SOIL SURVEY OF

Chaves County, New Mexico, Southern Part

United States Department of Agriculture
Soil Conservation Service and
United States Department of the Interior
Bureau of Land Management
In cooperation with
New Mexico Agricultural Experiment Station

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

Major fieldwork for this soil survey was completed in the period 1964–73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service; the Bureau of Land Management; and the New Mexico Agricultural Experiment Station. It is part of the technical assistance furnished to the Chaves, Hagerman-Dexter, and Penasco Natural Resource Conservation Districts.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

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

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

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

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreational areas in the sections "Building Site Development" and "Recreation."

Engineers and builders can find, under "Engineering" and "Soil Properties," 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 Chaves County, Southern Part, 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, "Environmental Features That Affect Soil Use in the Survey Area."

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Issued April 1980

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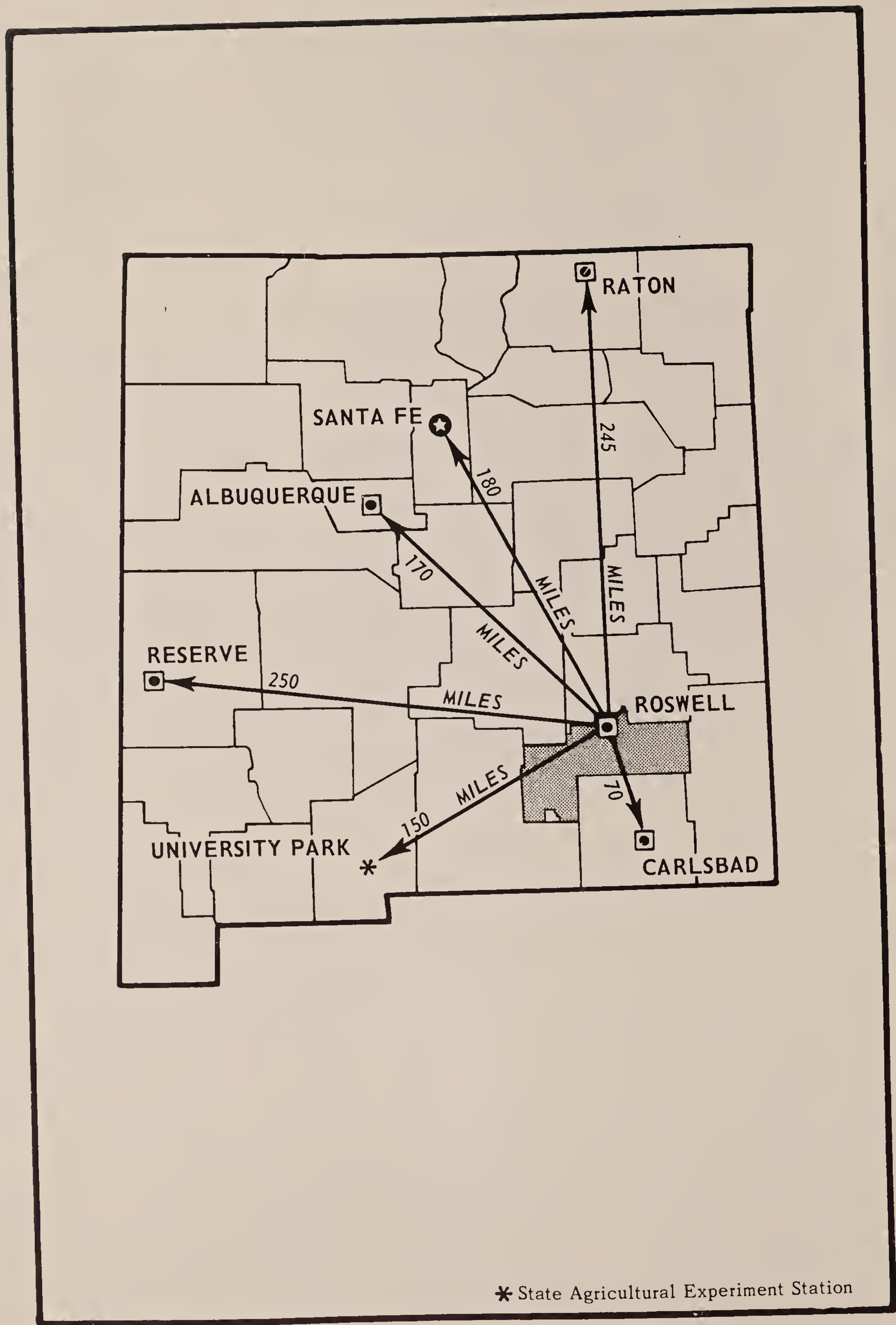

