sand, 0 to 3 percent slopes, eroded. Berino soils make up about 20 to 40 percent of the acreage. Except for the texture of the surface layer, they have a profile similar to that of Berino loamy fine sand, 0 to 3 percent slopes. Included in mapping were areas of Kermit fine sand; Dune land; Tonuco loamy fine sand, 0 to 3 percent slopes; and Pajarito loamy fine sand, 0 to 3 percent slopes. The included soils make up about 15 percent of the acreage.

The Tonuco soils in this complex are severely eroded and are susceptible to continued wind erosion. Hummocks of sand, 1 to 3 feet high, cover 40 to 60 percent of the surface. These hummocks are somewhat stabilized by woody plants. The areas between the hummocks are barren or are only sparsely vegetated. Good management is

needed to control erosion and to maintain a cover of desirable forage. Revegetation is difficult because temperatures are high and rainfall is undependable. Nearly all the precipitation that falls soaks in; runoff occurs only on rare occasions when the soils have become saturated after prolonged rainfall.

The Berino soils are slightly eroded. The hazard of further wind erosion is severe if the vegetative cover is seriously depleted.

All the acreage is used for native pasture and wildlife habitat. (Dryland capability unit VIIe–2; Tonuco soils are in Sandy range site; Berino soils are in Deep Sand range site)

Upton Series

The Upton series consists of moderately dark colored, calcareous, gravelly soils that developed in old alluvium derived from calcareous sedimentary rocks. These soils are very shallow to shallow over caliche and cemented gravel. They occur on upland plains between the Pecos River and the mountains and hills of the western part of the survey Area. They are nearly level to sloping.

Soils of the Upton series typically have a surface layer of grayish-brown gravelly loam about 3 inches thick. The next layer, about 6 inches thick, is brown gravelly loam. Fractured, platy, indurated caliche is at a depth of about 9 inches.

These soils are uneroded or only slightly eroded. Runoff is slow to medium. Permeability is moderate. The water-holding capacity is low to very low, and the soils are droughty. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,000 to 4,400 feet.

Upton soils are used principally for native pasture and wildlife habitat. A small acreage is used for irrigated crops. The vegetation consists mainly of black grama, side-oats grama, blue grama, hairy grama, creosotebush, tarbush, burrograss, broom snakeweed, and mesquite. Good management is needed to maintain a cover of desirable forage and to control erosion. Revegetation is difficult because temperatures are high and rainfall is undependable. Surface water is lacking.

Typical profile of Upton gravelly loam, 2,160 feet east and 1,650 feet south of the NW. corner of sec. 15, T. 24 S., R. 26 E.

A1—0 to 3 inches, grayish-brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine pores; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

C1—3 to 9 inches, brown (10YR 5/3) gravelly loam, dark brown to brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine pores; strongly calcareous; mildly alkaline; abrupt boundary.

C2cam—9 inches, fractured, platy, indurated caliche and cemented gravel; upper part of the horizon is laminar.

The A1 horizon ranges from 1 to 4 inches in thickness. The color ranges from 10YR to 7.5YR in hue, from 5 to 7 in value, and from 2 to 4 in chroma. The C1 horizon ranges from 1 to 9 inches in thickness. The color ranges from 10YR to 7.5YR in hue, from 5 to 6 in value, and from 3 to 4 in chroma. The depth to caliche ranges from 2 to 20 inches.

Upton soils are associated with Atoka, Reagan, and Simona soils.

Upton gravelly loam, 0 to 9 percent slopes (UG, Uo).—This soil has the profile (fig. 17) described as typical of the series. It occurs as whalebacks, or elongated areas with rounded crests. The areas are west of the Pecos River on broad plains and in valleys, and east and west of the River, from Carlsbad southward to the Texas State line. Included in mapping were small areas of Upton soils 0 to 1 percent slopes; Upton soils, 1 to 3 percent slopes; Atoka loam, 0 to 1 percent slopes; Atoka loam, 1 to 3 percent slopes; and Reagan loam, 0 to 1 percent slopes. The included areas make up less than 15 percent of the acreage.

Some of the acreage was mapped at high intensity, and some at low intensity. Most of the acreage is in the low-intensity survey. The principal difference between the soils mapped at the two intensities is the size of the individual areas and the kinds of included soils. In the low-intensity survey, the areas are generally large; some are as much as several hundred acres in size. In the high-intensity survey, most areas are 5 to 50 acres in size. The included areas of Atoka loam and Reagan loam are more extensive in the low-intensity survey.

This soil is used for native pasture. Roots are restricted by shallowness over hard caliche. Fertility is low. (Dryland capability unit VIIs–1; Shallow range site)

Upton soils, 0 to 1 percent slopes (Up).—This undifferentiated unit consists of calcareous loam and sandy loam on uplands. These soils occur as small areas widely scattered throughout the irrigated tracts between Artesia and Lakewood and between Carlsbad and Otis. They have a profile similar to the one described as typical of the series, except that the soils are not gravelly and they are 10 to 20 inches deep over indurated caliche. Included in mapping were small areas of Upton gravelly loam, 0 to 9 percent slopes, on knobs or ridges, and of Atoka loam, 0 to 1 percent slopes, in swales. These soils make up less than 10 percent of the acreage.

The plow layer is brown, calcareous loam or sandy loam about 8 inches thick. Below this is a layer, about 10 inches thick, of yellowish-brown, calcareous loam. Fractured, platy, indurated caliche begins at a depth of about 18 inches.

These soils are used for irrigated pasture, native pasture, and wildlife habitat. They are moderately fertile, but their use is limited. Shallowness over caliche makes leveling difficult. (Irrigated capability unit IVs–3; dryland capability unit VIIs–1; Shallow range site)

Upton soils, 1 to 3 percent slopes (Ut).—Except for the slope, these soils have a profile (fig. 18) similar to that described for Upton soils, 0 to 1 percent slopes. This mapping unit occurs adjacent to Upton gravelly loam, 0 to 9 percent slopes, on the side slopes of swales. It is widely scattered throughout the high-intensity mapping areas near Artesia and Carlsbad. Included in mapping were areas of Upton gravelly loam, 0 to 9 percent slopes, on knobs or ridges; and areas of Atoka loam, 0 to 1 percent slopes, in the center of narrow swales. The included areas make up less than 10 percent of the acreage.

Figure 17.—**Profile of Upton gravelly loam, 0 to 9 percent slopes. A layer of hard, fractured caliche is at a depth of about 1 foot.**

Much of the acreage is used for native pasture and wildlife habitat. The irrigated areas are suitable for tame pasture. Bench leveling is very difficult. (Irrigated capability unit IVs–3; dryland capability unit VIIs–1; Shallow range site)

Upton-Reagan complex, 0 to 9 percent slopes (UR).—This complex is extensive in the northwestern part of the survey Area. The Upton gravelly loam in this complex has the profile described as typical of the series, and the Reagan soil is like Reagan loam, 0 to 3 percent slopes. Included in mapping were areas of Pima soils on flood plains. These soils make up less than 15 percent of the acreage.

Upton soils, which make up about 50 to 70 percent of the acreage, occur on uplands. They occupy the higher parts of the landscape. They are nearly level to sloping.

Reagan soils, which make up about 30 to 50 percent of the acreage, occur in upland swales and drainageways. They are nearly level to gently sloping.

All of this complex is used for native pasture and wildlife habitat. The soils are uneroded or only slightly eroded. Good management is needed to maintain a cover of desirable vegetation. Revegetation is difficult because temperatures are high and rainfall is undependable. Surface water is lacking, except for brief periods after prolonged rainfall, which is infrequent. (Upton soils are in dryland capability unit VIIs–1 and Shallow range site; Reagan soils are in dryland capability unit VIs–4 and Loamy range site)

Upton-Simona complex, 1 to 15 percent slopes, eroded (US).—This complex occurs on slopes or breaks to drainageways in the southeastern part of the survey Area. The Upton gravelly loam and Simona gravelly fine sandy loam have the profile described as typical of their respective series. Included in mapping were areas of Stony and Rough broken land and of Pajarito-Dune land complex, 0 to 3 percent slopes. The included areas make up less than 25 percent of the acreage.

Upton soils, which make up about 35 to 45 percent of the acreage, occupy the steeper parts of the slopes. Simona soils, which make up about 30 to 40 percent, occur at the tops of the slopes and along gently sloping ridges between small streams and larger drainageways.

The soils of this complex are slightly to moderately eroded. Rills and sheet erosion are common on the Upton soils, and sand hummocks occur on the Simona soils.

This complex is used for native pasture and wildlife habitat. Good management is needed to maintain a cover of desirable forage and to control erosion. Revegetation

is difficult because temperatures are high and rainfall is undependable. Surface water is lacking, except for brief periods after prolonged rainfall, which is infrequent. (Dryland capability unit VIIs–1; the Upton soils are in Shallow range site; the Simona soils are in Sandy range site)

Wink Series

The Wink series consists of moderately dark colored, strongly calcareous soils that developed in moderately coarse textured, wind-worked material. These soils are moderately deep over very strongly calcareous lacustrine sediments, and they are well drained. They occur in swales or depressions in the "Deep Sand Country" east of the Pecos River. They are nearly level to gently sloping.

Soils of the Wink series typically have a surface layer of brown loamy fine sand about 8 inches thick. Below this, to a depth of about 38 inches, is light-brown and pink fine sandy loam. Layered lacustrine material begins at a depth of about 38 inches. It is light colored, sandy, and strongly calcareous.

These soils are moderately to severely eroded; they are subject to severe wind erosion if the vegetative cover is seriously depleted. The surface is hummocky. Permeability is moderately rapid in the surface layer and the subsoil. Nearly all of the precipitation soaks in, but the water-holding capacity is moderately low. Rainfall amounts to 10 to 14 inches annually, and the mean annual temperature is 60° to 64° F. The frost-free season is 200 to 217 days. Elevations range from 3,000 to 4,000 feet.

All the acreage is used for native pasture. The vegetation consists mainly of sand sagebrush, mesquite, threeawn, broom snakeweed, dropseed, and annuals. Revegetation is extremely difficult once the plant cover is lost, because rainfall is low and erratic. Surface water is lacking, except for brief periods after the infrequent heavy rains.

Typical profile of Wink loamy fine sand, 1,910 feet west and 2,320 feet south of the NE. corner of sec. 13, T. 21 S., R. 32 E.

A1—0 to 8 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; very weak, medium, subangular blocky structure, except for the uppermost 1 inch, which has very weak, thin, platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; very porous; slightly calcareous; mildly alkaline; gradual, smooth boundary.

AC—8 to 28 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; massive; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; mildly alkaline; common fine and medium pores; gradual, smooth boundary.

C1ca—28 to 38 inches, pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) when moist; massive; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine and medium pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

IIC2—38 to 60 inches, pink (7.5YR 8/4) when dry; strongly calcareous, layered, sandy lacustrine sediments.

The A1 horizon ranges from 7 to 15 inches in thickness. The color ranges from 7.5YR to 10YR in hue, from 5 to 6 in value, and from 2 to 4 in chroma. The texture includes loamy fine sand, fine sandy loam, and fine sand where it is winnowed or overblown. The surface is generally hummocky; dunes are less than 36 inches high. The AC horizon ranges from 12 to 24 inches in thickness. The color is slightly lighter than that of the A1 horizon. The texture ranges from loamy fine sand to fine sandy loam. The Cca horizon ranges from 8 to 20 inches in thickness. The color ranges from 10YR to 7.5YR in hue, from 6 to 8 in value, and from 2 to 4 in chroma. The depth to the IIC horizon ranges from 36 to 60 inches. The color ranges from 7.5YR to 10YR in hue, from 6 to 8 in value, and from 2 to 4 in chroma. This horizon consists of stratified, sandy, strongly calcareous, lacustrine material.

Wink soils are associated with Berino and Simona soils.

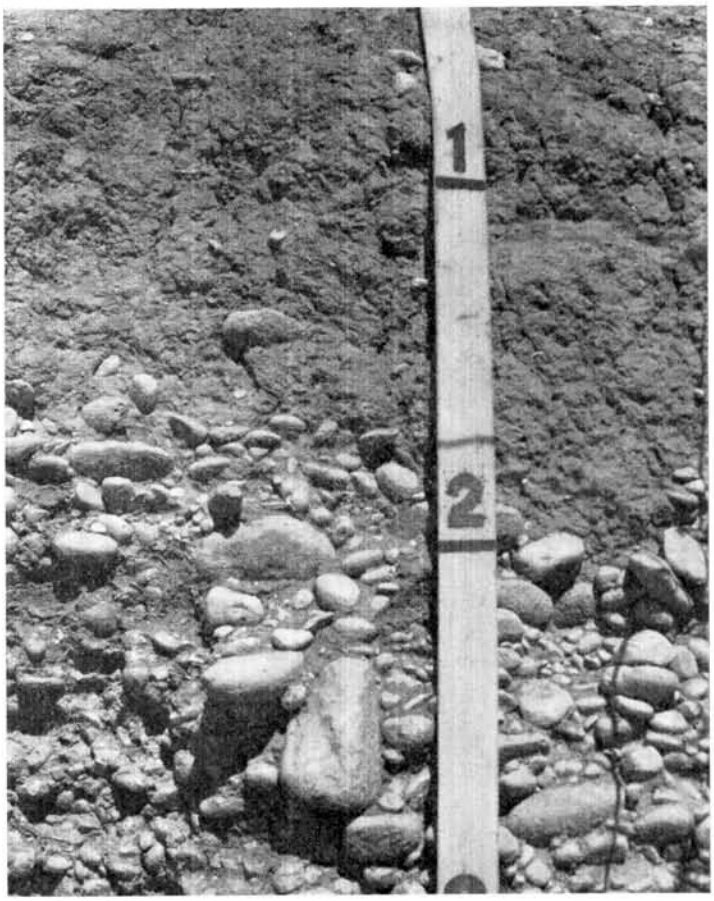

Figure 18.—**Profile of Upton soils, 1 to 3 percent slopes. The gravel that begins at a depth of about 2 feet is in hard caliche.**

Wink loamy fine sand, 0 to 3 percent slopes, eroded (WK).—This soil has the profile described as typical of the series. It occurs in swales or depressions in the "Deep Sand Country" east of the Pecos River. Some of the areas have been influenced by the underlying red-bed material. Included in mapping were areas of Simona and Wink fine sandy loams, 0 to 3 percent slopes, eroded. The included areas make up less than 15 percent of the acreage.

This soil has been moderately to severely eroded by wind. Hummocks of sand range from 12 to 36 inches in height. Runoff is very slow.

All the acreage is used for native pasture and wildlife habitat. The effective rooting zone is not restricted. Good management is needed to control wind erosion. (Dryland capability unit VIIe–1; Deep Sand range site)

Use and Management of the Soils

This section discusses the use and management of the soils for irrigated cropland, unirrigated cropland, range, wildlife habitat, and engineering. It includes an explanation of capability classification of soils, discussions of management of irrigated and dryland soils by capability units, and estimates of yields of irrigated crops under two levels of management. Much of the information significant in engineering is presented in the form of tables.

Capability Grouping

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

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

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

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

Class I soils have few limitations that restrict their use. (None of the soils of this Area are in class I.)

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None of the soils of this Area are in class V.)

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

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

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

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

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

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or VIs–1. Thus in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the Eddy Area, the capability units are set up and numbered within a system of capability classification that is used throughout the land resource area of which this survey Area is a part. Not all the capability units in this system are applicable, and for this reason the numbering of the capability units is not consecutive in all cases.

The names of the soil series represented are mentioned in the description of each capability unit, but the listing of the series name does not necessarily indicate that all the soils of a series are in the same capability unit. The capability classification of any given soil can be learned by referring to the "Guide to Mapping Units."

In the following pages the soils of this Area are discussed both by irrigated capability units and by dryland capability units. A section on estimated yields of irrigated crops follows the discussion of irrigated capability units.

Management by Irrigated Capability Units

This section gives information about the soils that are placed in irrigated capability units. Some of the irrigated soils become slightly to moderately saline if a poor quality of irrigation water is applied. The effect on crops becomes noticeable in as little as 1 year or as much as 15 years after the first application of saline water. In this

Area salinity of irrigation water from all sources ranges from a few hundred parts per million to more than 4,000 parts per million. Usually, salinity is within a range of 1,000 to 4,000 parts per million, but the high proportion of gypsum to the total salts lessens the adverse effects.

The soils of the Area can be worked the year around because they seldom freeze and cold spells last only a few days. To minimize soil blowing, farmers plow their fields in spring but leave them rough until time for planting and irrigation. Practices for control of wind erosion do not entail serious problems, even though wind velocities are high in spring.

Several management practices apply to all the soils that are used for crops and pasture. These practices include application of fertilizer according to field trials and the results of soil tests. Practices that help to control erosion and maintain tilth and organic-matter content are mulching and the use of crop residue, manure, cover crops, and green-manure crops.

The most common cropping sequence used on these soils is alfalfa 3 to 4 years, followed by 2 years of soil-depleting crops, such as cotton. Another example of a conservation cropping system is growing soil-improving crops and high-residue crops on at least a fourth of the acreage each year, then returning the residue to the soil. Alternate cropping systems are (1) growing grasses and legumes in rotation; (2) growing soil-improving crops, cover crops, and green-manure crops; and (3) growing soil-improving crops and mulching.

The irrigated capability units recognized in the Eddy Area are discussed in the following pages.

IRRIGATED CAPABILITY UNIT IIe–1

Reagan loam, 1 to 3 percent slopes, is the only soil in this capability unit. This is a deep, friable soil on uplands. It is susceptible to water erosion and to wind erosion at times when the seedbed is being prepared and the surface is bare.

The natural fertility is high, but the organic-matter content is low. The water-holding capacity is about 2 inches per foot. Permeability is moderate in the subsoil. Tillage is easy, but the soil compacts readily if it is tilled when too wet.

The principal crops are cotton, alfalfa, grain sorghum, silage sorghum, and small grain. Smaller acreages are used for tame pasture and corn. Windbreaks are well suited to these soils.

Alfalfa responds well to applications of phosphorus. Cotton and sorghum respond to nitrogen.

This soil can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open, lined ditches. The fields are short, and in many places it is difficult to wet the root zone uniformly unless the soils are bench leveled. Additional control structures are needed to handle the flow of irrigation water safely. Berms along benched soils need to be protected against burrowing animals.

IRRIGATED CAPABILITY UNIT IIe–2

Karro loam, 1 to 3 percent slopes, is the only soil in this capability unit. It occurs on uplands. This is a deep, friable, very strongly calcareous soil that has a moderately permeable subsoil. It is susceptible to erosion. The content of lime is high, and the soil aggregates are unstable.

The natural fertility is fair, but the organic-matter content is low. The water-holding capacity is about 2 inches per foot. Tillage is easy, but the soil compacts readily if it is tilled when too wet.

The principal crops are cotton, alfalfa, grain, and sorghum for silage. Sugar beets are also suitable. A limited acreage is used for tame pasture, corn, and small grain. Chlorosis is common because the soil has a high content of calcium. Crops respond well to additions of organic matter, nitrogen, phosphorus, and iron.

This soil can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open, lined ditches. The fields are short, and in many places it is difficult to wet the root zone uniformly unless the soils are bench leveled. Additional control structures are needed to handle the flow of irrigation water safely. Berms along benched soils need to be protected against burrowing animals.

IRRIGATED CAPABILITY UNIT IIe–3

Anthony sandy loam, 0 to 1 percent slopes, is the only soil in this capability unit. This is a deep, very friable soil on river terraces. It is susceptible to erosion.

The organic-matter content is low. The water-holding capacity is about 1.2 inches per foot. Permeability is moderately rapid in the subsoil. Tillage is easy, and soil compaction is not a problem.

The principal crops are cotton, alfalfa, grain sorghum, and small grain. Seedlings are damaged or destroyed by high winds in some years. Alfalfa responds to phosphorus. Row crops need both nitrogen and phosphorus.

Frequent applications of irrigation water are needed. If the applications are too heavy, plant nutrients are leached out. Generally, a sprinkler system of irrigation controls erosion more effectively than a surface system, and it results in smaller loss through evaporation. However, a surface system of level borders, graded borders, or furrows can be used, and the irrigation water can be carried by a system of pipelines or open ditches.

IRRIGATED CAPABILITY UNIT IIe–4

Harkey sandy loam, 0 to 1 percent slopes, is the only soil in this capability unit. This is a deep, very friable soil on river terraces. The hazard of wind erosion is moderate.

The natural fertility is moderate, and the organic-matter content is low. The water-holding capacity is about 1.2 inches per foot in the uppermost 6 to 16 inches and about 2 inches per foot in the rest of the soil. Permeability is moderate in the subsoil. Tillage is easy, and soil compaction is not a problem.

The principal crops are cotton, alfalfa, grain sorghum, silage sorghum, and small grain. Smaller acreages are used for tame pasture and corn. Young seedlings are damaged by high winds in some years. Windbreaks are well suited to this soil.

Alfalfa responds well to applications of phosphorus. Row crops respond to both nitrogen and phosphorus.

This soil can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open, lined ditches.

IRRIGATED CAPABILITY UNIT IIs-1

This unit consists of deep, well-drained soils of the Pima series. These soils occur on bottom lands and are subject to periodic flooding. They are nearly level. Their surface layer is silt loam or clay loam.

The natural fertility is high, but the organic-matter content is medium. The water-holding capacity is about 2 inches per foot. Permeability is moderately slow in the subsoil. Tillage is difficult; the soils are cloddy and are easily compacted by machinery and livestock. Workability can be improved by plowing in fall and leaving the soils rough over the winter. The soils are relatively resistant to wind erosion.

The principal crops are cotton, alfalfa, grain sorghum, silage sorghum, and small grain. Alfalfa responds to applications of phosphorus. Row crops and small grain respond to both nitrogen and phosphorus.

These soils can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open ditches. Too much irrigation water, however, damages fine roots, and ponded water kills alfalfa if the water stands more than 24 hours. Sprinkler systems are not well suited to these soils, because the water evaporates too fast and because the soils crust readily and the crust retards seedling emergence.

IRRIGATED CAPABILITY UNIT IIs-2

This unit consists of deep, friable soils of the Harkey and Reagan series. These soils occur on plains and low river terraces. They have a surface layer of very fine sandy loam or loam. They are strongly to very strongly calcareous and are susceptible to slight erosion.

The natural fertility is high, but the organic-matter content is low. The water-holding capacity is 2 inches per foot. Permeability is moderate in the subsoil. Tillage is easy, but the soils compact readily if they are tilled when too wet.

These soils are better suited to crops than any others in the survey Area. The principal crops are cotton, alfalfa, grain sorghum, silage sorghum, and small grain. Smaller acreages are used for sugar beets, tame pasture, corn, pecans, and truck crops. Salt-tolerant crops should be grown because the available irrigation water is saline. Windbreaks are well suited to these soils.

Alfalfa responds to applications of phosphorus. Cotton and sorghum respond moderately well to nitrogen.

These soils can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open, lined ditches.

IRRIGATED CAPABILITY UNIT IIs-13

Karro loam, 0 to 1 percent slopes, is the only soil in this capability unit. It occurs on terraces. This is a deep, friable, strongly calcareous soil. It is susceptible to erosion. The lime content is high, and the soil aggregates are unstable.

The natural fertility is fair, but the organic-matter content is low. The water-holding capacity is about 2 inches per foot. Permeability is moderate in the subsoil. The root zone is 36 to 60 inches thick. Tillage is easy, but the soil compacts readily if it is tilled when too wet.

The principal crops are cotton, alfalfa, grain sorghum, and silage sorghum. Sugar beets are also suitable. Smaller acreages are used for tame pasture, corn, and small grain. Chlorosis is common.

This soil can be irrigated by a surface system of level borders, graded borders, or furrows, and the water can be carried by a system of pipelines or open, lined ditches. Leveling the soil helps to control waste of irrigation water. Sprinkler systems are not well suited to these soils, because the surface crusts and the crust retards seedling emergence.

IRRIGATED CAPABILITY UNIT IIIe-2

This unit consists of moderately deep, friable, upland soils of the Atoka and Reeves series. These soils are gently sloping and are susceptible to erosion. Their surface layer is loam.

The natural fertility is high, but the organic-matter content is low. The water-holding capacity is about 2 inches per foot. Permeability is moderate in the subsoil. The effective root zone is 20 to 36 inches thick. Tillage is easy when these soils are moist, but the soils compact readily if they are tilled when too wet. Cuts for land leveling should not exceed one-fourth the depth to the underlying hard layer.

The principal crops are alfalfa, cotton, sorghum, and grain. Pecans are not suitable. Alfalfa responds well to applications of phosphorus. Row crops respond well to nitrogen.

These soils can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open ditches. The fields are short, and in many places it is difficult to wet the root zone uniformly unless the soils are bench leveled. Additional control structures are needed to handle the flow of irrigation water safely and to control waste. Berms along benched soils need to be protected against burrowing animals. Salt spots caused by seepage develop in the Reeves soil unless irrigation water is carefully managed.

IRRIGATED CAPABILITY UNIT IIIs-6

This unit consists of deep to moderately deep, friable, saline soils of the Karro, Pima, Reagan, and Reeves series. These soils occur on flood plains, terraces, and uplands. They are nearly level. Their surface layer is loam or silt loam. The soil aggregates are unstable in water. Seepage from adjacent uplands has brought about a saline condition.

The natural fertility is moderate in the Karro soils, but it is high in the rest of the soils. The organic-matter content is low to moderately low. The water-holding capacity is about 2 inches per foot. Permeability is moderate to slow in the subsoil. The root zone of the Reeves soil is 20 to 36 inches thick, but it extends to a depth of 40 inches or more in the rest of the soils. The soils are cloddy when plowed, and preparation of the seedbed is difficult. They compact readily when moist or wet.

The principal crops are cotton, alfalfa, and barley. Tame pasture, sugar beets, and oats can be grown also. Only salt-tolerant crops are suitable. Chlorosis is common; it persists in crops grown on the Karro soil, even after leaching, because that soil has a high content of lime.

These soils can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of open ditches or pipelines. Good management of the irrigation water is needed to leach salts out of the soils.

IRRIGATED CAPABILITY UNIT IIIs–14

This unit consists of moderately deep, friable, saline soils of the Atoka, Reeves, and Russler series. These soils are loams underlain by gypsiferous material that restricts the penetration of roots. They occur on uplands and are nearly level to gently undulating.

The natural fertility and the organic-matter content are low. The water-holding capacity is about 4 to 5 inches. Permeability is moderate in the subsoil. Tillage is easy, but the soils compact readily if tilled when too wet.

The principal crops are cotton, alfalfa, grain sorghum, silage sorghum, and small grain. Sugar beets, barley, and tame pasture can be grown also. Salt-tolerant crops are better suited than other crops. Alfalfa and other legumes generally respond to applications of phosphorus. Row crops respond to nitrogen.

These soils are typically saline, and practices are needed to prevent accumulation of salt and to keep the salt content low. They can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open, lined ditches. In many places it is difficult to wet the root zone uniformly unless the soils are bench leveled. Control structures are needed in many places to check erosion and soil cutting by irrigation water.

IRRIGATED CAPABILITY UNIT IVs–1

Arno silty clay loam, 0 to 1 percent slopes, is the only soil in this capability unit. This is a deep, saline soil. It occurs on bottom lands along the Pecos River.

The organic-matter content is low. The water-holding capacity is high. Permeability is slow in the subsoil. The soil stays wet for long periods and is difficult to till. It compacts readily.

The principal crops are alfalfa and cotton. Sugar beets are also grown. Only salt-tolerant crops are suitable. Row crops respond to applications of nitrogen and phosphorus. Grasses generally need nitrogen.

This soil can be irrigated by a surface system of level borders, graded borders, or furrows, and the irrigation water can be carried by a system of pipelines or open ditches. Careful management of irrigation water is needed to control the salt content of the soil. Ponded water will kill fine roots if the water stands a long period of time.

IRRIGATED CAPABILITY UNIT IVs–3

This unit consists of shallow, friable, upland soils of the Reeves and Upton series. These soils consist of loam or fine sandy loam underlain by hard caliche or gypsiferous material. They are nearly level to gently sloping.

The organic-matter content is low. The water-holding capacity is low. The effective root zone is 10 to 20 inches thick. Tillage is easy; soil compaction is not a serious problem. Cuts for land leveling should not exceed one-fourth the depth to the underlying hard layer.

Although small grain and cotton are grown, these soils are better suited to tame pasture. Nitrogen and phosphorus are needed for row crops, and nitrogen is needed for pasture plants.

Frequent, light applications of irrigation water are needed. Generally, a sprinkler system is the most effective method of irrigation. A sprinkler system does not necessitate as much leveling as a surface system, nor does it result in as much loss through evaporation. However, a surface system of level borders, graded borders, or furrows can be used. Land leveling and lining of ditches are needed to limit loss of water on the Upton soils.

Estimated yields of irrigated crops

The estimates of yields given in table 3 are averages that can be expected over a period of years. These estimates are based on the results of research and on information obtained in interviews with farmers and other informed persons. Soils used only for range are not listed in the table. Some of the irrigated soils are not listed, because the irrigated acreage is small.

The table shows estimates under two levels of management. The figures in columns A represent yields that can be expected under an average level of management. Those in columns B represent yields that can be expected under a moderately high level of management.

Under an average level of management, one or more of the following is assumed—

1. A conservation cropping system is not followed.
2. Suitable crops are not planted at the proper time or at the proper planting rates.
3. Fertilizer is not applied or is applied irregularly.
4. Crop residue is not properly managed.
5. The soils are tilled or grazed or crops are harvested when the soil is wet enough to compact excessively.
6. Control of insect pests, plant diseases, and weeds is inconsistent and not timely.
7. The length and slope of the irrigation run is not correct for applying irrigation water.
8. Irrigation water is not conserved.
9. Irrigation is erratic and untimely.
10. Harvesting is not properly done or properly timed.

Under a moderately high level of management, all of the following are assumed—

1. Conservation cropping systems are followed that include crops that produce a large amount of residue and crops that improve the soil.
2. Suitable crop varieties are selected, and seed is planted at the proper time and at the correct rates.
3. The right kind of fertilizer is applied in proper amounts and at the proper time.

TABLE 3.—*Estimated average yields per acre of principal irrigated crops under two levels of management*

[Yields in columns A are to be expected under an average level of management; yields in columns B can be obtained under a moderately high level of management. Only the soils used to a significant extent for the specified crops are listed]

Soil	Cotton lint		Alfalfa		Grain sorghum		Silage sorghum		Barley		Tame pasture	
	A	B	A	B	A	B	A	B	A	B	A	B
	Lb.	*Lb.*	*Tons*	*Tons*	*Lb.*	*Lb.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*A.U.M.*[1]	*A.U.M.*[1]
Anthony sandy loam, 0 to 1 percent slopes	750	1,000	4	7	3,000	4,500	9	15	30	45	10	15
Arno silty clay loam, 0 to 1 percent slopes	600	1,000	3	5	1,500	2,500	6	10	30	65	7	14
Atoka loam, 0 to 1 percent slopes	800	1,300	4	6	2,400	4,100	10	16	35	70	8	16
Atoka loam, 1 to 3 percent slopes	750	1,200	4	6	2,300	3,800	9	15	35	70	8	15
Harkey sandy loam, 0 to 1 percent slopes	800	1,300	4	6	2,400	4,100	10	16	35	70	8	16
Harkey very fine sandy loam, 0 to 1 percent slopes	1,000	1,650	5	8	3,500	6,500	12	20	45	90	10	20
Karro loam, 0 to 1 percent slopes	850	1,400	4	6	2,600	4,500	10	14	40	80	9	17
Karro loam, 1 to 3 percent slopes	800	1,350	4	5	2,400	4,100	10	13	35	70	8	16
Karro loam, saline, 0 to 1 percent slopes	700	1,150	3	5	1,200	2,000	4	8	30	65	7	14
Pima silt loam, 0 to 1 percent slopes	1,000	1,650	5	8	3,000	5,500	12	20	45	90	10	20
Pima silt loam, saline, 0 to 1 percent slopes	700	1,150	4	6	1,500	2,500	6	10	30	65	7	14
Pimaclay loam, gray variant, 0 to 1 percent slopes	900	1,500	5	7	2,700	4,600	11	18	40	80	9	18
Reagan loam, 0 to 1 percent slopes	1,000	1,650	5	8	3,500	6,500	12	20	45	90	10	20
Reagan loam, 1 to 3 percent slopes	950	1,550	5	8	3,000	5,100	11	19	45	85	10	19
Reagan loam, saline, 0 to 1 percent slopes	700	1,150	4	6	1,500	2,500	6	10	30	65	7	14
Reeves loam, 0 to 1 percent slopes	750	1,000	4	6	2,500	4,000	10	16	35	70	8	15
Reeves loam, 1 to 3 percent slopes	700	900	4	5	2,300	3,800	9	15	35	65	8	14
Reeves loam, saline, 0 to 1 percent slopes	650	1,000	3	6	1,200	2,000	4	8	30	65	7	14
Reeves loam, shallow, 0 to 1 percent slopes	550	825	3	4	1,500	2,500	6	10	30	65	5	10
Russler loam, 1 to 3 percent slopes	500	825	3	4	1,500	2,500	6	10	30	45	7	10
Upton soils, 0 to 1 percent slopes	500	825	3	4	1,500	2,500	6	10	30	45	5	10
Upton soils, 1 to 3 percent slopes	500	825	3	4	1,500	2,500	6	10	30	45	5	10

[1] A.U.M. stands for animal-unit-month. The figures represent the number of months that 1 acre will provide grazing for 1 animal (1,000 pounds live weight).

4. The soils are tilled carefully at the right time and with the right kinds of implements so that crop residue is utilized, weeds are controlled, and excessive compaction is prevented.
5. Insect pests and plant diseases are controlled by chemicals and proper management.
6. Length and slope of irrigation runs are suitable.
7. Irrigation water is applied in accordance with crop needs and at proper times.
8. Crops are harvested at the proper times and with equipment that is properly operated.

Yields may change in the future as a result of the development of new crop varieties that will tolerate the diseases and insect pests common in the Area and that are adapted to the salinity of the soils. Yields higher than the estimates given in columns B are not uncommon in favorable seasons.

Management by Dryland Capability Units

This section gives information about the soils that are placed in dryland capability units. Generally, these soils are suitable only for native pasture and wildlife habitat. Rainfall is not adequate for the establishment of planted grasses. Severe wind erosion is common in the "Deep Sand Country" east of the Pecos River. Some of the soils can be used for cultivated crops if they are irrigated.

DRYLAND CAPABILITY UNIT VIe–1

This unit consists of shallow to deep, well-drained, nearly level to gently sloping soils of the Bippus, Dev, Largo, and Pima series. These soils are medium textured to moderately fine textured. They occur on narrow flood plains and in swales throughout the Area. Unprotected areas are flooded periodically, but in most places the deposits left by floodwaters are not thick enough to damage the vegetative cover. If the plant cover is seriously depleted, the hazard of water erosion is severe.

The natural fertility is low to high. Runoff is slow to rapid, and the water-holding capacity is low to high. Permeability is moderate to moderately slow in the subsoil.

These soils are suited to cultivation only if they are irrigated and protected from flooding. They are not suited to dryland farming, because rainfall is insufficient and erratic. They are suitable for range and for wildlife habitat. In the Artesia and Carlsbad areas, where irrigation water is available, the Pima soils are irrigated.

The vegetation consists mainly of tobosa, alkali sacaton, vine-mesquite, and side-oats grama.

DRYLAND CAPABILITY UNIT VIs–1

This unit consists of very shallow to deep, nearly level to gently sloping soils of the Arno, Cottonwood, Harkey, and Reeves series. These soils occur on bottom lands and are subject to periodic flooding. They are moderately to

strongly saline, and soluble salts are at or near the surface in places. In some areas the water table fluctuates, but it is usually below a depth of 6 feet.

These soils absorb water slowly, and permeability is moderate to slow. The water-holding capacity ranges from very low to high, but absorption of water by plants is restricted by salinity. Runoff is slow to very slow.

These soils are not suited to dryland farming, because of salinity and the low rainfall. They are suited to native grasses and wildlife habitat. The vegetation consists mainly of alkali sacaton, inland saltgrass, and saltcedar. Plant density is restricted by the salt.

DRYLAND CAPABILITY UNIT VIs–2

This unit consists of moderately deep and deep, nearly level, saline soils of the Karro, Pima, Reagan, and Reeves series. These soils occur on terraces and uplands and in swales. Seepage from nearby soils that contain gypsum has brought about a saline condition, and soluble salts are at or near the surface.

These soils absorb water at a slow to moderate rate, and permeability is moderate to slow. The water-holding capacity is high, but water is released to plants slowly. Runoff is slow.

Most areas are used for irrigated crops if water is available. The soils are not suited to dryland farming, because of their moderate to strong salinity and the low rainfall. They are used for native grasses and wildlife habitat. The vegetation consists mainly of alkali sacaton and four-wing saltbush.

DRYLAND CAPABILITY UNIT VIs–3

This capability unit consists of moderately deep, medium-textured and moderately fine textured soils of the Atoka, Reeves, and Russler series. These soils occur on uplands. They are nearly level to gently sloping.

These soils absorb water slowly, and permeability is moderately slow. The water-holding capacity is low to moderate; water is released to plants slowly. Runoff is slow to medium.

Some of the areas are used for irrigated crops. The soils are not suited to dryfarming, because rainfall is low and undependable. They are used for native pasture and wildlife habitat. The vegetation consists mainly of alkali sacaton, tobosa, burrograss, vine-mesquite, and mesquite.

DRYLAND CAPABILITY UNIT VIs–4

This capability unit consists of deep, friable, well-drained soils of the Harkey, Largo, Pima, Reagan, and Stegall series. These soils occur on uplands, mainly in the central and northwestern parts of the survey Area. They are strongly to very strongly calcareous and nearly level to gently sloping. Their surface layer and subsoil are medium textured to moderately fine textured.

Generally, these soils are uneroded or only slightly eroded, but the Largo soils erode readily if the plant cover is lost.

The natural fertility is high, and the soils are easily penetrated by roots, air, and water. The water-holding capacity is high. Permeability and the intake rate are moderate. Runoff is slow.

These soils are not suited to dryland farming, because rainfall is insufficient and erratic. They are used for native pasture and produce fairly high yields of forage in years when rainfall is favorable. Antelope inhabit these areas, and fencing makes herd management possible. Doves and other birds find suitable habitat. The vegetation consists mainly of black grama, blue grama, vine-mesquite, tobosa, burrograss, and broom snakeweed. Reestablishment of vegetation is difficult, once the plant cover is lost, because rainfall is low and undependable.

DRYLAND CAPABILITY UNIT VIIe–1

This unit consists of deep, sandy soils of the Anthony, Berino, Likes, Pajarito, and Wink series, and of Dune land. These soils occur on uplands and terraces in the eastern part of the survey Area. They are nearly level to gently sloping. These soils are subject to severe wind erosion if the vegetative cover is not maintained.

About 3 percent of the acreage has been severely eroded by wind. The sandy surface has been stripped and the sand deposited in dunes 3 to 6 feet high. The dunes are somewhat stabilized by woody plants, mainly mesquite, around which they have formed. The areas between dunes are nearly bare of vegetation. The dunes absorb moisture rapidly, but runoff occurs between dunes in places. During windstorms, the blowing sand cuts off and buries seedlings, and natural revegetation of severely eroded areas is difficult and slow.

The water-holding capacity is very low to moderate. It varies widely in severely eroded areas.

These soils are not suited to dryland farming, because they are sandy and rainfall is low and undependable. They are suitable for native pasture and wildlife habitat. The vegetation consists mainly of little bluestem, sand bluestem, sand dropseed, sand sagebrush, Havard oak, and mesquite. The plant cover is sparse, and the production of usable forage is limited in most years.

These soils must be constantly protected from overgrazing. Most conservation practices would fail without careful planning and management.

DRYLAND CAPABILITY UNIT VIIe–2

This unit consists of very shallow to deep, noncalcareous to strongly calcareous soils of the Anthony, Berino, Cacique, Harkey, Karro, Mobeetie, Reeves, Simona, and Tonuco series. These soils are moderately coarse textured to medium textured. They occur on uplands and terraces throughout the central, southeastern, and northeastern parts of the survey Area. They are nearly level to gently sloping.

About 2 percent of the acreage has been severely eroded by wind. The sandy surface has been stripped and the sand deposited in dunes 3 to 6 feet high. The dunes are somewhat stabilized by woody plants, mainly mesquite, around which they have formed. The areas between dunes are nearly bare of vegetation. The dunes absorb moisture very rapidly, but runoff occurs between dunes in places. During windstorms, the blowing sand cuts off and buries seedlings, and natural revegetation of severely eroded areas is difficult and slow.

The water-holding capacity ranges from moderately high to very low. It varies widely in severely eroded areas.

These soils are not suited to dryland farming, because the rainfall is low and undependable. They are suitable for native pasture and wildlife habitat. The vegetation consists mainly of black grama, side-oats grama, little bluestem, sand dropseed, broom snakeweed, and mesquite. The plant cover is sparse, and the production of usable forage is limited in most years.

These soils must be constantly protected from overgrazing. Careful planning and design of conservation structures are needed.

DRYLAND CAPABILITY UNIT VIIe–3

This unit consists of Kermit and Berino fine sands, 0 to 3 percent slopes. These are deep, coarse-textured, undulating soils that are droughty and erodible. They occur on uplands in the eastern part of the survey Area.

These soils are subject to severe wind erosion if they are not protected by adequate plant cover. The soils absorb all the precipitation that falls, and there is no runoff. Permeability is very rapid to moderately slow. The water-holding capacity is low to moderate. The natural fertility and the organic-matter content are low.

These soils are not suitable for dryland farming, because rainfall is low and undependable and the texture of the soils is too coarse. They can be used for wildlife habitat. The vegetation consists mainly of little bluestem, plains bristlegrass, Indian ricegrass, sand dropseed, little soaptree yucca, Havard oak, mesquite, and sand sagebrush. Grasses should not be overgrazed. Conservation structures are not feasible.

DRYLAND CAPABILITY UNIT VIIs–1

This unit consists of medium-textured and moderately coarse textured soils of the Kimbrough, Potter, Simona, and Upton series. These soils occur on uplands, ridges, side slopes, and plains. They are shallow to very shallow over caliche and are nearly level to strongly sloping.

These soils have low to very low water-holding capacity. They absorb moisture at a medium to rapid rate, and permeability is moderate above the caliche. Runoff is rapid when the soil is saturated. Wind and water erosion are severe on overgrazed areas.

These soils are not suitable for dryland farming, because they are shallow and droughty and rainfall is insufficient. They are suitable for native pasture and wildlife habitat. The vegetation consists mainly of black grama, plains bristlegrass, creosotebush, fluffgrass, burrograss, mesquite, and tarbush. Conservation practices are difficult.

DRYLAND CAPABILITY UNIT VIIs–2

This capability unit consists of Gypsum land, which occurs as steep, nearly barren breaks leading to drainageways in the central and southwestern parts of the survey Area. The soil material is very shallow. The surface layer is generally not more than 2 inches thick over soft gypsum. It crusts readily upon wetting and drying, and the crust somewhat restricts water intake and root penetration. Runoff is rapid. This land type is droughty and is easily eroded by wind and water. Reestablishment of vegetation is extremely difficult, once the plant cover is lost, because of the salt content, shallowness, and insufficient rainfall.

This land type is suited to native grasses. The vegetation consists of very sparse stands of gyp grama, alkali sacaton, soaptree yucca, gyp grass, and coldenia. Only a few kinds of wildlife find habitat.