Location of Chaves County, Southern Part, in New Mexico.

SOIL SURVEY OF CHAVES COUNTY, NEW MEXICO, SOUTHERN PART

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CHAVES COUNTY, SOUTHERN PART, is in the southeastern part of New Mexico (see illustration on facing page). The area has a total of 2,023,471 acres or 3,162 square miles. Roswell, the county seat, has a population of about 39,000. Dexter and Hagerman are 18 and 24 miles south of Roswell, respectively. Lake Arthur is 32 miles south of Roswell.

The Pecos River runs through the central part of the survey area from north to south. The Rio Hondo and Rio Felix drain into the Pecos River from the west. The Rio Penasco runs through the southwestern part from west to east.

Elevation of the land ranges from 3,200 feet in the central part of the area to 6,800 feet in the southwestern part. The eastern edge of the area has an elevation of 4,300 to 4,400 feet. The elevation at Roswell is 3,612 feet.

About 5 percent of the area, approximately 90,000 acres, is used for irrigated crops. Most of the cropland is in the central part of the area and west of the Pecos River. Cotton, alfalfa, sorghum, corn, small grain, and some specialty crops such as pecans are grown.

Chaves County, Southern Part, is covered by three Natural Resource Conservation Districts. These are the Chaves District, the Hagerman-Dexter District, and the Upper Penasco District. The districts were organized to help farmers and ranchers to effectively control water erosion, soil blowing, overgrazing, and the invasion of brush and noxious weeds. The need to increase the number of watering places for livestock and to conserve irrigation water was also recognized.

Chaves County, Southern Part, has a history of developing its resources. Agriculture is the main resource. Oil and gas fields are in the southeastern part, caliche can be found in most of the area, and gypsum deposits are in the central part. Gravel sources are common along the Rio Hondo.

One of the first soil surveys made in the United States was made in the Pecos Valley in 1899. This early soil survey covered an area in the vicinity of the Pecos River from Carlsbad north to Roswell. Then in 1933, the Bureau of Chemistry and Soils of the Department of Agriculture published another soil survey entitled "Soil Survey of the Roswell Area." This survey covered the irrigated land just north of Roswell and southward to the Lake Arthur area.

How This Survey Was Made

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

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

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

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

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

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

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Chaves County, Southern Part; soil complexes and soil associations.

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

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Reeves-Holloman association is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous areas and are given descriptive names. Gypsum land is a miscellaneous area in Chaves County, Southern Part.

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

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

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

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Chaves County, Southern Part, survey 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 land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations for the rest of Chaves County have been published separately (*10*).[1]

The soil associations in this survey have been grouped into six general kinds of landscapes for broad interpretative purposes. Each broad group and the soil associations it includes are described in the following pages.

Deep to Very Shallow, Well Drained, Moderately Permeable, Level to Hilly Loams and Gravelly Loams and Gypsum Land; on Uplands

The soils in this group are mostly in the west-central part of the survey area, at elevations ranging from 3,300 to 4,200 feet. These soils formed under mid and short grasses, forbs, and sparse shrubs in alluvium influenced by limestone, gypsum, or both.

[1] Italic numbers in parentheses refer to References, p. 141.