At present, Gypsum land is not being used commercially as a source of gypsum, but future development may be feasible.

DRYLAND CAPABILITY UNIT VIIs–3

This unit consists of medium-textured, upland soils of the Cottonwood series, and of Gypsum land. These soils generally occur east of the Pecos River and south of the Black River. They are very shallow over gypsiferous material and are nearly level to gently sloping.

The surface layer crusts readily upon wetting and drying, and the crust partly restricts water intake and root penetration. Runoff is medium to rapid. The erosion hazard is severe. The water-holding capacity is very low.

These soils are not suitable for dryland farming, because of droughtiness, salt content, and insufficient rainfall. They can be used for native grasses and for wildlife habitat. The vegetation consists mainly of gyp grama, black grama, three-awn, tobosa, fluffgrass, yucca, and coldenia. The soils must be protected from overgrazing and trampling because reestablishment of vegetation is extremely difficult once the plant cover is lost. Conservation structures are not feasible, because the soils are shallow over gypsiferous material.

At present, Gypsum land is not being used commercially as a source of gypsum, but future development may be feasible.

DRYLAND CAPABILITY UNIT VIIs–4

This capability unit consists of Stony and Rough broken land and the Stony land of the Largo-Stony land complex. The soil material is very shallow to shallow. The water-holding capacity is very low.

These areas can be used for production of native grasses. Most provide suitable habitat for wildlife. The vegetation is sparse, and careful management is needed to prevent overgrazing. Reestablishment of vegetation is extremely difficult because the areas are steep and rainfall is low and erratic.

DRYLAND CAPABILITY UNIT VIIs–5

This unit consists of shallow to very shallow, stony and rocky soils of the Ector series, and of Limestone rock land. It occurs as nearly level to very steep areas on hillsides and mountain slopes, generally in the western part of the survey Area. The soils are medium textured.

The water-holding capacity is very low to low. The soils absorb water at a medium rate, and permeability is moderate. The surface rock and the plant cover help to keep runoff and erosion to a minimum, but runoff is rapid and erosion severe if the plant cover is seriously depleted by overgrazing or trampling.

These soils are not suitable for dryland farming, but they can be used for native grasses, and they provide suitable habitat for wildlife. The vegetation consists mainly of black grama, blue grama, beargrass, tobosa, creosotebush, sotol, agave, broom snakeweed, and yucca. Conservation structures are difficult to establish because the soil material is shallow, stony, and rocky.

DRYLAND CAPABILITY UNIT VIIIe-1

This capability unit is made up of Active dune land, which consists of wind-drifted sands that shift about and blow freely with the wind. The sands accumulate into large dunes. These dunes occur in the eastern part of the survey Area. There are a few scattered clumps of grass and annuals, and here and there, mesquite and sand sage. Some kinds of wildlife find habitat. The areas may have some value for recreational purposes.

DRYLAND CAPABILITY UNIT VIIIs-1

This capability unit is made up of Rock land, which consists of steep rock and barren parent material. This land type occurs in hilly and mountainous areas and on breaks scattered throughout the survey Area. It is extensive east of the Pecos River.

Rock land is not suitable for grass or trees, but it is used for wildlife habitat, recreation, water supply, and esthetic purposes. There are a few clumps of grass, yucca, and cactus, and scattered juniper trees that have taken root in pockets of soil material in cracks in the rock.

Use of the Soils for Range

About 97 percent of the Eddy Area is used for range. The major livestock enterprises are grazing cattle, sheep, or both. Most of the cattle ranches are in the eastern part of the Area; the sheep ranches and the ranches where both cattle and sheep are raised are generally in the western part.

Much of the land of this Area is in the public domain and is administered by the Bureau of Land Management. Leased rangeland makes up part of most ranches.

Range sites and condition classes

Range sites are distinctive kinds of rangeland with different capabilities for producing native plants. Each range site has a characteristic plant community and, unless materially altered by physical deterioration, retains its ability to reproduce this characteristic plant community.

Range sites are differentiated according either to differences in the kinds of plants that make up the potential plant community and the proportion of each kind or to differences in total production of herbage when the composition of the plant community is essentially the same. The differences in the kinds or amounts of vegetation must be enough to necessitate some variation in management, such as a different rate of stocking. Distinctions between range sites are not based on differences in soils or climate, unless such differences result in differences in the potential plant community.

Individual factors of the environment associated with differences in potential vegetation include a water table within the root zone and a saline condition. Differences in soil texture, soil depth, or topographic position are other factors that result in significant differences in plant composition or in yields.

Range condition refers to the composition of the present vegetation on a given site in relation to the composition of the potential vegetation. It is expressed in terms of range condition classes. Four classes are defined, each representing a degree of deterioration of the plant cover. A site is in excellent condition if 76 to 100 percent of the stand is of the same composition as the potential stand. It is in good condition if the percentage is between 51 and 75, in fair condition if the percentage is between 26 and 50, and in poor condition if the percentage is less than 25.

Under prolonged excessive grazing, the more palatable plants are commonly replaced by less desirable plants. Range plants are classified in three broad categories, based on their response to grazing. These categories are identified as decreasers, increasers, and invaders.

Decreasers are plants that decrease in relative abundance under prolonged moderately heavy to heavy grazing. These are mostly perennials that are sought out by livestock because they are the most palatable.

Increasers are plants that normally increase in abundance as the decreasers decline. Under continued grazing, plants that increase at first may subsequently decrease. The forage value of increaser plants ranges from high to low. The low-value plants, which are less palatable to livestock, tend to increase more rapidly than the high-value plants.

Invaders are plants that become established only after the more desirable vegetation has been depleted. They are not part of the potential plant community for the particular range site, but they may be normal components of the potential plant community on other range sites in the same general area.

For effective planning of range management, it is necessary to know not only the present condition of the range but the trend, that is, whether the condition is improving or deteriorating. Signs of a trend toward deterioration include the appearance of bare spots, crusting and compaction of the soil, erosion, the formation of hummocks, a decline in vigor and a reduction in the proportion of the better range plants, and invasion by plants not native to the site. Signs of a trend toward improvement include the presence in the stand of seedlings and plants of different ages, an improvement in the vigor of the better range plants and an increase in the proportion of such plants in the stand, and a decrease in the proportion of invaders.

Descriptions of range sites

The soils of the Eddy Area are grouped into 13 range sites, which are described in the following pages. The soil series represented are named in the description of each site, but this does not mean that all the soils of a given series are in the site. The description of each range site gives significant soil characteristics and qualities, lists the principal range plants, and gives estimates of the average annual production of grazable forage. The estimates are based on air-dried samples.

To learn the range site for any given soil, refer to the "Guide to Mapping Units." Active dune land and Rock land, which are miscellaneous land types, are not assigned to a range site.

BOTTOMLAND RANGE SITE

This range site consists of nearly level to gently sloping, shallow to deep soils of the Bippus, Dev, Largo, Pima, and Stegall series. These soils are medium textured and moderately fine textured. They have a moderately

permeable to slowly permeable subsoil and low to high water-holding capacity. They occur in swales and on flood plains and are subject to periodic flooding.

The potential vegetation consists about 60 percent of decreasers and 40 percent of increasers. The decreasers are sacaton, alkali sacaton, and vine-mesquite. The increasers are tobosa, blue grama, buffalograss, and mesquite. Invaders are burrograss and tamarisk.

The average annual production ranges from about 500 pounds per acre of air-dry grazable forage if the site is in poor condition to about 2,000 pounds if the site is in excellent condition.

CLAYEY RANGE SITE

This range site consists of gently sloping, moderately deep to deep, loamy soils of the Russler and Stegall series. These soils are susceptible to water erosion. They have a slowly permeable subsoil and high water-holding capacity. The water-intake rate is slow.

The potential vegetation consists about 50 to 60 percent of decreasers and the rest of increasers. The decreasers are alkali sacaton, blue grama, side-oats grama, and vine-mesquite. The increasers are tobosa, three-awn, fluffgrass, burrograss, and sand dropseed.

The average annual production ranges from about 300 pounds per acre of air-dry grazable forage if the site is in poor condition to about 2,000 pounds if the site is in excellent condition.

DEEP SAND RANGE SITE

This range site consists of nearly level to gently sloping soils of the Anthony, Berino, Likes, Pajarito, and Wink series and of Dune land. These soils are deep sands. The surface is billowy, except in low places, where it is smooth. The water-intake rate is rapid, and there is no runoff.

The potential vegetation consists 50 to 60 percent of decreasers and 40 to 50 percent of increasers. The decreasers are mostly little bluestem, sand bluestem, black grama, bush muhly, side-oats grama, and plains bristlegrass. The increasers are blue grama, hairy grama, sand dropseed, three-awn, mesquite, and Havard oak. The common invaders are broom snakeweed and annuals.

The average annual production ranges from about 400 pounds per acre of air-dry grazable forage if the site is in poor condition to about 2,400 pounds if the site is in excellent condition.

GYP FLATS RANGE SITE

This range site consists of nearly level to gently undulating Cottonwood soils and Gypsum land. The soils have a loamy surface layer. Gypsiferous material begins at a depth of 1 to 10 inches. The water-intake rate is variable, and the water-holding capacity is very low. Runoff is moderate to rapid.

The potential vegetation is made up 60 percent of decreasers and 40 percent of increasers and invaders. The most common decreasers are gyp grama, black grama, and blue grama. The invaders include three-awn, tobosa, fluffgrass, and yucca.

The average annual production ranges from 400 to 950 pounds per acre of air-dry grazable forage.

GYP HILLS RANGE SITE

This range site consists of Gypsum land, a land type in which the soils are very shallow over gypsiferous material. Outcrops of the underlying material are common.

The potential vegetation consists about 70 percent of decreasers and 30 percent of increasers. About 10 percent of the vegetation is woody species. The principal decreasers are gyp grama, black grama, blue grama, alkali sacaton, side-oats grama, soaptree yucca, and chamiza. The principal increasers are gyp grass, coldenia, longleaf ephedra, and broom snakeweed. The principal invaders are mesquite and creosotebush.

The average annual production ranges from about 100 pounds per acre of air-dry grazable forage if the site is in poor condition to about 350 to 700 pounds if the site is in excellent condition.

HILLS AND BREAKS RANGE SITE

This range site consists of Stony and Rough broken land and of Stony land. These areas are generally steep, but in places they are more nearly level and are dissected by many stream channels.

The potential vegetation consists about 50 percent of decreasers, as much as 15 percent of woody species, and the rest of increasers. The principal decreasers are black grama, side-oats grama, blue grama, bush muhly, plains bristlegrass, green needlegrass, and New Mexico feathergrass. The principal increasers are tobosa, three-awn, fluffgrass, catclaw, sand dropseed, cactus, sacahuista, and longleaf ephedra. The invaders are mesquite, creosotebush, and tarbush.

The average annual production ranges from about 200 pounds per acre of air-dry grazable forage if the site is in poor condition to about 900 pounds if the site is in excellent condition.

LIMESTONE HILLS RANGE SITE

This range site consists of very shallow to shallow, stony Ector soils and Limestone rock land. The soils in this range site are underlain by fractured limestone. They are droughty, and runoff is rapid.

The potential vegetation consists approximately 75 percent of decreasers and 25 percent of increasers. The decreasers are black grama, blue grama, side-oats grama, bush muhly, hairy grama, cane beardgrass, and Arizona cottontop. Wavyleaf oak and Ceanothus generally occur at the higher elevations. The increasers are beargrass, tobosa, burrograss, creosotebush, ring muhly, sotol, agave, ocotillo, catclaw, and curly mesquite. About 15 percent of the increasers are woody species. The invaders are tarbush, snakeweed, mesquite, cholla, yucca, tumblegrass, and fluffgrass.

The average annual production ranges from about 450 pounds per acre of air-dry grazable forage if the site is in poor condition to about 2,500 pounds if the site is in excellent condition.

LOAMY RANGE SITE

This range site consists of nearly level to gently sloping soils of the Atoka, Harkey, Largo, Reagan, and Reeves series. Except for the shallow phase of the Reeves soil, which is 10 to 20 inches deep, these soils are gener-

ally more than 20 inches deep. In many places the areas are broken by swales or drainageways. The water-intake rate is moderate, and the water-holding capacity is moderate to high. Runoff is likely after prolonged or heavy rains.

The potential vegetation consists 65 percent of decreasers and the rest of increasers. The most common decreasers are black grama, blue grama, side-oats grama, vine-mesquite, alkali sacaton, and bush muhly. The increasers are tobosa, buffalograss, burrograss, three-awn, and sand dropseed. The most common invaders are broom snakeweed and mesquite.

The average annual production ranges from about 250 pounds per acre of air-dry grazable forage if the site is in poor condition to about 2,800 pounds if the site is in excellent condition.

SANDY RANGE SITE

This range site consists of nearly level to gently undulating or rolling soils of the Anthony, Berino, Cacique, Harkey, Karro, Mobeetie, Reeves, Simona, and Tonuco series. These soils are coarse textured to medium textured and are more than 18 inches deep. They are droughty, either because of low water-holding capacity or a high content of lime.

The potential vegetation consists about 60 percent of decreasers and 40 percent of increasers and invaders. The decreasers are black grama, side-oats grama, little bluestem, blue grama, Javelina, and bush muhly. The increasers are sand muhly, sand dropseed, three-awn, sand sage, and broom snakeweed. The invaders are mesquite, shinnery oak, and croton.

The average annual production ranges from about 400 pounds per acre of air-dry grazable forage if the site is in poor condition to about 2,500 pounds if the site is in excellent condition.

SAND HILLS RANGE SITE

This range site consists of deep, sandy, gently undulating to rolling soils of the Kermit series. These soils are droughty and very rapidly permeable. They occur on uplands.

The potential vegetation consists about 50 to 60 percent of decreasers and 40 to 50 percent of increasers and invaders. The principal decreasers are bush muhly, little bluestem, black grama, sand bluestem, side-oats grama, plains bristlegrass, Indian ricegrass, and switchgrass. The principal increasers are blue grama, red lovegrass, Halls panicum, sand dropseed, tall dropseed, sand muhly, mesquite, little soaptree yucca, Havard oak, sand sagebrush, and catclaw mimosa. The invaders are broom snakeweed, ring muhly, and annuals.

The average annual production ranges from about 800 pounds per acre of air-dry grazable forage if the site is in poor condition to about 3,000 pounds if the site is in excellent condition.

SALT FLATS RANGE SITE

This range site consists of the saline phases of deep, nearly level soils of the Harkey, Karro, Pima, Reagan, and Reeves series. These soils are normally well drained. Most of the acreage is used for irrigated crops, and the rest for pasture.

The potential vegetation consists about 80 to 90 percent of decreasers and the rest of increasers and invaders. The decreasers are alkali sacaton, inland saltgrass, and four-wing saltbush. The increasers are sedges. The principal invaders are mesquite and annuals.

The average annual production ranges from about 300 pounds per acre of air-dry grazable forage if the site is in poor condition to about 2,200 pounds if the site is in excellent condition.

SALTY BOTTOMLAND RANGE SITE

This range site consists of nearly level to gently sloping soils of the Arno, Cottonwood, and Reeves series. Except for the Cottonwood soil, which is shallow, these soils are moderately deep to deep. They occur in valleys and swales, and on river bottoms. They have a high water table and are subject to flooding. The water-intake rate ranges from moderately slow to slow, and the water-holding capacity is high. The soils contain enough salt to limit the vegetation to salt-tolerant plants.

The potential vegetation is made up about 60 to 70 percent of decreasers, including alkali sacaton, sacaton, vine-mesquite, and chamiza. The rest of the vegetation consists of increasers, such as saltgrass and salt sedges. The most common invader is saltcedar.

If moisture is adequate and there is a good grass cover, the average annual production of air-dry grazable forage is as much as 4,000 pounds per acre. If invasion of saltcedar is severe, production of usable forage is negligible.

SHALLOW RANGE SITE

This range site consists of very shallow and shallow soils of the Kimbrough, Potter, and Upton series. These soils are underlain by fractured, indurated caliche. Outcrops of caliche are common.

The potential vegetation consists about 65 percent of decreasers and the rest of increasers. As much as 10 percent of the vegetation is woody species. The principal decreasers are black grama, bush muhly, side-oats grama, blue grama, plains bristlegrass, and hairy grama. The increasers are creosotebush, fluffgrass, hairy tridens, burrograss, broom snakeweed, and three-awn. The principal invaders are mesquite and tarbush.

The average annual production ranges from about 200 pounds per acre of air-dry grazable forage if the site is in poor condition to about 1,500 pounds if the site is in excellent condition.

Use of the Soils for Wildlife[3]

Many species of wildlife find habitat in the Eddy Area. Fish, reptiles, birds, and mammals are all represented. There are both game species and nongame species. Important game species include desert mule deer, antelope, quail, pheasant, and Merriam's turkey. These are discussed in the wildlife groups.

Nongame species include black-tailed jackrabbits, cottontail rabbits, skunks, rock squirrels, chipmunks, ravens, and roadrunners. There are several kinds of hawks, including Cooper's sharp-shinned hawks, goshawks, red-tailed hawks, and marsh hawks. Predators include coy-

[3] By JOHN FARLEY, wildlife specialist, Soil Conservation Service.

otes, bobcats, gray foxes, ring-tailed cats, raccoons, and badgers. Bald eagles and golden eagles have been sighted.

The amount of rainfall is an important factor in the suitability of the soils for both wildlife and domestic livestock. In this semiarid climate, there are more drought years than wet years. If rainfall is relatively high, palatable grasses are more plentiful and stay green longer. Annual and perennial forbs are abundant. If rainfall is low, range grasses and forbs are soon depleted. Deer can subsist on browse the year around if other forage is lacking. Management can be directed toward use of the soils for grazing domestic livestock only, or it can be directed toward use of the soils for both domestic livestock and wildlife. Fences and watering places are useful tools for management of either.

Five wildlife groups, generally co-extensive with the seven soil associations described in the section "General Soil Map," have been designated. Wildlife group 4 is co-extensive with three associations. The discussions of the groups give information on distribution of wildlife in the Area and on the suitability of the soils for wildlife habitat. These groupings can be useful in broad land-use planning and in acquisition of land for wildlife programs. They may also serve as a general guide for making interpretations for use of local areas as wildlife habitat.

WILDLIFE GROUP 1

This wildlife group is co-extensive with the Limestone rock land-Ector association, which is in the western and central parts of the survey Area, west of the Pecos River. This soil association consists of rocky and stony soils of hills and mountains. It makes up 511,000 acres, or about 20 percent of the Area. Most of the acreage is used for native range for domestic livestock. About 50,000 acres is taken up by the Carlsbad Caverns National Park. The Park is used as a wildlife refuge, and domestic livestock are excluded.

Desert mule deer, scaled quail, and mourning dove are native to these soils. There are a few black bear and Merriam's turkey along the western limits of the association. Elk, although native to the State, are not believed to be native to the Eddy Area. They were introduced by releasing a few animals in suitable areas. Signs of succeeding generations have been observed in recent years. Efforts are being made to establish a population of Turkish chukars as a game bird for hunters.

Deer inhabit these areas the year around. If rainfall is not sufficient to produce a good cover of palatable grasses, deer must compete with domestic livestock for forage. They can subsist on browse the year around if the more desirable forage has been depleted.

WILDLIFE GROUP 2

This wildlife group is co-extensive with the Reagan-Upton soil association, which is generally west of the Pecos River in the northwestern part of the survey Area and on broad plains south of Carlsbad and north of the Black River. This soil association consists of deep and shallow, loamy soils of valleys and plains. It makes up more than 740,000 acres, or about 29 percent of the Area. About 85 percent of this association is used for range. The rest is irrigated cropland. The range provides suitable habitat for desert mule deer, pronghorn antelope, scaled quail, and mourning dove.

Deer inhabit the wooded areas along narrow drainageways. They venture away from the tree cover at night to feed. They do not move great distances when the seasons change, but they do roam from one place to another when local showers green up the range or when domestic livestock deplete the range so much that they must compete for the forage that deer prefer.

Although the habitat is favorable, the number of pronghorn antelope in this association is limited. More than other big-game species, antelope stay on their own side of a fence. Stock fences of woven wire or barbed wire interfere with their free movement and hold down their population. Domestic livestock, particularly sheep, compete with antelope for forage, especially if the range is in deteriorating condition. Properly used cattle range, however, can carry a herd of antelope, in addition to the cattle, without deteriorating. Because they can be controlled by fencing, antelope can be kept in or out of an area, and herd management is possible.

Mourning dove and scaled quail are to be found in the Reagan-Upton association the year around. Both dove and quail need open water, as well as food and cover. Fields of small grain and grain sorghum are attractive to these game birds and to field-feeding waterfowl as well. The dove population is swelled each fall and winter by migrating birds.

WILDLIFE GROUP 3

This wildlife group is co-extensive with the Reeves-Gypsum land-Cottonwood soil association, which occurs generally as areas scattered throughout the central part of the Area. This soil association consists of moderately deep and very shallow, loamy soils of valleys and plains. It makes up approximately 384,000 acres, or about 15 percent of the survey Area. About 70 percent of this association is used for range. The rest is irrigated cropland. Productivity is low on these soils, and the potential for habitat for game species of wildlife is low. Fairly stable, but comparatively small, populations of scaled quail, mourning dove, and antelope find habitats. Waterfowl use the lakebeds when heavy rains produce enough runoff to fill them for brief periods.

Much of the rangeland has deteriorated, and the plant cover is dominantly creosotebush, tarbush, catclaw, gyp grama, and gyp grass. After rain showers, the range becomes temporarily productive of palatable annuals. Antelope cannot follow the greening up of the range so easily as domestic livestock, but their chances of finding enough forage are better in the larger pastures than in the smaller ones. Wildlife species of greater mobility than antelope, such as mourning dove and, to some extent, scaled quail, are sighted in greater numbers in pastures where rain showers have produced a crop of annuals.

The croplands, although used in a way similar to those of wildlife group 2, are less productive, and the populations of game birds are smaller. Some of the croplands provide a favorable habitat for waterfowl. Ducks are attracted to fields where a seed crop, such as Japanese millet, has been grown, then flooded in fall and winter with 2 to 15 inches of water.

WILDLIFE GROUP 4

This wildlife group is co-extensive with the Kimbrough-Stegall, Kermit-Berino, and Simona-Pajarito soil associations, in the eastern part of the survey Area. These associations are made up, respectively, of very shallow and moderately deep, loamy soils of the plains; of deep, sandy soils of the plains; and of shallow and deep, calcareous, sandy soils of plains and valleys. They occupy approximately 830,717 acres, or about 33 percent of the Area.

This group has the largest variety of game species in the survey Area. Moderate numbers of antelope range over much of the acreage. Deer can be found in the northeastern corner of the Area. Mourning dove can be found throughout. Waterfowl use the many potholes and lakebeds when they fill up with water after heavy rains. There are a few lesser prairie chickens, ringneck pheasants, and bobwhite quail.

Nearly all the soils of this wildlife group are sandy. They are used as rangeland. The numbers and kinds of wildlife that find a suitable habitat are affected by the intensity and distribution of grazing domestic livestock and by the fencing and watering places that are necessary for range management.

Deer and pheasants can be found on the approximately 8,200 acres occupied by the Kimbrough-Stegall association, in the northeastern corner of the survey Area.

Lesser prairie chickens can be found in areas of sand dunes and hummocks, mainly in the southeastern corner and in the north-central part of the wildlife group. The vegetation is warm-season tall grasses and Havard oak.

Small numbers of quail can be found in the north-central part of this wildlife group, far removed from the croplands that are their normal habitat. The vegetation consists of bluestem, grama, Indian ricegrass, common winterfat, sand sagebrush, four-wing saltbush, mesquite, perennial forbs, and annuals.

WILDLIFE GROUP 5

This wildlife group is co-extensive with the Arno-Harkey-Anthony association, which is on nearly level flood plains of the Pecos River. This soil association consists of deep, alluvial soils of bottom lands. It makes up approximately 58,800 acres, or about 2 percent of the Area. A small part of this association is used for irrigated crops, such as cotton, alfalfa, small grain, and a small acreage of sugar beets. Yields are good on the Harkey soils, but poor to fair on the Arno soils. Most of the acreage is in deteriorated range. The vegetation is mainly alkali sacaton, inland saltgrass, and saltcedar. A large area south of Artesia, along the Pecos River, is in bog or marsh. Part of this area has open water the year around. The vegetation typically consists of cattails, sedges, rushes, seepwillow, tamarisk, alkali sacaton, giant sacaton, bluejoint reedgrass, and common reed.

Much of the land along the Pecos River and its reservoirs, Lake McMillan, and Carlsbad Municipal Lake are within this association. The Pecos River, which crosses the survey Area from north to south, provides the only fishing grounds of any consequence in the Area, and the major waterfowl refuges.

The fishing waters of the Pecos River waterways have received considerable attention from the New Mexico Department of Game and Fish. Fish populations have been thoroughly studied, and management programs, primarily concerned with improving the ratio of game fish to rough fish, have been explored. These programs include trapping, use of chemicals to control the numbers of unwanted fish, and stocking of game fish. The ratio of rough fish (carp, river carpsucker, longnose gar, smallmouthed buffalofish, gizzard shad, and suckers) has remained about 19:1, by weight, over game fish (largemouth bass, channel catfish, sunfish, flathead catfish, and black bullheads).

The Department of Game and Fish is currently considering stocking walleyed pike and northern pike, which are highly predacious, in an attempt to biologically control the fish population. These fish are well established as excellent game fish in the lakes and rivers of the north-central part of the United States.

Ducks, geese, lesser sandhill cranes, and shore birds winter on the waters and croplands of this association, as well as on croplands of adjacent areas. The waterfowl population begins to build in September with the arrival of the blue-winged teal. It reaches its peak in February, then fades away as the birds leave in March. Pintail, mallard, gadwall, merganser, widgeon, and teal are the most numerous of the ducks.

This association is better suited to wildlife habitat than others in the Eddy Area. Ducks, geese, cranes, and other waterfowl are attracted by the small grain and other desirable food crops grown in the irrigated tracts along the Pecos River. Ducks are especially attracted if large areas of their preferred food crops are grown, then shallowly flooded from October to February. Such areas provide good hunting if the shooting preserve is properly managed.

This association also provides one of the best wintering grounds for mourning doves in New Mexico. The combination of saltcedar, open water, waste grains, naturally occurring seeds, and the relatively mild winter weather suits these birds, and they come in large numbers.

Scaled quail, as well as a small population of pheasants, can be found in these areas. The limited population of pheasants was established several years ago by the New Mexico Department of Game and Fish by stocking the area around the Artesia bog. The Department operates the State Game Bird Farm, north of Carlsbad and within the boundaries of this association. In addition to providing exotic game birds for stocking trials, the farm provides an interesting and educational wildlife facility for visitors.

Engineering Uses of the Soils [4]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, building foundations, pipelines, drainage systems, facilities for water storage, erosion control structures, sewage disposal systems, irrigation systems, and related structures. Among the soil properties most im-

[4] By LUTHER F. MCDOUGAL, area engineer, Soil Conservation Service.

portant to engineers are permeability, shear strength, compaction, shrink-swell characteristics, water-holding capacity, grain size, plasticity, and soil reaction. Also important are topography, depth to bedrock or caliche, and depth to the water table.

Much of the information in this section is presented in tables. Only the data in table 6 are from actual laboratory tests. The estimates in table 4 and the interpretations in table 5 are based on comparisons of soils with those tested. At many construction sites, major variations in soil characteristics occur within the depth of the proposed excavation, and several kinds of soil occur within short distances. Specific laboratory data on engineering properties of the soil at the site should be obtained before planning detailed engineering work.

The characteristics of the soils in the Eddy Area are described in detail in the section "Descriptions of the Soils." Those characteristics that affect engineering are interpreted in this section for engineers and others concerned with use of soil as a construction material.

Information in this survey can be used to—

1. Make preliminary estimates of the engineering properties of soils for use in planning irrigation systems and other agricultural systems.
2. Make preliminary evaluations that will aid in selecting locations for highways, pipelines, underground cables, railroads, and airports, and in planning detailed investigations of the soils at the selected locations.
3. Make studies that will aid in selecting and developing sites for industrial, business, residential, and recreational uses.
4. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
5. Supplement information obtained from published maps, reports, and aerial photographs, for the purpose of making maps and reports that can be used readily by engineers.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or excavations deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used in this publication have a special meaning to soil scientists and a different meaning to engineers. The Glossary defines many such terms as they are used in soil science.

Estimated properties of the soils

Table 4 gives some of the characteristics of the soils of the Eddy Area that are significant in engineering. The information in the table was based on data compiled for the survey and on test data shown in table 6.

The three columns under the heading "Classification" show soil texture as it is classified both by soil scientists and by engineers.

The estimated percentages of soil material passing sieves No. 4, No. 10, and No. 200 reflect the normal range for the series. As the grain-size distribution of any soil varies considerably, it should not be assumed that the range shown in the table will be applicable to all samples of a specified soil, nor that the engineering classification will invariably be as shown.

The rates of permeability given in table 4 are based on the movement of water through the soil in its undisturbed state. They were estimated by comparison with soils of known permeability. Permeability is expressed in terms of inches per hour.

Available moisture capacity, measured in inches per inch of soil depth, is the approximate amount of capillary water in the soil available for plant growth after all free water has drained away.

Reaction refers to the degree of acidity or alkalinity of a soil, expressed in pH values. A soil having a pH value of 7 is neutral in reaction. The pH value gives an indication of the corrosiveness of the soils and the protection needed for pipelines and other engineering structures.

Salinity affects not only the suitability of a soil for crops, but also its stability when used as a construction material and its corrosiveness to other materials. Estimates of salinity are based on estimates of electrical conductivity of saturated soil extract.

Shrink-swell potential is an indication of the volume change to be expected when the moisture content of soil material changes. In general, soils that have a high shrink-swell potential present hazards to the maintenance of engineering structures.

Some of the nearly level to gently sloping soils of the Arno, Cottonwood, Harkey, Reeves, and Pima series have a seasonal high water table. In some areas of these soils, the water table fluctuates between depths of about 1 foot and 3 feet during the irrigation season or in years when rainfall is above normal.

Periodic flooding occurs in swales and on the lower parts of flood plains of soils of the Arno, Bippus, Cottonwood, Dev, Harkey, Largo, Reeves, and Stegall series. On soils other than those of the Arno, Pima, and Reeves series, floodwaters seldom stand more than a few hours. Flooded areas of these soils are sometimes under water 1 or 2 days, but serious damage is infrequent.

Engineering interpretations

Table 5 gives estimates of the suitability of the soils for specified uses and lists soil properties that might present hazards for such use. Generally, the soils of the Eddy Area are not suitable as sources of sand and gravel, but some areas of Dev and Ector soils yield gravelly material suitable for crushing. Grassed or sodded waterways are not common in this Area, because rainfall is too low to maintain a good plant cover and use of irrigation water for this purpose is not economical.

The ratings of the soils as a source of topsoil are based on use of the soil as topdressing on road slopes and dams.

A good rating is given to a soil, such as Reagan loam, that is fertile and tillable and generally not subject to erosion.

The suitability of a soil for road fill depends largely on the texture of the material and on its natural water content. Compaction characteristics, erodibility, depth to bedrock, and presence of coarse fragments within the normal depth of road excavation are features that should be considered. Highly plastic soil material with high natural water content is rated as poor. Soils that have a high proportion of silt and fine sand are rated poor to fair because they are difficult to compact, slow to revegetate, and easily eroded on steep embankments.

Suitability of the soils for disposal fields for septic tanks and tile systems is shown in the table in terms of the degree of limitation for such use. A rating of slight indicates no unfavorable features. Characteristics and qualities considered are permeability, ground-water level, slope, overflow hazard, depth to impervious material, and the possibility of polluting the water supply.

The entire profile was evaluated in making interpretations of the soils for use as highway locations. The ratings are for undisturbed soil without artificial drainage. It was assumed that the surface soil would be removed in construction for use as topsoil wherever feasible. Significant factors considered are the content of organic matter, salts, stones, and rock outcrops; the depth to hard rock or caliche; the suitability of the soil for embankments; the stability of the soil and the ease of handling; the hazards of flooding and erosion; the plasticity of the soils; and topography. Frost heave was not considered, because the soils seldom freeze.

Significant factors considered in rating the soils for use in constructing dikes and levees are stability of the soils when wet and their workability when used in construction.

The characteristics of the soils that affect suitability for constructing farm ponds and irrigation reservoirs are the amount of seepage to be expected and the depth to an inhibiting layer, such as bedrock, caliche, or gypsiferous material. The characteristics and qualities considered in determining suitability of the soils for embankments are the same as those for dikes and levees.

The factors that affect irrigation are depth of tillable soil, texture, intake rate, permeability, water-holding capacity, soil reaction, and topography. The availability of suitable irrigation water is not considered. The characteristics and qualities considered in determining suitability of the soils for leveling and benching are the same as those for irrigation.

The properties considered in rating the soils as to their suitability for building foundations are bearing capacity, shrink-swell potential, and shear strength.

The ratings of suitability of the soils for pipelines is based mainly on soil depth and rockiness and on the content of salts.

The soils are classified in the table according to their hydrologic group. These are groups of soils having similar rates of infiltration by water, even when wetted, and similar rates of water transmission within the soil. There are four hydrologic groups:

GROUP A consists of soils that have a high infiltration rate even when thoroughly wetted, chiefly deep, well-drained to excessively drained sand, gravel, or both. These soils have a high rate of water transmission and a low runoff potential.

GROUP B consists of soils that have a moderate infiltration rate when thoroughly wetted and that are chiefly moderately deep to deep, moderately well drained to well drained, and moderately fine textured to moderately coarse textured. These soils have a moderate rate of water transmission.

GROUP C consists of soils that have a slow rate of infiltration when thoroughly wetted, chiefly soils that have a layer that impedes downward movement of water and soils that are moderately fine textured to fine textured. These soils have a slow rate of transmission.

GROUP D consists of soils that have a very slow rate of infiltration when thoroughly wetted, chiefly clay soils that have a high swelling potential, soils that have a permanently high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Engineering test data

Table 6 gives data obtained by laboratory testing of samples of selected soils of the Area. The soils tested were sampled at several locations. The engineering characteristics of a soil at a specific location are indicated by these test data, but variations in properties can be expected at other locations. Even for those soils sampled in more than one location, the test data probably do not show the maximum range in characteristics that affect engineering.

Engineering classification systems

Two systems of classifying soils for engineering purposes are in general use. Classification of the soils of the Eddy Area according to both of these systems is given in this survey.

The Unified system of soil classification was developed by the Waterways Experiment Station, Corps of Engineers (*15*). In this system, soil classification is based on the identification of soils according to texture and plasticity and their performance as construction material. In the Unified system SW and SP are clean sands, SM and SC are sands with fines of silt and clay, ML and CL are silts and clays with low liquid limit, and MH and CH are silts and clays with high liquid limit. If soils are on the borderline between two classifications, a joint classification symbol is used, for example, ML–CL.

The system used by the American Association of State Highway Officials (AASHO) (*2*) is based on field performance of soils in highways. In this system, soil materials are classified into seven principal groups, designated A–1 through A–7. The best materials for use in highway subgrades (gravelly soils of high bearing capacity) are classified as A–1, and the poorest (clayey soils having low strength when wet) are classified A–7. The relative engineering values of the soils within each group are indicated by group index numbers. Group indexes range from 0 for the best material to 20 for the poorest.

TABLE 4.—*Estimated properties*

[Properties are not estimated for Dune land, Limestone rock land, Rock land, Stony and Rough

Soil series and map symbols	Depth to bedrock, hard caliche, or gypsum	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Inches	*Inches*			
Active dune land: AD	More than 60.	0–60	Fine sand	SP	A–3
Anthony: AE, Aa, Ah	More than 60.	0–60	Stratified sandy loam and loamy sand.	SM	A–1 or A–2
Arno: AH, Ak, An (For Harkey part of AH and Ak, see Harkey series.)	More than 60.	0–14 14–60	Silty clay loam Silty clay	CL CH	A–6 A–7
Atoka: Ao, At	20 to 36.	0–8 8–33 33	Loam Loam and light clay loam Hard, fractured caliche.	ML CL	A–4 A–6
Berino: BA, BB, BD, BP (For Pajarito part of BP, see Pajarito series; the Dune land part of BD is too variable for reliable evaluation.)	More than 60.	0–17 17–50	Loamy fine sand and fine sand Sandy clay loam	SM SC	A–2 A–6
Bippus	More than 60.	0–48 48	Silty clay loam and clay loam Weakly cemented caliche.	CL	A–6
Cacique: CA	12 to 36.	0–17 17–24 24	Loamy sand and sandy loam Sandy clay loam Indurated, fractured caliche.	SM SC	A–2 A–6
Cottonwood: CR (For Reeves part of CR, see Reeves series.)	Soft to hard gypsum below a depth of 9 inches.	0–9 9	Loam Gypsum.	ML–CL	A–4
Dev: DP (For Pima part of DP, see Pima series.)	More than 60.	0–15 15–60	Gravelly loam Very gravelly loam	GM GP	A–1 or A–2 A–1
Ector: EC, EE, ER (For Reagan part of ER, see Reagan series.)	1 to 18.	0–6 6	Stony loam Limestone bedrock.	SM–ML	A–4
Gypsum land: GA, GC, GR, Gs (For Cottonwood part of GC and Gs, see Cottonwood series; for Reeves part of GR, see Reeves series.)	Soft or hard gypsum at a depth of 0 to 10 inches.	0–19 19	Gypsiferous earth Gypsum.	ML	A–4
Harkey: Ha, Hk	More than 60.	0–87	Very fine sandy loam, loam, and silt loam.	ML	A–4
Karro: KA, KL, Kr, Ku, Kv	More than 60.	0–20 24–60	Loam Clay loam	ML–CL CL	A–4 A–6
Kermit: KM (For Berino part of KM, see Berino series.)	More than 60.	0–60	Fine sand	SP–SM	A–3
Kimbrough: KO, KS, KT (For Stegall part of KS and KT, see Stegall series.)	2 to 15.	0–9 9	Loam Caliche.	ML	A–4
Largo: LA, LG, LN (The Stony land part of LN is too variable for reliable evaluation.)	More than 60.	0–65	Stratified loam and silt loam	ML–CL	A–4
Likes: LS	More than 60.	0–60	Loamy fine sand	SM	A–1
Mobeetie: MO	More than 60.	0–60	Fine sandy loam	SM	A–4

and characteristics

broken land, and Stony land, because the soil material is too variable for reliable evaluation]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Electrical conductivity (Ec × 10^3) *Mmho./cm. at 25° C.*	Corrosivity (Untreated steel pipe)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
			Inches per hour	*Inches per inch of soil*	*pH*			
100	100	0–5	>10. 0	0. 06–0. 08	6. 6–7. 3	0–1. 0	Low	Low.
100	100	15–25	2. 5–5. 0	0. 10–0. 12	7. 4–7. 8	0–1. 0	Low	Low.
100	100	90–95	0. 05–0. 20	0. 18–0. 20	7. 9–8. 4	4. 0–8. 0	High	Moderate.
100	100	90–95	0. 05–0. 20	0. 15–0. 17	7. 9–8. 4	8. 0–12. 0	High	High.
100	100	60–75	0. 8–2. 5	0. 16–0. 18	7. 4–7. 8	0–2. 0	Moderate	Low to moderate.
100	100	70–80	0. 8–2. 5	0. 17–0. 19	7. 4–7. 8	0–2. 0	Moderate	Moderate.
100	100	10–20	5. 0–10. 0	0. 06–0. 08	6. 6–7. 3	0–1. 0	Low	Low.
100	100	35–45	0. 2–0. 8	0. 14–0. 16	6. 6–7. 3	0–4. 0	Moderate	Moderate.
100	100	85–95	0. 2–0. 8	0. 18–0. 20	7. 4–8. 4	0–4. 0	Moderate	Moderate.
100	100	20–35	5. 0–10. 0	0. 10–0. 12	6. 6–7. 3	0–1. 0	Low	Low.
100	100	35–50	0. 8–2. 5	0. 14–0. 16	6. 6–7. 3	0–4. 0	Moderate	Moderate.
100	100	60–75	0. 8–2. 5	0. 16–0. 18	6. 6–7. 8	8. 0–15. 0	High	Low to moderate.
35–75	30–70	15–20	0. 8–2. 5	0. 11–0. 13	7. 4–7. 8	0–2. 0	Moderate	Low.
15–45	10–40	5–10	>10. 0	0. 06–0. 08	----------	0–1. 0	Low	Low.
55–85	50–80	40–60	0. 8–2. 5	0. 11–0. 13	7. 4–7. 8	0–4. 0	Moderate	Low.
100	100	60–70	0. 8–2. 5	0. 16–0. 18	6. 6–7. 8	>15. 0	High	Low.
100	100	60–75	0. 8–2. 5	0. 17–0. 19	7. 4–7. 8	2. 0–12. 0	Moderate to high.	Low.
100	100	60–75	0. 8–2. 5	0. 16–0. 18	7. 9–8. 4	4. 0–10. 0	High	Moderate.
100	100	70–80	0. 8–2. 5	0. 18–0. 20	7. 9–8. 4	8. 0–15. 0	High	Moderate.
100	100	5–10	>10. 0	0. 06–0. 08	6. 6–7. 3	0–1. 0	Low	Low.
95–100	90–95	50–65	0. 8–2. 5	0. 16–0. 18	6. 6–7. 8	0–4. 0	Moderate	Low.
100	100	60–70	0. 8–2. 5	0. 17–0. 19	7. 4–7. 8	0–4. 0	Moderate	Low to moderate.
98	97	10–20	5–10. 0	0. 08–0. 10	6. 6–7. 8	0–1. 0	Low	Low.
100	100	40–50	2. 5–5. 0	0. 13–0. 15	7. 4–8. 4	0–1. 0	Low	Low.

TABLE 4.—*Estimated properties*

Soil series and map symbols	Depth to bedrock, hard caliche, or gypsum	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Inches	*Inches*			
Pajarito: PA, PD (The Dune land part of PD is too variable for reliable evaluations.)	More than 60.	0–60	Loamy fine sand and fine sandy loam.	SM	A–1 or A–2
Pima: PM, Pe, Pn, Pv	More than 60.	0–60	Silt loam to silty clay loam	CL	A–6
Potter: PS (For Simona part of PS, see Simona series.)	2 to 12.	0–10 10	Gravelly loam Fractured, indurated caliche.	SM	A–2
Reagan: RA, RE, Rc, Rd (For Upton part of RE, see Upton series.)	More than 60.	0–60	Loam and light clay loam	CL	A–4 or A–6
Rf	More than 60.	0–60	Loam and light clay loam	CL	A–4
Reeves: RG, RM, Rl, Rn, Rt (For Reagan part of RM, see Reagan series; for Gypsum land part of RG, see Gypsum land.)	Soft or hard gypsum at a depth of 10 to 36 inches.	0–32 32	Heavy loam and light clay loam. Gypsum.	CL	A–4 or A–6
Rr	Soft or hard gypsum at a depth of 20 to 36 inches.	0–31 31	Heavy loam and light clay loam. Gypsum.	CL	A–4
Russler: RS, RU, Rv (For Ector part of RU, see Ector series.)	Soft or hard gypsum at a depth of 45 inches or more.	0–11 11–52 52	Loam Clay loam Gypsiferous earths.	ML–CL CL	A–4 A–6
Simona: SA, SG, SM, SN (For Bippus part of SM, see Bippus series; for Wink part of SN, see Wink series.)	10 to 24.	0–19 19	Gravelly fine sandy loam Indurated, fractured caliche.	SM	A–4
Stegall	18 to 40.	0–22 22	Clay loam and heavy clay loam. Indurated, fractured caliche.	CL	A–6
Tonuco: TC, TF, TN, TO (For Berino part of TO, see Berino series.)	6 to 20.	0–15 15	Loamy fine sand Indurated, fractured caliche.	SM	A–1
Upton: UG, UR, US, Uo, Up, Ut (For Reagan part of UR, see Reagan series; for Simona part of US, see Simona series.)	2 to 20.	0–9 9	Gravelly loam Indurated, fractured caliche.	SM	A–2
Wink: WK	More than 60.	0–60	Loamy fine sand and fine sandy loam.	SM	A–1 or A–2

and characteristics—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Electrical conductivity (Ec × 10^3) *Mmho./cm. at 25° C.*	Corrosivity (Untreated steel pipe)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
			Inches per hour	*Inches per inch of soil*	*pH*			
100	100	20–30	5. 0–10. 0	0. 13–0. 15	6. 6–7. 8	0–1. 0	Low	Low.
100	100	85–95	0. 2–0. 8	0. 18–0. 20	7. 4–7. 8	0–4. 0	Moderate	Moderate.
75–85	75–85	20–30	0. 8–2. 5	0. 11–0. 13	7. 4–7. 8	0–4. 0	Moderate	Low.
100	100	60–75	0. 8–2. 5	0. 17–0. 19	7. 4–8. 4	2. 0–8. 0	Moderate to high.	Moderate.
100	100	60–75	0. 8–2. 5	0. 17–0. 19	7. 4–8. 4	4. 0–15. 0	High	Moderate.
100	100	60–75	0. 8–2. 5	0. 17–0. 19	7. 4–7. 8	4. 0–8. 0	High	Moderate.
100	100	60–75	0. 8–2. 5	0. 17–0. 19	7. 4–7. 8	4. 0–12. 0	High	Moderate.
100	100	60–75	0. 8–2. 5	0. 16–0. 18	7. 4–7. 8	8. 0–15. 0	High	Low.
100	100	70–80	0. 2–0. 8	0. 18–0. 20	7. 4–7. 8	8. 0–15. 0	High	Moderate.
100	100	40–50	2. 5–5. 0	0. 09–0. 11	7. 4–7. 8	0–1. 0	Low	Low.
100	100	70–80	0. 2–0. 8	0. 18–0. 20	6. 6–7. 8	0–4. 0	Moderate	Moderate.
100	100	15–25	5. 0–10. 0	0. 09–0. 11	6. 6–7. 3	0–1. 0	Low	Low.
75–85	75–85	20–30	0. 8–2. 5	0. 11–0. 13	7. 4–7. 8	0–4. 0	Moderate	Low.
100	100	20–35	2. 5–5. 0	0. 12–0. 14	7. 4–7. 8	0–4. 0	Low to moderate.	Low

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Degree of limitation for disposal fields for septic tanks and tile systems	Highway location	Dikes and levees
	Topsoil	Road fill			
Active dune land: AD	Poor: erodible; low fertility.	Good if soil binder is used.	Slight: drifting sand.	Loose sand hinders hauling; drifting sand.	Not applicable
Anthony: AE, Aa, Ah	Poor: sandy	Good	Slight: features favorable.	Loose sand hinders hauling; exposed embankments are highly erodible.	Unstable; erodible
Arno: AH, Ak, An (For Harkey part of AH and Ak, see Harkey series.)	Poor: salty; high clay content.	Poor to very poor	Severe: slow permeability; subject to flooding; fluctuating water table in places.	Subject to flooding; unstable when wet; high shrink-swell potential.	Unstable embankment; subject to cracking; difficult to work.
Atoka: Ao, At	Fair if fertilized	Poor to a depth of 33 inches, good below 33 inches; hard caliche.	Severe: caliche at a depth of 33 inches.	Caliche at a depth of 33 inches.	Caliche at a depth of 33 inches.
Berino: BA, BB, BD, BP (For Pajarito part of BP, see Pajarito series; for Dune land part of BD, see Dune land.)	Poor	Poor to fair	Severe: moderately slow permeability; soft caliche at a depth of 50 inches.	Features favorable	Sandiness of surface material necessitates mixing with subsoil material.
Bippus	Fair	Poor	Severe: periodic flooding; moderately slow permeability.	Unstable; subject to periodic flooding.	Subject to cracking; wide embankment necessary.
Cacique: CA	Poor	Good: hard caliche at a depth of 24 inches.	Severe: hard caliche at a depth of 24 inches.	Sand dunes hinder hauling; hard caliche at a depth of 24 inches.	Unstable, sandy surface; shallow to moderately deep soils; undulating topography.
Cottonwood: CR (For Reeves part of CR, see Reeves series.)	Poor: very shallow to gypsiferous material.	Poor: gypsiferous material at a depth of 4 to 10 inches.	Severe: creviced material that may allow pollution of water supply.	Gypsiferous material at a depth of 4 to 10 inches.	Not applicable
Dev: DP (For Pima part of DP, see Pima series.)	Poor: gravel and cobblestones intermixed with soil material.	Fair: careful selection of site required.	Severe: periodic flooding.	Subject to periodic flooding; shifting stream channels.	Features favorable
Dune land	Poor: sandy	Very good	Slight: moderate permeability in soil material below the dune sand.	Loose, sandy material that hinders hauling.	Not applicable
Ector: EC, EE, ER (For Reagan part of ER, see Reagan series.)	Poor: rock outcrops.	Very good: limestone bedrock at a depth of 1 to 18 inches.	Severe: blasting required below a depth of 20 inches; danger of contaminating water supply through crevices.	Limestone bedrock at a depth of 1 to 18 inches.	Not applicable

See footnote at end of table.

interpretations

Farm ponds and embankments	Irrigation	Leveling and benching	Foundations for low buildings [1]	Pipelines	Hydrologic group
Not applicable	Not applicable	Not applicable	Good suitability if soil is confined.	Deep, loose sand; blowouts and drifting sand.	A
Erodible; moderately rapid permeability.	Rapid intake rate; susceptible to wind erosion; sprinkler system desirable.	Susceptible to wind erosion; dunes.	Good suitability if confined.	Features favorable	A
High water table in places; subject to flooding; highly compressible; poor stability.	Slow intake rate; saline; level grade necessary; subject to periodic flooding.	Features favorable	Poor bearing capacity; high shrink-swell potential; poor to fair shear strength; susceptible to periodic flooding.	Special treatment needed for salts.	C–D
Caliche substratum; limited fill material.	Moderately deep soil; smoothing necessary.	Slope as much as 3 percent; caliche at a depth of 33 inches.	Fair to poor shear strength; moderate shrink-swell potential; poor to fair bearing strength; hard caliche at a depth of 33 inches.	Caliche at a depth of 33 inches.	C
Susceptible to piping; moderate seepage; sandy, porous surface.	Rapid intake rate; smoothing necessary; susceptible to wind erosion.	Soft caliche at a depth of 50 inches; highly susceptible to wind erosion.	Good bearing capacity	Features favorable	A
Subject to cracking	Slow intake rate; level grade necessary; subject to periodic flooding.	Not applicable	Poor suitability; moderate shrink-swell potential.	Periodic flooding	C
Pervious material; susceptible to piping; slopes unstable unless protected.	Rapid intake rate; moderately low water-holding capacity; shallow to moderately deep soil.	Sandy; subject to blowing; shallow to moderately deep.	Good suitability; hard caliche at a depth of 24 inches.	Hard caliche at a depth of 24 inches.	C
Not applicable	Not applicable	Not applicable	Poor shear strength and bearing capacity.	Special treatment needed for gypsum salts; varying hardness of gypsiferous rocks.	C
Gravel and cobblestones mixed with soil material.	Not applicable	Not applicable	Poor suitability; susceptible to periodic flooding.	Periodic flooding; shifting stream channels.	B
Not applicable	Not applicable	Not applicable	Good suitability if soil is confined.	Loose sand; hazard of blowouts and drifting sand.	A
Not applicable	Not applicable	Not applicable	Good suitability; limestone bedrock.	Limestone bedrock at a depth of 1 to 18 inches.	C

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TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Degree of limitation for disposal fields for septic tanks and tile systems	Highway location	Dikes and levees
	Topsoil	Road fill			
Gypsum land: GA, GC, GR, Gs. (For Cottonwood part of GC and Gs, see Cottonwood series; for Reeves part of GR, see Reeves series.)	Poor: little or no soil.	Poor: gypsiferous material.	Severe: creviced material that may allow pollution of water supply.	Gypsiferous material; little or no soil.	Not applicable
Harkey: Ha, Hk	Fair to good if fertilized.	Poor to fair	Slight to moderate: moderate permeability.	Features favorable	Features favorable
Karro: KA, KL, Kr, Ku, Kv.	Fair in uppermost 10 inches if fertilized.	Fair	Slight to moderate: moderate permeability.	Features favorable	Features favorable
Kermit: KM (For Berino part of KM, see Berino series.)	Poor: drifting sand.	Good if soil binder is added.	Slight: drifting sand.	Loose sand hinders hauling; drifting sand; embankments highly erodible when exposed.	Not applicable
Kimbrough: KO, KS, KT. (For Stegall part of KS and KT, see Stegall series.)	Fair in uppermost 9 inches.	Poor: surface is good, but hard caliche occurs below a depth of 9 inches.	Severe: fractured caliche at a depth below 9 inches; danger of pollution.	Hard caliche at a depth of 9 inches.	Hard caliche at a depth of 9 inches.
Largo: LA, LG, LN (For Stony land part of LN, see Stony land.)	Poor to fair: moderately slow intake rate; erodible.	Poor	Severe: the overflow phase is subject to flooding; moderate permeability.	Overflow phase is subject to periodic flooding; exposed embankments are highly erodible.	Unstable; level grade necessary.
Likes: LS	Poor: sandy	Very good	Slight: gently sloping.	Loose sand hinders hauling; embankments are highly erodible.	Unstable; sandy material; level grade and soil binder are necessary.
Limestone rock land: LT.	Poor: rock outcrops.	Unsuitable	Not applicable	Limestone bedrock at or near the surface; slopes are more than 25 percent.	Not applicable
Mobeetie: MO	Poor: erodible	Fair	Slight: gently sloping.	Exposed embankments are highly erodible.	Unstable; subject to piping; level grade and protective soil binder are necessary.
Pajarito: PA, PD (For Dune land part of PD, see Dune land.)	Poor: sandy	Good to a depth of 3 feet; fair below 3 feet.	Slight: moderately rapid permeability.	Loose sand hinders hauling; drifting sand; exposed embankments are highly erodible.	Unstable; sandy material; level grade and protective soil binder are necessary.

See footnote at end of table.

interpretations—Continued

Farm ponds and embankments	Irrigation	Leveling and benching	Foundations for low buildings [1]	Pipelines	Hydrologic group
Not applicable	Not applicable	Not applicable	Poor shear strength and bearing capacity.	Special treatment needed for gypsum salts; varying hardness of gypsiferous rocks.	C
Features favorable	If cultivated, the sandy loam type is susceptible to wind erosion.	If cultivated, the sandy loam type is susceptible to wind erosion.	Fair bearing capacity and shear strength.	Features favorable	B
Features favorable	Susceptible to crusting; high lime content.	Features favorable	Moderate bearing capacity.	Special treatment needed for gypsum salts generally below a depth of 3 feet.	B
Not applicable	Not applicable	Not applicable	Good suitability if soil is confined.	Subject to blowouts	A
Not applicable	Not applicable	Not applicable	Good suitability; hard caliche at a depth of 9 inches.	Hard caliche at a depth of 9 inches.	D
Unstable; good for core material.	Susceptible to water erosion.	Overflow phase is susceptible to periodic flooding.	Fair to poor bearing capacity and shear strength; low to high shrink-swell potential; overflow phase is susceptible to periodic flooding.	Features favorable	C
Not applicable	Rapid intake rate; sprinkler system needed; susceptible to wind erosion.	Susceptible to wind erosion.	Good suitability if confined.	Features favorable	A
Not applicable	Not applicable	Not applicable	Good suitability; blasting required for excavations.	Limestone bedrock at or near the surface; steep.	D
Moderately pervious; susceptible to piping.	Rapid intake rate; sprinkler system needed; susceptible to wind erosion.	Not applicable	Features favorable	Features favorable	B
Not applicable	Rapid intake rate; sprinkler system needed; dune topography; susceptible to wind erosion.	Very sandy; susceptible to soil blowing.	Good suitability if confined.	Features favorable	A

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Degree of limitation for disposal fields for septic tanks and tile systems	Highway location	Dikes and levees
	Topsoil	Road fill			
Pima: PM, Pe, Pn, Pv	Fair to poor; slow intake rate; erodible.	Poor	Severe: periodic flooding; moderately slow permeability.	Unstable material; subject to periodic flooding.	Subject to cracking; wide embankment is necessary.
Potter: PS (For Simona part of PS, see Simona series.)	Poor: gravelly	Good: hard caliche at a depth of 10 inches.	Severe: fractured caliche below a depth of 10 inches; danger of well pollution.	Hard caliche at a depth of 10 inches.	Not applicable
Reagan: RA, RE, Rc Rd (For Upton part of RE, see Upton series.)	Fair if fertilized	Fair	Slight to moderate: moderate permeability.	Features favorable	Features favorable
Rf	Poor: salty	Poor	Severe: subject to saturation because of seepage.	Subject to periodic saturation because of seepage.	Unstable; subject to cracking.
Reeves: RG, RM, Rl, Rn (For Reagan part of RM, see Reagan series; for Gypsum land part of RG, see Gypsum land.)	Fair if fertilized	Poor	Severe: gypsiferous material at a depth of 20 to 36 inches; crevices and solution holes; danger of pollution.	Gypsiferous material at a depth of 20 to 36 inches.	Gypsiferous material at a depth of 20 to 36 inches.
Rr	Poor: salty	Poor	Severe: gypsum at a depth of 20 to 36 inches; danger of pollution of water supply.	Gypsum below a depth of 20 to 36 inches.	Unstable; subject to cracking.
Rt	Fair if fertilized: 10 to 20 inches thick.	Poor	Severe: gypsiferous material at a depth of 10 to 20 inches.	Gypsum at a depth of 10 to 20 inches.	Gypsum at a depth of 10 to 20 inches.
Rock land: RO	Unsuitable	Poor	Not applicable	Bedrock at or near the surface; rough broken topography.	Not applicable
Russler: RS, RU, Rv (For Ector part of RU, see Ector series.)	Poor: gypsiferous soil.	Poor to very poor	Severe: moderately slow permeability; gypsum below a depth of 16 to 48 inches; crystalline gypsum; danger of pollution of water supply.	Unstable material; gypsiferous soil material with gypsiferous, interbedded clays at a depth of 16 to 48 inches.	Unstable; level grades and wide embankments necessary.
Simona: SA, SG, SM, SN (For Bippus part of SM, see Bippus series; for Wink part of SN, see Wink series.)	Poor: sandy	Fair in surface layer; good at a depth of 10 to 24 inches because material is hard caliche.	Severe: hard caliche below a depth of 10 to 24 inches.	Hard caliche below a depth of 10 to 24 inches.	Not applicable

See footnote at end of table.

interpretations—Continued

Farm ponds and embankments	Irrigation	Leveling and benching	Foundations for low buildings [1]	Pipelines	Hydrologic group
Subject to cracking; some areas are subject to a high water table.	Slow intake rate; level grade needed; subject to accumulation of salt.	Features favorable	Fair to poor bearing capacity and shear strength; moderate to high shrink-swell potential.	Periodic flooding; occasional high water table in the gray variant type; special treatment for salts needed in saline phase.	C
Not applicable	Not applicable	Not applicable	Caliche at a depth of 10 inches.	Caliche at a depth of 10 inches.	C
Gypsum or soft caliche below a depth of 40 inches in places.	Susceptible to accumulation of salt.	Features favorable	Fair bearing capacity and shear strength; low to high shrink-swell potential.	Gypsum salts below a depth of 40 inches in places; special treatment needed.	C
Unstable; dispersed	Susceptible to accumulation of salt.	Features favorable	Poor bearing capacity and shear strength; moderate shrink-swell potential.	Special treatment needed for salts.	C
Gypsiferous substratum.	Susceptible to accumulation of salt; gypsiferous material at a depth of 20 to 36 inches.	Limitation on depth of cuts.	Poor to fair bearing capacity and shear strength; moderate shrink-swell potential.	Special treatment needed for salts.	C
Gypsum below a depth of 20 to 36 inches.	Susceptible to accumulation of salt; gypsum at a depth of 20 to 36 inches.	Limitation on depth of cuts.	Poor bearing capacity and shear strength; moderate shrink-swell potential; periodic overflow or shrinkage.	Special treatment needed for salts.	C
Gypsum at a depth of 10 to 20 inches.	Susceptible to accumulation of salt; gypsum at a depth of 10 to 20 inches.	Soil smoothing only; gypsum at a depth of 10 to 20 inches.	Poor bearing capacity and shear strength.	Special treatment needed for salts.	C
Not applicable	Not applicable	Not applicable	Good suitability; blasting required for excavations.	Blasting required to bury exposed bedrock.	D
Not applicable	Slow intake rate; crusts easily; susceptible to water erosion.	Limitation on depth of cuts; gypsiferous soil.	Poor bearing capacity and shear strength; moderate to high shrink-swell potential.	Special treatment needed for salt below a depth of 16 to 48 inches.	B
Not applicable	Not applicable	Not applicable	Good suitability if confined.	Hard caliche below a depth of 10 to 24 inches.	B

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Degree of limitation for disposal fields for septic tanks and tile systems	Highway location	Dikes and levees
	Topsoil	Road fill			
Stegall	Fair: erodible	Poor to a depth of 22 inches; good below that depth because material is hard caliche.	Severe: moderately slow permeability; caliche at a depth of about 22 inches; flooding; danger of pollution of wells.	Unstable material; subject to periodic flooding; hard caliche at a depth of 22 inches.	Subject to cracking; wide embankment necessary; caliche at a depth of 22 inches.
Stony and Rough broken land: SR.	Poor: gravel and stone mixed with soil material.	Poor	Not applicable	Rough broken land; hard to soft rocks; steep.	Not applicable
Stony land	Unsuitable	Unsuitable	Not applicable	Bedrock at or near the surface; rough broken topography.	Not applicable
Tonuco: TC, TF, TN, TO. (For Berino part of TO, see Berino series.)	Poor: sandy	Good: hard caliche below a depth of 6 to 14 inches.	Severe: fractured caliche; danger of pollution of wells.	Hard caliche at a depth of 6 to 14 inches.	Not applicable
Upton: UG, UR, US, Uo, Up, Ut. (For Reagan part of UR, see Reagan series; for Simona part of US, see Simona series.)	Poor: shallow; gravelly.	Good: caliche below a depth 2 to 20 inches.	Severe: caliche below a depth of 2 to 20 inches.	Hard caliche at a depth of 2 to 20 inches.	Not applicable
Wink: WK	Poor: sandy; erodible.	Fair	Slight: features favorable.	Loose sand hinders hauling; occurs in low places.	Unstable; erodible

[1] Engineers and others should not apply specific values to the estimates given for bearing capacity of soils.

interpretations—Continued

Farm ponds and embankments	Irrigation	Leveling and benching	Foundations for low buildings [1]	Pipelines	Hydrologic group
Unstable; high shrink-swell potential; pervious substratum.	Flooding; moderately slow intake rate; less than 22 inches of soil over hard caliche.	Cuts should be less than 6 inches deep.	Fair to poor bearing capacity and shear strength; moderate to high shrink-swell potential; susceptible to periodic flooding.	Periodic flooding; hard caliche at a depth of 22 to 48 inches.	C
Not applicable	Not applicable	Not applicable	Not applicable	Blasting necessary if pipe is installed beneath the surface.	D
Not applicable	Not applicable	Not applicable	Good suitability; blasting required for excavations.	Hard rock at the surface.	D
Not applicable	Not applicable	Not applicable	Hard caliche at a depth of 6 to 14 inches.	Hard caliche at a depth of 6 to 14 inches; sandy surface.	B
Not applicable	Generally not applicable; land leveling is difficult.	Little or no cutting is feasible, even on deeper soils; narrow benches.	Good bearing capacity	Hard caliche at a depth of 2 to 20 inches.	C
Moderately rapid permeability; erodible; unstable.	Rapid intake rate; low water-holding capacity; susceptible to wind erosion; sprinkler system needed.	Susceptible to wind erosion; sandy.	Good suitability if soil is confined.	Features favorable	A–B

TABLE 6.—*Engineering test data*

[Tests performed by New Mexico State Highway Department, Materials and Testing Division, in accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Soil name and location	Parent material	New Mexico report No.	Depth from surface	Mechanical analysis data [1]					Liquid limit	Plasticity index	Classification	
				Percentage passing sieve—								
				⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			AASHO	Unified [2]
Berino fine sand:			*Inches*						*Percent*			
1,100 feet S. and 1,280 feet E. of NW. corner of sec. 27, T. 17 S., R. 30 E.	Eolian sand.	63–9480	0–17	------	------	100	99	12	(3)	(3)	A–2–4(0) A–6(1)	SP–SM
		63–9481	23–36	------	------	100	99	36	29	12	A–2–4(0)	SC
		63–9482	36–50	------	------	100	99	35	25	8		SC
Cottonwood loam:												
150 feet SE. of NW. corner of NE¼ sec. 13, T. 23 S., R. 27 E.	Gypsiferous residuum.	S31980	1–5	------	------	100	99	67	22	5	A–4(6)	ML–CL
		S31981	9–36	------	------	100	90	74	(3)	(3)	A–4(8)	ML
		S31982	36–60	------	------	100	97	67	19	3	A–4(6)	ML
Gypsum land:												
250 feet SE. of NW. corner of SW¼ sec. 33, T. 23 S., R. 28 E.	Gypsiferous residuum.	S31986	0–19	------	------	100	97	83	(3)	(3)	A–4(8)	ML
Karro loam:												
150 feet E. and 750 feet S. of NW. corner of NE¼ sec. 18, T. 24 S., R. 28 E.	Old alluvium.	S31990	2–9	------	------	100	98	70	22	7	A–4(7)	ML–CL
		S31991	9–25	100	99	98	96	73	26	11	A–6(8)	CL
		S31992	54–79	100	99	98	96	77	32	16	A–6(8)	CL
Pajarito loamy fine sand:												
300 feet S. and 300 feet W. of north quarter corner, sec. 28, T. 17 S., R. 31 E.	Alluvial and eolian sandy material.	63–9477	0–9	------	------	100	99	30	(3)	(3)	A–2–4(0)	SM
		63–9478	18–36	------	------	100	97	31	(3)	(3)	A–2–4(0)	SM
		63–9479	36–72	100	99	98	91	46	21	6	A–4(2)	SM–SC
Reagan loam:												
1,000 feet S. and 100 feet W. of NE. corner of NW¼ SE¼ sec. 30, T. 22 S., R. 27 E.	Old alluvium.	S31987	3–10	------	------	100	99	64	21	5	A–4(6)	ML–CL
		S31988	23–38	------	------	------	100	78	26	9	A–4(8)	CL
		S31989	63–87	------	------	------	100	87	32	14	A–6(10)	CL
Reeves loam, shallow:												
NE¼SW¼SW¼ sec. 15, T. 24 S., R. 28 E.	Old alluvium.	S31983	3–8	------	------	100	99	62	20	6	A–4(5)	ML–CL
		S31984	8–18	------	------	100	98	67	26	10	A–4(6)	CL
		S31985	31–66	------	------	100	90	53	26	4	A–4(4)	ML–CL

See footnotes at end of table.

TABLE 6.—*Engineering test data*—Continued

Soil name and location	Parent material	New Mexico report No.	Depth from surface	Mechanical analysis data [1]					Liquid limit	Plasticity index	Classification	
				Percentage passing sieve—								
				⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			AASHO	Unified [2]
			Inches						*Percent*			
Simona gravelly fine sandy loam: 600 feet W. of SE. corner of SE¼ sec. 35, T. 16 S., R. 29 E.	Eolian sand and old alluvium.	63-9488	0-18	[4] 82	78	76	75	42	[3]	[3]	A-4(1)	SM
Upton gravelly sandy loam: SW¼ sec. 31, T. 22 S., R. 28 E.	Old alluvium.	S32240	0-6	[5] 78	67	60	56	37	21	5	A-4(0)	GM-GC

[1] Analysis according to AASHO Designation: T 88-57 (*2*). Results by this procedure frequently differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soil.

[2] Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points of the A-line are to be given a borderline classification. An example of a borderline classification so obtained is SP-SM.

[3] Nonplastic.

[4] 100 percent passed the 2-inch sieve, 96 percent passed the 1½-inch sieve, 90 percent passed the 1-inch sieve, and 88 percent passed the ¾-inch sieve.

[5] 100 percent passed the 2-inch sieve, 99 percent passed the 1½-inch sieve, 94 percent passed the 1-inch sieve, and 90 percent passed the ¾-inch sieve.

Formation and Classification of the Soils

This section discusses the major factors of soil formation as they relate to the soils of the Eddy Area and briefly explains the system of classifying soils into categories broader than the series. It also contains data obtained by physical and chemical analyses of eight selected soils.

Factors of Soil Formation

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

Climate and vegetation are the active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the development of distinct horizons.

The factors of soil genesis are so closely interrelated that few generalizations can be made regarding the effect of any one factor because the effect of each is modified by the other four. Many of the processes of soil development are unknown.

Parent material

The soils of the Eddy Area developed in material derived from parent material whose mineralogy is primarily carbonatic, mixed, montmorillonitic, or siliceous. The parent material can be related to four geologic systems (fig. 19).

QUATERNARY SYSTEM. The Quaternary System is the youngest geologic system in the Eddy Area. The younger part of this system, the Recent Series, is represented by alluvial deposits on flood plains of major streams. These deposits are mostly loamy and sandy sediments that contain some coarse fragments. The thickness of the deposits ranges from a few feet in secondary stream channels to more than 300 feet in the valley of the Pecos River, where the lower part of the sediments may be of Tertiary age. Soils of the Anthony, Arno, Dev, Harkey, Largo, and Pima series are representative of soils that developed in Recent deposits.

The older part of the Quaternary System is represented by alluvial deposits, mostly loamy sediments derived from limestone of Permian age. These deposits are commonly less than 50 feet thick. They occur west of the Pecos River. Soils of the Atoka, Upton, and Reagan series are representative.

Some of the materials representing the Quaternary System consist mostly of bolson deposits, dune sand, allu-

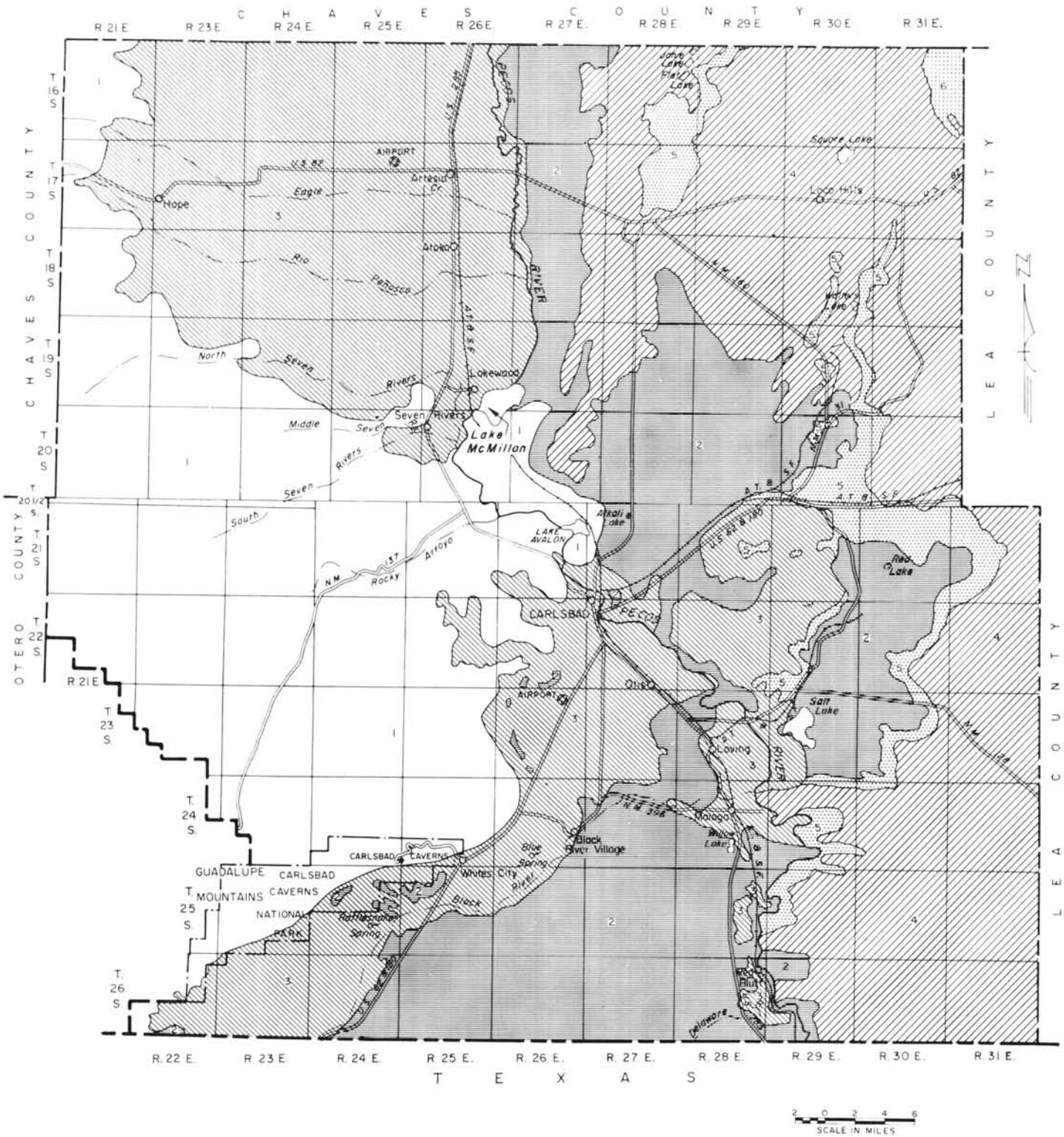

Figure 19.—Generalized geologic map of the Eddy Area, New Mexico:

1. Rocks of Permian age, primarily carbonatic.
2. Rocks of Permian age, primarily gypsiferous.
3. Loamy deposits of Quaternary age.
4. Sandy deposits of Quaternary age.
5. Rocks of Triassic age.
6. Rocks of Tertiary age.

vium, and other surface deposits. These materials are generally in the eastern part of the survey Area. Some of the areas have karst topography; playas and potholes are common. Soils of the Berino, Cacique, Kermit, Kimbrough, Likes, Mobeetie, Potter, Simona, Stegall, Tonuco, and Wink series are representative.

Tertiary System. The Tertiary System is represented by the Ogallala Formation. This formation consists of irregularly bedded sand, grit, and conglomerate of local gravel cemented with lime or caliche, and also of beds of local shale, clay, and limestone many hundreds of feet thick. The High Plains escarpment, northeast of Loco Hills, is a prominent exposure of the Ogallala Formation. The edge of the escarpment was mapped in this Area as Stony and Rough broken land. The High Plains has karst topography; small playas and potholes are common. Soils of the Kimbrough and Stegall series are representative.

Triassic System. The Triassic System is represented by the Dockum Group of rocks. This group includes Santa Rosa sandstone, Chinle shale, and Pierce Canyon red beds. These are formations of maroon, red, and gray irregularly bedded sandstone, bright-red and dark-red shale and sandy shale, and purplish limestone-and-pebble beds. Low escarpments and other exposures of these formations are common throughout the eastern part of the survey Area. Soils of the Largo and Pajarito series are representative of soils that developed in material washed from these formations. The escarpments and exposed rock are mapped as Stony and Rough broken land, Rock land, and Stony land.

Permian System. The Permian System is the oldest of the geologic systems in the Eddy Area. It is represented by two general groups of rocks: those that are dominantly carbonatic and those that are gypsiferous. The carbonatic group includes the San Andres, Grayburg, Yates, Queen, and Capitan Formations. The gypsiferous group includes the Castile, Rustler, Seven Rivers, and Tansill Formations, and undifferentiated rocks of the Guadalupe Group.

Carbonatic rocks make up a complex pattern in the mountains and hills of the western part of the survey Area. The San Andres Formation consists of light-gray to dark-gray evenly bedded limestone and dolomite; its lower part contains thick beds of gypsum and beds of sandstone. The Grayburg Formation consists of a bed of yellowish-gray dolomite stratified with thin bands of sandstone. The Yates Formation consists of thick- to thin-bedded carbonatic rocks interbedded with grayish-orange sandstone and siltstone. The Queen Formation consists of thick-bedded to thin-bedded sandstone, siltstone, and sandy dolomite, predominantly siltstone in the upper part. The Capitan Formation consists of thick-bedded to massive, light-gray, fossiliferous, calcitic limestone and deposits of thick-bedded talus. Soils of the Ector series are representative of soils that developed in material derived from carbonatic rocks. Limestone rock land is a representative land type. The Carlsbad Caverns and other caves in the Area were formed by the sculpturing action of ground water seeping through limestone of the Capitan Formation and limestone of similar age.

Gypsiferous rocks of the Permian System underlie the plains on a north-south axis through the central part of the survey Area. The Castile Formation consists of gypsum and dark, bituminous limestone interlaminated with white gypsum. The Rustler Formation consists of thin-bedded, grayish-pink dolomite and associated gypsum and brown siltstone. The Seven Rivers Formation consists of thick-bedded to thin-bedded carbonatic rocks that grade laterally into interbedded dolomite and gypsum and then to material that is dominantly gypsum. The Tansill Formation consists of thin-bedded carbonatic rocks interbedded with gypsum. The upper part of this formation contains siltstone. The undifferentiated rocks of the Guadalupe Group include gypsum, anhydrite, dolomite, dolomitic limestone, red sandstone, siltstone, and shale. Soils of the Cottonwood, Karro, Reeves, and Russler series are representative. Gypsum land is a representative land type.

Climate

The Eddy Area has a semiarid, continental climate that is typical of that part of the Western Range and Irrigated Region known as the Southern Desertic Basins and Mountains (*4*). The climate is characterized by abundant sunshine, low relative humidity, erratic rainfall, and a wide variation in daily and seasonal temperatures.

Winters are short and mild, and summers are long and hot. Most of the precipitation falls in summer. In winter, some of the precipitation falls as snow, but the ground is seldom covered for more than a few hours. The soils rarely freeze to a depth of more than a few inches. March is the windiest month, and September the least windy. The prevailing winds are from the southeast, but they generally shift to a southwesterly direction in midwinter.

Most of the soils of the Eddy Area developed in a low-rainfall climate, as evidenced by the limited amount of leaching of salts and other minerals. The depth to lime accumulations is generally shallow or very shallow. Some of the soils, however, such as those of the Berino series, show evidence of having developed in a wetter climate, probably during the Pleistocene epoch. These soils, which are among the most mature of the upland soils of the Area, have a clayey subsoil and deeply leached salts. They are deep and sandy.

Soils on upland flood plains, such as those of the Stegall, Pima, and Bippus series, show varying degrees of development, mainly in their content of organic matter and the extent of leaching of salts and minerals into the lower part of the solum. These soils are subject to periodic flooding, and the additional moisture encourages the growth of vegetation and provides a longer growing period.

Relief and drainage

The effects of climate and vegetation, as factors in soil formation, are modified to varying degrees by relief. If other factors are about equal, runoff is rapid on steep slopes and slow on level areas. In sandy areas all the water received soaks in.

If runoff is rapid, little water enters the soil, plants do not grow well, and soil formation proceeds slowly; soil horizons are indistinct and thin. Soils of the Ector series

are examples of soils that formed where runoff is rapid, and Limestone rock land is a representative land type. A layer of lime at or near the surface can cause runoff to be rapid. Karro and Upton soils are examples.

Evaporation, capillary action, and living plants bring salts to the surface of a soil. If runoff is restricted either by natural or manmade structures, the salts cannot be washed away and the soils become saline. The saline phases of Karro, Pima, Reagan, and Reeves soils are examples of soils that have become saline because of manmade restrictions. Soils of the Arno series are naturally saline because the underlying water table is saline. Most of the larger playas, such as Jahie and Salt Lakes, are saline because water that collects in them can escape only by evaporation or seepage. Either of these natural processes leaves the salt behind. Cottonwood and Russler soils are naturally saline because their parent material was gypsiferous.

Depletion of the vegetative cover influences relief because wind shifts the surface sand and exposes the harder, finer textured underlying material. Hummocks and sand dunes as much as 6 feet in height are common. Runoff is generally slow to very slow in these areas. Soils of the Berino, Cacique, and Pajarito series are representative.

Plant and animal life

Trees and shrubs, grasses and other herbaceous plants, micro-organisms, ants, earthworms, gophers, mice, badgers, and various other forms of plant and animal life are active factors in soil formation.

The soils of the Eddy Area formed under two general types of vegetation—mixed shrubs and mixed grasses. These vegetative types are closely related to the climate and parent material. The grasses are tall on sandy soils and short on gypsiferous soils.

Organic matter is added to the soil in the form of leaves, stems, roots, and entire plants. Most of it is incorporated into the A horizon, where it is acted upon by micro-organisms, earthworms, and other forms of life, and by chemicals. The darkness of the color of the A horizon is directly related to the amount of organic matter in the soil and is a factor in soil classification.

Soil-dwelling animals have influenced the development of some of the soils of the Eddy Area. Soils that receive overflow, such as those of the Pima series, are generally affected by earthworm activity. Soils that developed in loamy alluvium, such as those of the Reagan series, are affected by the activities of ants, grasshoppers, and cicadas. Sandy soils, such as those of the Berino series, have been altered by the mixing resulting from the burrowing of rats, mice, and insects, as well as the burrowing of foxes and coyotes in search of food.

Man has also influenced soil characteristics. The first settlers fenced the range, brought in livestock, and allowed the range to be overgrazed. As the vegetative cover became depleted, soil erosion accelerated. The areas most severely eroded by wind are east of the Pecos River, where the soils are sandy. Berino and Pajarito soils are representative. The soils most severely eroded by water are the Largo soils.

Man has plowed and leveled large areas of loamy soils on the flood plains of the Pecos River and on the adjoining uplands, where surface and ground water are accessible for irrigation. Poor quality and improper management of irrigation water have caused some good soils to become saline. In most areas used for irrigated crops, the organic-matter content has increased. In some areas, such as in areas of Arno soils, irrigation has improved the soils by leaching out some of the salt.

Time

The length of time needed for a soil to form depends on the kind of parent material, the climate, plant growth and animal activity, and relief and drainage. The degree of profile development depends on the intensity of the different soil-forming factors and on the length of time they have been active.

A soil is young, or immature, if the soil-forming factors have not been active long enough for the soil to be in equilibrium with its environment. A soil is mature, or old, if it has been in place for a long time and has approached equilibrium.

Soils of the Anthony, Arno, Harkey, and Kermit series are young, or immature. These soils show little or no profile development and but little leaching of soil colloids. Soils of the Bippus and Dev series are young soils that receive fresh deposits of soil material from time to time.

Soils of the Atoka, Berino, Mobeetie, Pajarito, Reagan, and Upton series are old, or mature. These soils show some profile development and leaching of carbonates into the lower part of the solum. They occur mainly in the plains and valleys east of the mountains and hills. Soils of the Stegall series are examples of mature soils that occur on flood plains.

Classification of the Soils

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*11*) and later revised. The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 and supplemented in March 1967 (*14*). This system is under continual study, and readers interested in the development of the system should refer to the latest literature available (*1*, *5*, *10*).

Table 7 shows the classification of each of the soil series represented in the Eddy Area according to the present system, and also the great soil group according to the 1938 system. Placement of some of the soil series in the comprehensive system, particularly in families, may change as more precise information becomes available.

The current system defines classes in terms of observable or measurable properties of soils. The properties chosen are primarily those that permit the grouping of soils that are similar in genesis. The classification is designed to encompass all soils. It has six categories. Beginning with the most inclusive, they are the order, the suborder, the great group, the subgroup, the family, and the series. These are briefly defined in the following paragraphs.

ORDER.—Ten soil orders are recognized in the current system. These are the Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols,

TABLE 7.—*Classification of soil series of Eddy Area*

Series	Family	Subgroup	Suborder	Order	Great soil group (1938 classification)
Anthony	Coarse-loamy, mixed, calcareous, thermic.	Typic Torrifluvent	Fluvent	Entisol	Alluvial.
Arno	Fine, mixed, calcareous, thermic	Vertic Torrifluvent	Fluvent	Entisol	Alluvial.
Atoka	Fine-loamy, mixed, thermic	Typic Paleorthid	Orthid	Aridisol	Calcisol.
Berino	Fine-loamy, mixed, thermic	Typic Haplargid	Argid	Aridisol	Red Desert.
Bippus [1]	Fine-loamy, mixed, thermic	Aridic Pachic Haplustoll	Ustoll	Mollisol	Chestnut.
Cacique	Fine-loamy, mixed, thermic	Petrocalcic Paleorgid	Argid	Aridisol	Red Desert.
Cottonwood [1]	Fine, carbonatic, thermic, shallow	Ustic Torriorthent	Orthent	Entisol	Lithosol.
Dev [1]	Loamy-skeletal, carbonatic, thermic.	Torrifluventic Haplustoll	Ustoll	Mollisol	Alluvial.
Ector	Loamy-skeletal, carbonatic, thermic.	Aridic Haplustoll	Ustoll	Mollisol	Lithosol.
Harkey	Coarse-silty, mixed, calcareous, thermic.	Typic Torrifluvent	Fluvent	Entisol	Alluvial.
Karro [1]	Fine, carbonatic, thermic	Ustollic Calciorthid	Orthid	Aridisol	Calcisol.
Kermit	Siliceous, thermic	Typic Torripsamment	Psamment	Entisol	Regosol.
Kimbrough	Loamy, mixed, thermic, shallow	Aridic Petrocalcic Calciustoll	Ustoll	Mollisol	Lithosol.
Largo	Fine-silty, mixed, calcareous, thermic.	Typic Torriorthent	Orthent	Entisol	Alluvial.
Likes [1]	Mixed, thermic	Ustic Torripsamment	Psamment	Entisol	Regosol.
Mobeetie [1]	Coarse-loamy, mixed, thermic	Ustollic Camborthid	Orthid	Aridisol	Regosol.
Pajarito	Coarse-loamy, mixed, thermic	Typic Camborthid	Orthid	Aridisol	Regosol.
Pima [2]	Fine-silty, mixed, thermic	Torrifluventic Haplustoll	Ustoll	Mollisol	Alluvial.
Pima, gray variant.	Fine-silty, mixed, thermic	Aquic Calciustoll	Ustoll	Mollisol	Humic Gley.
Potter [1]	Loamy-skeletal, carbonatic, thermic, shallow.	Typic Paleorthid	Orthid	Aridisol	Lithosol.
Reagan [1]	Fine, carbonatic, thermic	Typic Calciorthid	Orthid	Aridisol	Calcisol.
Reeves	Fine-silty, carbonatic, thermic	Typic Calciorthid	Orthid	Aridisol	Calcisol.
Russler	Fine-silty, mixed, thermic	Typic Camborthid	Orthid	Aridisol	Reddish Brown.
Simona	Loamy, mixed, thermic, shallow	Typic Paleorthid	Orthid	Aridisol	Calcisol.
Stegall [3]	Fine, mixed, thermic	Aridic Petrocalcic Paleustoll	Ustoll	Mollisol	Chestnut.
Tonuco	Sandy, mixed, thermic, shallow	Typic Paleorthid	Orthid	Aridisol	Regosol.
Upton	Fine, carbonatic, thermic, shallow	Typic Paleorthid	Orthid	Aridisol	Regosol.
Wink	Coarse-loamy, mixed, thermic	Typic Calciorthid	Orthid	Aridisol	Calcisol.

[1] Studies subsequent to the completion of this survey indicate that some of the soils correlated in the Eddy Area are somewhat drier than the concept of the series for which they are named. In future surveys it is expected that soils correlated as Bippus in the Eddy Area will be named Begetty; Cottonwood soils will be named Holloman; Dev soils will be named Santo Tomas; Likes soils will be named Bluepoint; and Reagan soils will be named Reakor. In addition, Karro soils will be named Reakor, light colored phase; Mobeetie soils will be included in the Pajarito series; and Potter soils will be named Tencee.

[2] The Pima soils mapped in the Eddy Area commonly contain more calcium carbonate than is typical of the series.

[3] Soils of the Stegall series mapped in the Eddy Area are drier than is typical of the series.

and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, the Entisols and Histosols, occur in many different climates. Three of the ten soil orders are represented in the Eddy Area. These are the Entisols, Aridisols, and Mollisols.

Entisols are recent soils in which there has been no horizon development. This order is represented in the Eddy Area by soils of the Anthony, Arno, Cottonwood, Harkey, Kermit, Largo, and Likes series.

Aridisols are primarily soils of dry places. This order is represented by soils of the Atoka, Berino, Cacique, Karro, Mobeetie, Pajarito, Potter, Reagan, Reeves, Russler, Simona, Tonuco, Upton, and Wink series.

Mollisols have a thick, dark-colored surface layer. The vast majority of these soils formed under grass. This order is represented by soils of the Bippus, Dev, Ector, Kimbrough, Pima, and Stegall series.

SUBORDER.—Each order is divided into suborders, primarily on the basis of characteristics that seem to produce classes having genetic similarity. Mainly, these are characteristics that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The climatic range is narrower than that of the orders.

GREAT GROUP.—Each suborder is divided into great groups, on the basis of uniformity in the kinds and sequence of major horizons and similarity of the significant features of corresponding horizons. The horizons considered are those in which clay, iron, or humus has accumulated and those that have pans that interfere with the growth of roots or the movement of water. The features selected are the self-mulching properties of clays, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

SUBGROUP.—Each great group is divided into subgroups, one representing the central (typic) segment of the group, and other groups, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Sub-

groups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order.

FAMILY.—Families are established within a subgroup primarily on the basis of properties that affect the growth of plants or the behavior of soils in engineering use. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

Physical and Chemical Analyses

Data obtained by physical and chemical analyses of eight selected soils in the Eddy Area are given in table 8. Such data are useful to soil scientists in classifying soils and in developing concepts of soil genesis. They are also helpful for estimating rate of water intake, water-holding capacity, alkalinity, organic-matter content, fertility, erodibility, and other properties significant in soil management.

The samples used to obtain the data in table 8 were collected from carefully selected pits. The percentage figures are the percentages of material passing the 2-millimeter sieve.

Methods of the Soil Survey Laboratory were used to obtain most of the physical and chemical analyses. The particle size distribution was determined by the pipette method (*6*, *7*, *8*). The pH value of the saturated paste was measured with a glass electrode. Organic carbon was determined by a modification of the Walkley-Black wet combustion method (*9*). A 77-percent recovery factor for this method was used. Nitrogen was determined by methods of analysis of the Association of Official Agricultural Chemists (*3*). Estimated salt was determined from conductivity of saturated paste in Bureau of Soils cup. The calcium carbonate equivalent was determined by a modified procedure of acid neutralization (*13*). The cation exchange capacity was determined by flame photometric determination of adsorbed sodium (*13*). The extractable cations were extracted with 1 normal ammonium-acetate (*13*). The sodium and potassium were determined by the Perkin-Elmer photometer. The saturation extract soluble cations were determined by methods used by the U.S. Salinity Laboratory (*13*). The calcium and magnesium were determined by the versenate method.

General Nature of the Area

This section gives general facts about the Eddy Area. It briefly discusses the history and development of the Area, the mineral resources, and the climate.

History and Development

Four historic trails follow the Pecos River through Eddy County. The earliest of these is one blazed by the Spaniards in 1536. Apache Indians lived in the region at that time, and they found abundant game in the mountains and on the plains and many kinds of fish in the rivers.

The earliest white settlement was established near the present city of Carlsbad in 1881. The largest numbers of settlers arrived in the 1880's and 1890's. The county was organized in 1889 from a part of Lincoln County. Carlsbad was made the county seat in 1890.

Grassland suitable for livestock grazing was the principal attraction for the settlers. Irrigated farming, dairying, mining, oil production, and development of recreation areas came in later years.

Irrigated farming has become increasingly important. The principal irrigated crops are cotton, alfalfa, sorghum, and small grain. Much of the irrigation water comes from wells.

The New Mexico State University has established a testing station approximately 5 miles south and half a

TABLE 8.—*Analytical*

[Analyses made at Cooperative Soils Laboratory, Soil Conservation Service, and

Soil type, location of sample, and sample number	Horizon	Depth	Texture	Particle size distribution						
				Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
Atoka loam:		*In.*		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Location: NE¼NW¼SW¼ NE¼ sec. 4, T. 23	A11	0–2	Very fine sandy loam.	0. 4	0. 7	0. 8	10. 2	42. 5	35. 0	10. 4
S., R. 27 E. (Sample No. S57NMex–8–3-(1–6);	A12	2–8	Loam	. 5	. 7	. 8	8. 9	36. 8	31. 5	20. 8
laboratory No. 331–336)	AC	8–15	Loam	. 6	. 6	. 7	7. 8	33. 6	37. 2	19. 5
	C1	15–23	Loam	. 6	. 8	. 8	7. 7	31. 6	35. 5	23. 0
	C2ca	23–33	Loam	1. 0	. 6	. 7	7. 6	28. 0	35. 7	26. 4
	C3cam	33	Indurated caliche.							

mile east of Artesia. Cotton, alfalfa, small grain, and sorghum are grown on experimental plots. In recent years sugar beets have been tested. The soils on the testing grounds are mainly of the Reagan, Reeves, Pima, and Harkey series, but there are small areas of Karro soils also.

The Eddy Area is on the western side of a large petroleum field, and the town of Artesia is a center for activities connected with oil production. Potash and rock salt are mined east of Carlsbad, and several hundred people are employed in the mines. About 384,000 acres in the Eddy Area are underlain by gypsiferous rocks and earths of varying quality. These areas hold some potential for commercial mining of gypsum.

Climate [5]

The Eddy Area has the semiarid, continental climate that is characteristic of the southeastern plains of New Mexico. Hot summer days are followed by cool nights. Winters are usually moderate, but cold waves sometimes move in abruptly and the temperature falls sharply in a few hours. Farming is risky, because the climate is dry and hot and wind velocities are high.

Some of the information in this section is presented in tabular form. Table 9 gives data on temperature and precipitation, and table 10 gives data on evaporation and wind movement.

Table 9 shows temperature and precipitation data for Carlsbad. These are representative of most of the Eddy Area. It is cooler and rainier at the higher elevations than at Carlsbad, and the range between average high and low temperatures is narrower than at locations along the Pecos River. The mean annual temperature in the Eddy Area ranges from 60° to 64° F. The mean minimum temperature ranges from 44° to 49°, and the mean maximum temperature, from 75° to 79°. Annual extremes near 110° in summer and below zero in winter are the general rule. The highest temperature recorded in the Eddy Area was 116° at Artesia in June 1916. The lowest was −35°, also at Artesia, in February 1933.

Figures 20 and 21 show the probabilities of the latest spring and earliest fall dates of specified temperatures. The probabilities are based on data recorded at Carlsbad over a period of 30 years. A difference of several days should be expected at higher elevations and to the north, where temperatures are lower.

To determine from figure 20 the probability that there will be a temperature at Carlsbad of 32° F. after April 10, lay a ruler vertically on the line extending from the point indicated by April 10. Look to the left from the point where the ruler crosses the diagonal 32° line, and read the percentage listed at the side of the graph. The probability of a 32° temperature is approximately 20 percent. In the same manner, figure 21 can be used to determine the probability that the temperature listed will occur before the dates indicated in fall.

The average annual rainfall amounts to 10 to 14 inches in the central part of the Eddy Area, and nearly 16 inches at the higher elevations in the eastern plains. Rainfall is more plentiful in summer, when the prevailing winds bring moisture in from the Gulf of Mexico. Nearly 80 percent of the rainfall falls in the period from May through October. Brief, heavy thunderstorms are frequent in June, July, and August. As many as forty may occur in one year. Some of the heaviest storms are accompanied by hail. Measurable rainfall can be expected an average of 42 days a year.

The average annual snowfall ranges from 3 to 8 inches in most places, but it is heavier at the higher elevations. As much as 40 inches of snow has fallen in one year at Hope and Artesia, in the north. In some years southern and central weather stations have gone without measurable snowfall. Occasional glaze or sleet can be expected in winter, but only a few times a year. The smallest annual precipitation recorded was 2.16 inches at Lake Avalon in 1917.

[5] By FRANK E. HOUGHTON, State climatologist.

data for selected profiles

New Mexico Agricultural Experiment Station. Dashes indicate values not determined]

Reaction (saturated paste)	Organic carbon	Nitrogen	Electrical conductivity	$CaCO_3$ equivalent	Gypsum	Cation exchange capacity	Extractable cations		Saturation extract soluble cations				Moisture at saturation	Saturation extract soluble sodium	Exchangeable sodium
							Na	K	Na	K	Ca	Mg			
pH	*Pct.*	*Pct.*	*Ec × 10³ Mmhos/cm. at 25° C.*	*Pct.*	*Pct.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./liter*	*Meq./liter*	*Meq./liter*	*Meq./liter*	*Pct.*	*Meq./100 gm.*	*Meq./100 gm.*
7. 8	0. 70	0. 073	1. 2	5. 7	------	18. 6	0. 4	1. 2	2. 3	0. 8	8. 0	1. 2	29	0. 1	0. 3
7. 5	. 70	. 085	1. 3	8. 4	------	19. 7	. 5	1. 0	1. 8	. 6	8. 7	2. 1	34	. 1	. 4
7. 5	. 60	. 075	1. 2	11. 4	------	20. 0	. 6	. 7	1. 2	. 4	7. 9	2. 4	42	. 1	. 6
7. 5	. 54	. 067	1. 2	12. 7	------	20. 3	. 5	. 6	1. 8	. 2	7. 5	2. 2	41	. 1	. 4
7. 5	. 39	. 051	1. 0	17. 7	------	20. 2	. 6	. 5	1. 9	. 1	6. 2	2. 2	43	. 1	. 5

TABLE 8.—*Analytical data*

Soil type, location of sample, and sample number	Horizon	Depth	Texture	Particle size distribution						
				Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
		In.		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Cottonwood loam:										
Location: 3 miles NW. of Loving, 150 feet SE. of the NW. corner of NE¼ sec. 13, T. 23 S., R. 27 E. (Sample No. S57NMex–8–8–(1–5); laboratory No. 360–364)	A11	0–1	Loam (flocculated).							
	A12	1–5	Loam	0. 2	0. 6	1. 2	15. 4	34. 0	29. 0	19. 6
	C1	5–9	Loam		. 4	1. 0	12. 6	32. 6	34. 4	19. 0
	C2cs	9–36	Gypsiferous material.							
	C3cs	36–60	Gypsiferous material.							
Harkey very fine sandy loam:										
Location: 150 feet NE. of the SW. corner of NW¼SE¼ sec. 24, T. 22 S., R. 27 E. (Sample No. S57NMex–8–5–(1–6); laboratory No. 344–349)	Ap	0–9	Very fine sandy loam.	. 1	. 5	. 7	8. 8	48. 6	31. 3	10. 0
	AC	9–14	Very fine sandy loam.	. 2	1. 0	. 5	6. 4	42. 8	34. 3	14. 8
	C1	14–30	Very fine sandy loam.		. 1	. 2	4. 4	47. 6	35. 3	12. 4
	C2	30–37	Loam	. 1	. 2	. 4	3. 3	41. 4	41. 3	13. 3
	C3	37–51	Loam	. 1	. 3	. 2	2. 0	33. 0	46. 8	17. 6
	C4	51–87	Silt loam	. 1	. 6	. 9	3. 0	24. 2	55. 2	16. 0
Karro loam:										
Location: At the center of the E½NW¼SE¼ sec. 7, T. 24 S., R. 28 E. (Sample No. S56NMex–8–24–(1–6); laboratory No. 309–314)	Ap	0–10	Loam	. 2	1. 8	2. 8	9. 3	28. 1	38. 9	18. 9
	AC	10–20	Loam	. 1	1. 8	2. 7	8. 6	24. 4	38. 9	23. 5
	C1	20–46	Clay loam	. 5	2. 0	2. 8	8. 4	24. 0	34. 3	28. 0
	C2ca	46–60	Clay loam	. 3	1. 8	3. 0	9. 2	24. 0	32. 2	29. 5
	C3ca	60–90	Clay loam	. 6	2. 3	2. 9	7. 6	21. 4	35. 4	29. 8
Reagan loam:										
Location: 100 yards E. of house, NW¼NW¼ sec. 27, T. 22 S., R. 27 E. (Sample No. S57NMex–8–19–(1–8); laboratory No. 397–404)	Ap	0–8	Loam		. 3	. 5	8. 3	37. 7	34. 3	18. 9
	C1	8–19	Loam	. 1	. 1	. 3	6. 0	29. 9	42. 7	20. 9
	C2	19–32	Loam	. 1	. 3	. 6	5. 9	26. 8	41. 8	24. 5
	C3ca	32–44	Clay loam	. 1	. 3	. 5	5. 7	23. 3	40. 2	29. 9
	C4ca	44–54	Clay loam	. 1	. 2	. 4	4. 2	19. 8	44. 9	30. 4
	C5ca	54–67	Clay loam		. 1	. 2	3. 0	18. 9	48. 2	29. 6
	C6	67–82	Loam	. 1	. 2	. 5	4. 9	22. 1	47. 6	24. 6
Reeves loam:										
Location: 800 feet E. and 100 feet S. of the NW. corner of sec. 24, T. 23 S., R. 27 E. (Sample No. S57NMex–8–7–(1–4); laboratory No. 355–359)	Ap	0–8	Heavy loam	. 1	. 4	. 7	11. 1	26. 3	33. 0	28. 4
	AC	8–15	Clay loam	. 1	. 2	. 6	8. 0	22. 3	39. 0	29. 8
	C1ca	15–23	Clay loam		. 2	. 4	5. 4	17. 4	42. 0	34. 6
	C2cs	23–32	Light clay loam; many crystals of gypsum.							
	Res	32	Gypsum							
Reeves loam, shallow:										
Location: 1 mile SW. of Malaga, NE¼SW¼SW¼ sec. 15, T. 24 S., R. 28 E. (Sample No. S57NMex–8–11–(1–5); laboratory No. 373–377)	Ap1	0–3	Loam	. 3	1. 7	4. 8	20. 2	33. 2	29. 6	10. 2
	Ap2	3–8	Loam	. 3	1. 8	6. 2	22. 8	28. 1	28. 3	12. 5
	C1	8–18	Loam	. 1	1. 6	4. 4	16. 4	23. 2	31. 9	22. 4
	C2cs	18–31	Gypsiferous material.							
	C3cs	31–66	Gypsiferous material.							
Russler loam:										
Location: NW¼SE¼ sec. 35, T. 23 S., R. 28 E. (Sample No. S57NMex–8–17–(1–6); laboratory No. 386–391)	Ap	0–11	Loam	. 4	1. 0	4. 3	20. 8	21. 4	21. 5	30. 6
	B21ca	11–19	Clay loam	. 4	. 6	2. 6	11. 0	12. 8	38. 8	33. 8
	B22ca	19–34	Clay loam	. 4	. 8	2. 9	11. 2	12. 0	38. 3	34. 4
	B23ca	34–45	Clay loam	. 2	. 6	2. 0	8. 4	11. 6	41. 8	35. 4
	IIC1cs	45–52	Gypsiferous material.							
	IIC2cs	52	Gypsiferous material.							

for selected profiles—Continued

Reaction (saturated paste)	Organic carbon	Nitrogen	Electrical conductivity	$CaCO_3$ equivalent	Gypsum	Cation exchange capacity	Extractable cations		Saturation extract soluble cations				Moisture at saturation	Saturation extract soluble sodium	Exchangeable sodium
							Na	K	Na	K	Ca	Mg			
pH	*Pct.*	*Pct.*	*Ec × 10³ Mmhos./cm. at 25° C.*	*Pct.*	*Pct.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./liter*	*Meq./liter*	*Meq./liter*	*Meq./liter*	*Pct.*	*Meq./100 gm.*	*Meq./100 gm.*
7. 3	2. 63	. 280	10. 0+	11. 0	24. 6	17. 6	6. 3	1. 9	133. 0	7. 9	145. 2	41. 0			
7. 1	1. 14	. 160	10. 0+	10. 7	2. 0	15. 7	6. 9	1. 3	165. 4	5. 6	279. 8	46. 6	37	6. 1	0. 1
7. 1	. 90	. 137	10. 0+	14. 2	2. 3	16. 7	6. 1	. 9	144. 2	2. 9	175. 1	25. 8	38	5. 5	. 1
7. 5	. 74	. 087	4. 1	11. 5	. 2	14. 4	. 5	. 9	4. 0	. 3	31. 3	7. 6	32	0	. 5
7. 5	. 45	. 068	5. 0	16. 3	2. 0	14. 3	1. 1	. 6	13. 5	. 2	29. 6	10. 3	34	. 5	. 6
7. 8	. 25	. 040	9. 0	15. 7	. 9	12. 7	2. 1	. 4	37. 0	. 9	26. 6	27. 0	33	1. 2	. 9
8. 0	. 28	. 047	10. 0+	17. 3	. 6	15. 0	4. 7	. 4	43. 8	. 1	28. 1	42. 9	34	1. 5	3. 2
8. 3	. 25	. 046	10. 0+	18. 6	. 6	16. 3	7. 9	. 5	12. 5	. 2	27. 4	35. 7	38	. 7	7. 2
8. 2	. 29	. 055	10. 0+	16. 1	. 7	19. 2	9. 4	. 6	19. 0	. 2	29. 1	38. 2	37	. 7	8. 7
7. 7	. 74	. 106	9. 5	23. 4	2. 2	12. 3	2. 8	. 8	49. 6	1. 5	31. 0	13. 9	32	1. 6	1. 2
7. 6	. 52	. 091	10. 0+	28. 7	2. 1	12. 2	3. 8	. 8	71. 3	1. 5	29. 4	15. 2	38	2. 7	1. 1
7. 8	. 36	. 083	10. 0+	29. 4	1. 2	11. 3	4. 3	. 9	84. 6	2. 0	35. 9	24. 8	37	3. 1	1. 2
7. 9	. 34	. 062	10. 0+	38. 6	. 7	10. 2	3. 2	. 9	67. 4	2. 2	40. 4	25. 3	36	2. 4	. 8
8. 0	. 20	. 037	9. 0	46. 6	. 4	8. 6	2. 0	. 4	29. 7	1. 2	27. 9	21. 0	37	1. 1	. 9
7. 7	. 90	. 103	7. 9	15. 3	. 5	16. 6	2. 6	. 8	36. 2	. 7	33. 0	9. 7	40	. 1	2. 5
7. 5	. 45	. 082	5. 2	20. 8	1. 3	16. 6	1. 9	. 6	21. 8	. 5	32. 3	7. 0	42	. 9	1. 0
7. 6	. 31	. 047	5. 5	23. 7	1. 8	16. 8	1. 5	. 5	16. 8	. 3	30. 2	9. 1	43	. 7	. 8
7. 7	. 30	. 044	6. 0	26. 9	1. 8	15. 7	1. 4	. 4	18. 2	. 2	30. 7	10. 1	44	. 8	. 6
7. 7	. 20	. 044	4. 9	39. 3	1. 3	16. 0	1. 6	. 4	16. 2	. 2	29. 2	10. 0	44	. 7	. 9
7. 7	. 20	. 040	4. 6	37. 5	1. 4	16. 4	1. 4	. 3	15. 2	. 2	29. 2	11. 7	46	. 7	. 7
7. 8	. 14	. 028	5. 0	27. 2	1. 1	18. 2	1. 9	. 4	20. 1	. 2	26. 5	11. 5	47	. 9	1. 0
7. 6	. 60	. 102	5. 0	22. 5	1. 2	19. 9	1. 3	. 7	9. 0	. 1	32. 4	9. 4	40	. 4	. 9
7. 6	. 51	. 096	5. 0	30. 1	2. 0	20. 5	1. 1	. 7	9. 9	. 1	34. 7	9. 6	42	. 4	. 7
7. 6	. 31	. 064	6. 0	43. 8	2. 6	17. 6	3. 5	. 5	24. 9	. 1	29. 1	13. 4	43	1. 1	2. 4
7. 8	. 12	. 033	6. 1	22. 3	31. 3	13. 0	1. 4	. 2	20. 8	. 9	29. 4	17. 4	62	1. 1	. 1
7. 3	. 66	. 115	10. 0+	10. 6	. 1	12. 1	1. 8	1. 4	41. 2	6. 8	162. 7	28. 4	29	1. 2	. 6
7. 0	. 85	. 156	10. 0+	10. 4	. 2	13. 8	5. 0	. 9	152. 4	5. 1	368. 6	66. 2	29	4. 4	. 6
7. 3	. 62	. 097	10. 0+	18. 4	. 9	15. 7	3. 9	. 8	105. 4	2. 2	17. 6	2. 4	36	3. 8	. 1
				8. 0	35. 2										
				14. 1	26. 5										
7. 7	. 71	. 122	10. 0+	9. 8	4. 0	15. 2	4. 8	. 9	91. 7	1. 6	37. 6	22. 4	38	3. 5	1. 3
7. 5	. 54	. 078	10. 0+	19. 4	1. 9	17. 5	4. 8	. 9	66. 4	. 9	37. 9	24. 7	50	3. 3	1. 5
7. 6	. 41	. 063	10. 0+	19. 6	1. 0	20. 8	6. 3	. 7	76. 3	. 6	29. 6	19. 2	50	3. 8	2. 5
7. 6	. 31	. 050	10. 0+	21. 3	2. 2	21. 8	10. 8	. 6	149. 2	. 7	42. 6	21. 0	52	7. 7	3. 0
7. 6	. 18	. 042	10. 0+	17. 2	20. 3	20. 0	8. 2	. 6	101. 7	. 6	50. 3	23. 8	54	5. 5	2. 7
				17. 8	20. 9										

TABLE 9.—*Temperature and precipitation data*

[All data from Carlsbad]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Average number of days with—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	0.10 inch or more	0.25 inch or more
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Days*	*Days*
January	59	29	74	17	0.44	(1)	0.9	1	1
February	65	32	79	19	.37	(1)	1.0	1	1
March	71	38	85	25	.46	(1)	1.1	1	1
April	80	46	92	35	.54	(1)	1.3	1	1
May	88	55	99	43	1.76	0.4	3.4	3	2
June	96	64	105	55	1.33	.1	3.1	2	1
July	96	67	103	61	1.56	.6	2.5	3	2
August	96	66	102	60	1.60	.2	3.1	3	2
September	89	59	99	48	1.94	.2	5.8	3	2
October	80	49	92	37	1.61	.2	3.3	3	1
November	68	35	82	23	.35	(1)	.7	1	1
December	60	29	78	18	.47	(1)	1.9	1	(2)
Year	79	47	[3]107	[4]8	12.43	6.4	18.1	23	15

[1] 0.005 inch, the smallest measurable amount.
[2] Less than half a day.
[3] Average annual highest maximum.
[4] Average annual lowest minimum.

Evaporation from a Class A measuring pan ranges from 100 to 110 inches per year, and lake evaporation, from 66 to 72 inches. About two-thirds of the evaporation takes place during the period May through October. Table 10 shows the rate of evaporation and wind movement at Lake Avalon over a 10-year period.

Winds are predominantly from the south-southeast in summer and autumn. They are predominantly from the west-southwest in winter and spring. Late in winter they shift to the southwest in the western parts of the Area and in the Pecos River valley. The strongest winds occur in March, when the average windspeed reaches 16 miles per hour. Windspeeds decrease to their low monthly average of 10 miles per hour in September. More than 80 percent of the winds stronger than 31 miles per hour are from the west-southwest. Windspeeds stronger than 46 miles per hour occur an average of 40 hours per year.

The relative humidity averages nearly 45 percent annually. The lowest average humidity, nearly 35 percent, occurs in spring; the highest, nearly 50 percent, in summer and in January.

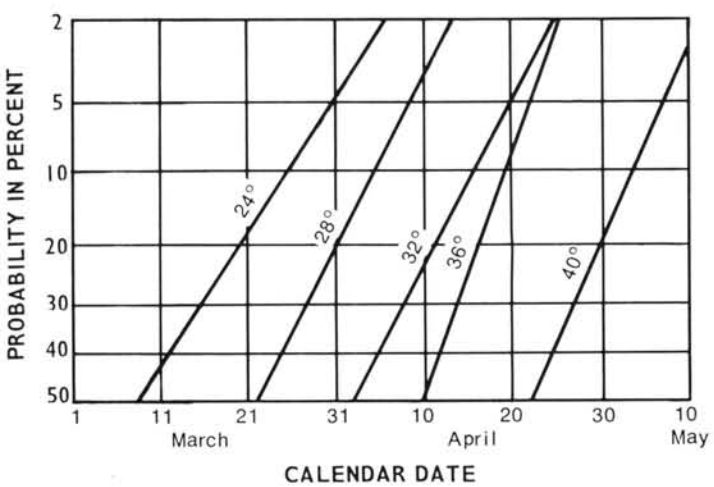

***Figure 20.*—Probability that the temperature at Carlsbad will be 24°, 28°, 32°, 36°, and 40° F. after the dates indicated in spring.**

TABLE 10.—*Evaporation and wind movement*

[All data based on records at Lake Avalon, for the period 1952 to 1961. All measurements were taken at a height of 2 feet above the ground]

Month	Evaporation	Wind movement
	Inches	*Miles*
January	4.44	2,393
February	5.75	2,644
March	9.51	3,407
April	12.04	3,272
May	14.14	2,980
June	14.79	2,533
July	13.65	2,140
August	12.68	1,915
September	10.13	1,858
October	7.17	1,849
November	4.54	2,039
December	3.91	2,012
Year	112.75	29,042

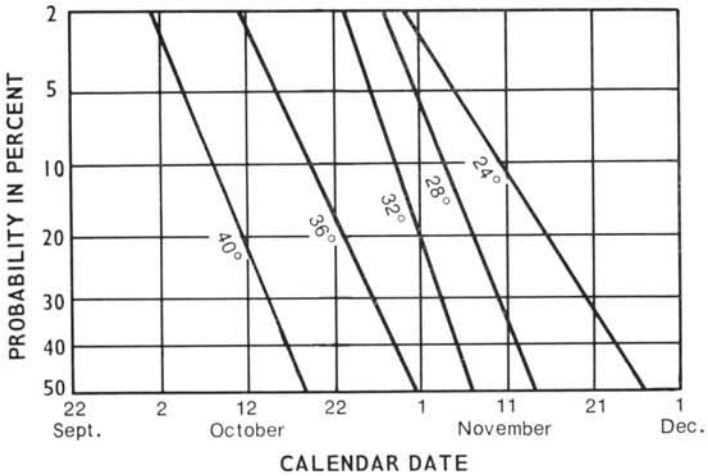

Figure 21.—**Probability that the temperature at Carlsbad will be 40°, 36°, 32°, 28°, and 24° F. before dates indicated in fall.**

The skies are sunny nearly 75 percent of the daylight hours; sunshine is most abundant in June and in fall. In an average year, there are 223 clear days, 97 partly cloudy days, and 45 cloudy days.

Tornadoes are rare. They develop only in May, June, and July. One or two have touched down in recent years, but damage has been slight. Tornadoes are occasionally accompanied by hail.

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Glossary

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

Bolson. A drainage basin surrounded by high land and flanked by alluvial fans.

Boundary, horizon. The boundaries between horizons are described to indicate their vertical thickness and horizontal shape. The terms for thickness are (1) abrupt, if less than 1 inch thick; (2) clear, if about 1 to 2½ inches thick; (3) gradual, if 2½ to 5 inches thick; and (4) diffuse, if more than 5 inches thick. The terms for shape are smooth, wavy, irregular, or broken.

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

Catsteps. Very small, irregular terraces on steep hillsides, especially in pastures, formed by cattle tracks or slippage of saturated soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

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

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Country rock (*Geol.*). A general term applied to the rock surrounding and penetrated by mineral veins; in a wider sense applied to the rocks invaded by and surrounding an igneous intrusion.

Desert pavement. A space between dunes in arid and semiarid areas where the soil has been blown or washed away, leaving a covering of stones on the surface.

Eolian soil material. Soil parent material accumulated through wind action; commonly refers to sandy material in dunes.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon. The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residue.

A horizon. The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon. The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon. The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

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

Karst (topography). Marked by sinkholes, (karst holes) interspersed with abrupt ridges and irregular protuberant rocks, and by caverns and underground streams.

Mottled. 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.

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

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Playa. The flat basin or sump area in nearly level uplands or on the floor of a desert valley in the western United States. The sediments of the playa left by flooding are generally fine or clayey, highly charged with salts or alkalis, and such areas are nearly bare of vegetation.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

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

Red beds (*Geol.*). Sedimentary strata, largely of Permian and Triassic age, that are predominantly red in color. Red beds contain few fossils.

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

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

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

Soil variant. A soil having properties sufficiently different from those of other known soils to justify establishing a new soil series, but of such limited known area that establishment of a new series is not believed to be justified.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated) *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer lying below the solum, or true soil; the C or R horizon.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 13, and table 2, page 14.
Estimated yields, table 3, page 48.

Engineering uses of the soils, tables 4, 5, and 6, pages 58 through 71.

HIGH-INTENSITY SURVEY

Map symbol	Mapping unit	Described on page	Capability unit Irrigated Symbol	Irrigated Page	Dryland Symbol	Dryland Page	Range site Name	Range site Page
Aa	Anthony sandy loam, 0 to 1 percent slopes	14	IIe-3	45	VIIe-2	49	Sandy	53
Ah	Anthony sandy loam, 0 to 1 percent slopes, eroded	14	-----	--	VIIe-1	49	Deep Sand	52
Ak	Arno-Harkey complex, saline, 0 to 1 percent slopes	15						
	Arno silty clay loam	--	-----	--	VIs-1	48	Salty Bottomland	53
	Harkey very fine sandy loam, saline	--	-----	--	VIs-1	48	Salt Flats	53
An	Arno silty clay loam, 0 to 1 percent slopes	15	IVs-1	47	VIs-1	48	Salty Bottomland	53
Ao	Atoka loam, 0 to 1 percent slopes	16	IIIs-14	47	VIs-3	49	Loamy	52
At	Atoka loam, 1 to 3 percent slopes	16	IIIe-2	46	VIs-3	49	Loamy	52
Gs	Gypsum land-Cottonwood complex, 0 to 3 percent slopes	22	-----	--	VIIs-3	50	Gyp Flats	52
Ha	Harkey sandy loam, 0 to 1 percent slopes	24	IIe-4	45	VIIe-2	49	Sandy	53
Hk	Harkey very fine sandy loam, 0 to 1 percent slopes	24	IIs-2	46	VIs-4	49	Loamy	52
Kr	Karro loam, 0 to 1 percent slopes	25	IIs-13	46	VIIe-2	49	Sandy	53
Ku	Karro loam, 1 to 3 percent slopes	25	IIe-2	45	VIIe-2	49	Sandy	53
Kv	Karro loam, saline, 0 to 1 percent slopes	25	IIIs-6	46	VIs-2	49	Salt Flats	53
Pe	Pima silt loam, 0 to 1 percent slopes	31	IIs-1	46	VIs-4	49	Bottomland	51
Pn	Pima silt loam, saline, 0 to 1 percent slopes	31	IIIs-6	46	VIs-2	49	Salt Flats	53
Pv	Pima clay loam, gray variant, 0 to 1 percent slopes	31	IIs-1	46	VIe-1	48	Bottomland	51
Rc	Reagan loam, 0 to 1 percent slopes	32	IIs-2	46	VIs-4	49	Loamy	52
Rd	Reagan loam, 1 to 3 percent slopes	33	IIe-1	45	VIs-4	49	Loamy	52
Rf	Reagan loam, saline, 0 to 1 percent slopes	34	IIIs-6	46	VIs-2	49	Salt Flats	53
Rl	Reeves loam, 0 to 1 percent slopes	35	IIIs-14	47	VIs-3	49	Loamy	52
Rn	Reeves loam, 1 to 3 percent slopes	35	IIIe-2	46	VIs-3	49	Loamy	52
Rr	Reeves loam, saline, 0 to 1 percent slopes	35	IIIs-6	46	VIs-2	49	Salt Flats	53
Rt	Reeves loam, shallow, 0 to 1 percent slopes	35	IVs-3	47	VIs-3	49	Loamy	52
Rv	Russler loam, 1 to 3 percent slopes	37	IIIs-14	47	VIs-3	49	Clayey	52
Uo	Upton gravelly loam, 0 to 9 percent slopes	41	-----	--	VIIs-1	50	Shallow	53
Up	Upton soils, 0 to 1 percent slopes	41	IVs-3	47	VIIs-1	50	Shallow	53
Ut	Upton soils, 1 to 3 percent slopes	41	IVs-3	47	VIIs-1	50	Shallow	53

LOW-INTENSITY SURVEY

AD	Active dune land	12	-----	--	VIIe-1	51	-----	--
AE	Anthony sandy loam, 0 to 1 percent slopes, eroded	14	-----	--	VIIe-1	49	Deep Sand	52
AH	Arno-Harkey complex, saline, 0 to 1 percent slopes	15						
	Arno silty clay loam	--	-----	--	VIs-1	48	Salty Bottomland	53
	Harkey very fine sandy loam, saline	--	-----	--	VIs-1	48	Salt Flats	53
BA	Berino loamy fine sand, 0 to 3 percent slopes	17	-----	--	VIIe-2	49	Sandy	53

Map symbol	Mapping unit	Described on page	Capability unit Irrigated Symbol	Irrigated Page	Capability unit Dryland Symbol	Dryland Page	Range site Name	Range site Page
BB	Berino complex, 0 to 3 percent slopes, eroded	17	-----	--	VIIe-1	49	Deep Sand	52
BD	Berino-Dune land complex, 0 to 3 percent slopes	17	-----	--	VIIe-1	49	Deep Sand	52
BP	Berino-Pajarito complex, 0 to 3 percent slopes, eroded	17	-----	--	VIIe-1	49	Deep Sand	52
CA	Cacique loamy sand, 0 to 3 percent slopes, eroded	19	-----	--	VIIe-2	49	Sandy	53
CR	Cottonwood-Reeves loams, overflow, 0 to 3 percent slopes	20	-----	--	VIs-1	48	Salty Bottomland	53
DP	Dev-Pima complex, 0 to 3 percent slopes	21	-----	--	VIe-1	48	Bottomland	51
EC	Ector stony loam, 0 to 9 percent slopes	21	-----	--	VIIs-5	50	Limestone Hills	52
EE	Ector extremely rocky loam, 9 to 25 percent slopes	22	-----	--	VIIs-5	50	Limestone Hills	52
ER	Ector-Reagan association, 0 to 9 percent slopes	22						
	Ector stony loam, 0 to 9 percent slopes	--	-----	--	VIIs-5	50	Limestone Hills	52
	Reagan loam, 0 to 3 percent slopes	--	-----	--	VIs-4	49	Loamy	52
GA	Gypsum land	22	-----	--	VIIs-2	50	Gyp Hills	52
GC	Gypsum land-Cottonwood complex, 0 to 3 percent slopes	22	-----	--	VIIs-3	50	Gyp Flats	52
GR	Gypsum land-Reeves complex, 0 to 3 percent slopes, eroded	23						
	Gypsum land	--	-----	--	VIIs-3	50	Gyp Flats	52
	Reeves sandy loam, 0 to 3 percent slopes	--	-----	--	VIIe-2	49	Sandy	53
KA	Karro fine sandy loam, 0 to 3 percent slopes, eroded	25	-----	--	VIIe-2	49	Sandy	53
KL	Karro loam, 0 to 3 percent slopes	25	-----	--	VIIe-2	49	Sandy	53
KM	Kermit-Berino fine sands, 0 to 3 percent slopes	26						
	Kermit fine sand	--	-----	--	VIIe-3	50	Sand Hills	53
	Berino fine sand	--	-----	--	VIIe-3	50	Deep Sand	52
KO	Kimbrough loam, 0 to 3 percent slopes	26	-----	--	VIIs-1	50	Shallow	53
KS	Kimbrough-Stegall complex, 0 to 3 percent slopes	26						
	Kimbrough loam	--	-----	--	VIIs-1	50	Shallow	53
	Stegall loam	--	-----	--	VIs-4	49	Clayey	52
KT	Kimbrough-Stegall loams, 0 to 3 percent slopes	27						
	Kimbrough loam	--	-----	--	VIIs-1	50	Shallow	53
	Stegall loam	--	-----	--	VIs-4	49	Bottomland	51
LA	Largo loam, 1 to 5 percent slopes	27	-----	--	VIe-1	48	Loamy	52
LG	Largo silt loam, overflow, 0 to 1 percent slopes	27	-----	--	VIe-1	48	Bottomland	51
LN	Largo-Stony land complex, 0 to 25 percent slopes	28						
	Largo loam	--	-----	--	VIs-4	49	Loamy	52
	Stony land	--	-----	--	VIIs-4	50	Hills and Breaks	52
LS	Likes loamy fine sand, 1 to 5 percent slopes	28	-----	--	VIIe-1	49	Deep Sand	52
LT	Limestone rock land	28	-----	--	VIIs-5	50	Limestone Hills	52
MO	Mobeetie fine sandy loam, 1 to 5 percent slopes	29	-----	--	VIIe-2	49	Sandy	53
PA	Pajarito loamy fine sand, 0 to 3 percent slopes, eroded	30	-----	--	VIIe-1	49	Deep Sand	52
PD	Pajarito-Dune land complex, 0 to 3 percent slopes	30	-----	--	VIIe-1	49	Deep Sand	52
PM	Pima silt loam, 0 to 1 percent slopes	31	IIs-1	46	VIs-4	49	Bottomland	51
PS	Potter-Simona complex, 5 to 25 percent slopes	32						
	Potter gravelly loam, 5 to 25 percent slopes	--	-----	--	VIIs-1	50	Shallow	53
	Simona gravelly fine sandy loam, 0 to 3 percent slopes	--	-----	--	VIIe-2	49	Sandy	53
RA	Reagan loam, 0 to 3 percent slopes	33	-----	--	VIs-4	49	Loamy	52
RE	Reagan-Upton association, 0 to 9 percent slopes	34						
	Reagan loam, 0 to 3 percent slopes	--	-----	--	VIs-4	49	Loamy	52
	Upton gravelly loam, 0 to 9 percent slopes	--	-----	--	VIIs-1	50	Shallow	53

Map symbol	Mapping unit	Described on page	Capability unit Irrigated Symbol	Irrigated Page	Capability unit Dryland Symbol	Dryland Page	Range site Name	Range site Page
RG	Reeves-Gypsum land complex, 0 to 3 percent slopes--	35						
	Reeves loam, 0 to 1 percent slopes----------	--	-----	--	VIs-3	49	Loamy	52
	Gypsum land----------	--	-----	--	VIIs-3	50	Gyp Flats	52
RM	Reeves-Reagan loams, 0 to 3 percent slopes---------	36						
	Reeves loam, 0 to 1 percent slopes----------	--	-----	--	VIs-3	49	Loamy	52
	Reagan loam, 0 to 3 percent slopes----------	--	-----	--	VIs-4	49	Loamy	52
RO	Rock land----------	36	-----	--	VIIIs-1	51	-----	--
RS	Russler loam, 1 to 3 percent slopes----------	37	IIIs-14	47	VIs-3	49	Clayey	52
RU	Russler-Ector association, 0 to 9 percent slopes---	37						
	Russler loam, 1 to 3 percent slopes----------	--	-----	--	VIs-3	49	Clayey	52
	Ector stony loam, 0 to 9 percent slopes--------	--	-----	--	VIIs-5	50	Limestone Hills	52
SA	Simona sandy loam, 0 to 3 percent slopes----------	38	-----	--	VIIe-2	49	Sandy	53
SG	Simona gravelly fine sandy loam, 0 to 3 percent slopes----------	38	-----	--	VIIe-2	49	Sandy	53
SM	Simona-Bippus complex, 0 to 5 percent slopes-------	38						
	Simona gravelly fine sandy loam, 0 to 3 percent slopes----------	--	-----	--	VIIe-2	49	Sandy	53
	Bippus silty clay loam----------	--	-----	--	VIe-1	48	Bottomland	51
SN	Simona and Wink fine sandy loams, 0 to 3 percent slopes, eroded----------	38						
	Simona gravelly fine sandy loam, 0 to 3 percent slopes, eroded----------	--	-----	--	VIIe-2	49	Sandy	53
	Wink fine sandy loam, 0 to 3 percent slopes, eroded----------	--	-----	--	VIIe-1	49	Deep Sand	52
SR	Stony and Rough broken land----------	39	-----	--	VIIs-4	50	Hills and Breaks	52
TC	Tonuco loamy sand, 0 to 3 percent slopes, eroded---	40	-----	--	VIIe-2	49	Sandy	53
TF	Tonuco loamy fine sand, 0 to 3 percent slopes------	40	-----	--	VIIe-2	49	Sandy	53
TN	Tonuco loamy fine sand, 0 to 3 percent slopes, eroded----------	40	-----	--	VIIe-2	49	Sandy	53
TO	Tonuco-Berino loamy sands, 0 to 5 percent slopes---	40						
	Tonuco loamy sand, 0 to 3 percent slopes, eroded----------	--	-----	--	VIIe-2	49	Sandy	53
	Berino loamy sand----------	--	-----	--	VIIe-2	49	Deep Sand	52
UG	Upton gravelly loam, 0 to 9 percent slopes---------	41	-----	--	VIIs-1	50	Shallow	53
UR	Upton-Reagan complex, 0 to 9 percent slopes--------	42						
	Upton gravelly loam, 0 to 9 percent slopes-----	--	-----	--	VIIs-1	50	Shallow	53
	Reagan loam, 0 to 3 percent slopes----------	--	-----	--	VIs-4	49	Loamy	52
US	Upton-Simona complex, 1 to 15 percent slopes, eroded----------	42						
	Upton gravelly loam, 1 to 9 percent slopes-----	--	-----	--	VIIs-1	50	Shallow	53
	Simona gravelly fine sandy loam, 1 to 3 percent slopes----------	--	-----	--	VIIs-1	50	Sandy	53
WK	Wink loamy fine sand, 0 to 3 percent slopes, eroded----------	43	-----	--	VIIe-1	49	Deep Sand	52

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