1. *Reakor-Reeves association*

Deep, level to nearly level loams

This association consists of well drained soils that have slopes of 0 to 3 percent. Vegetation is mainly burrograss, tobosa, three-awn, black grama, and alkali sacaton. Elevation ranges from 3,300 to 3,900 feet. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

This association makes up about 7 percent of the survey area. It is about 65 percent Reakor soils and 10 percent Reeves soils. The remaining 25 percent is mainly Pecos, Atoka, Bigetty, Holloman, Tencee, and Upton soils.

Reakor soils are deep and level to nearly level. They have a surface layer of brown and light brown loam. The subsoil is light brown heavy loam and clay loam. The substratum is pink clay loam that has a high content of lime.

Reeves soils are deep and level to nearly level. They have a surface layer of brown and light brown loam. The subsoil is light brown clay loam. The upper part of the substratum is pink clay loam that has a high content of lime. The lower part is pinkish white loam and pink clay loam containing many soft masses and crystals of gypsum.

It is difficult to predict the occurrence of the Reakor and Reeves soils by surface features.

Reakor and Reeves soils have a moderate shrink-swell potential; therefore, they are moderately suited to community development. Pecos soils are subject to rare flooding so they are poorly suited to community development. Pecos soils are suited to earthen stock tanks. This association is used for grazing, irrigated crops, community development, watershed, and wildlife habitat. The main irrigated crops grown are alfalfa, cotton, grain sorghum, and silage sorghum.

2. *Reakor-Tencee association*

Deep, level to nearly level loams and nearly level to hilly gravelly loams that are very shallow and shallow over indurated caliche

This association consists of well drained soils that have slopes of 0 to 30 percent. Vegetation is mainly burrograss, three-awn, tobosa, black grama, creosotebush, and broom snakeweed. Elevation ranges from 3,300 to 4,200 feet. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

This association makes up about 9 percent of the survey area. It is about 55 percent Reakor soils and 20 percent Tencee soils. The remaining 25 percent is mainly Atoka, Bigetty, Dev, Pecos, and Upton soils.

Reakor soils are deep and level to nearly level. They are in depressions. They have a surface layer of brown and light brown loam. The subsoil is light brown heavy loam and clay loam. The substratum is pink clay loam that has a high content of lime.

Tencee soils are very shallow to shallow over indurated caliche. They are nearly level to hilly and are on ridges. They have a surface layer of yellowish brown gravelly loam. The subsoil is brown loam. The substratum is brown very gravelly loam. White indurated caliche is at a depth of 6 to 20 inches. The caliche becomes weakly cemented as depth increases and is underlain by weakly cemented pebbles and cobblestones.

Reakor soils have a moderate shrink-swell potential and are moderately suited to community development. Tencee soils are very shallow to shallow over indurated caliche and are poorly suited to community development. This association is used for grazing, watershed, wildlife habitat, community development, and as a source of crushed caliche.

3. *Holloman-Gypsum land-Reeves association*

Level to gently sloping loams that are very shallow and shallow over gypsum; Gypsum land; and deep, level to nearly level loams

This association consists of well drained soils that have slopes mainly of 0 to 5 percent, but some slopes range to 50 percent. Vegetation is mainly burrograss, tobosa, three-awn, alkali sacaton, and fourwing saltbush. Elevation ranges from 3,300 to 3,700 feet. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

This association makes up about 4 percent of the survey area. It is about 40 percent Holloman soils, 30 percent Gypsum land, and 10 percent Reeves soils. The remaining 20 percent is mainly Russler, Tencee, and Sotim soils.

Holloman soils are very shallow to shallow over gypsum and are mainly level to gently sloping. They are in depressions. They have a surface layer of pale brown loam. The underlying material is brown, heavy loam over white and very pale brown gypsum.

Gypsum land consists of exposed gypsiferous bedrock and is mostly level to undulating. It is on ridges and intermingled with Holloman and Reeves soils.

Reeves soils are deep and level to nearly level. They are in depressions. They have a surface layer of brown and light brown loam. The subsoil is light brown clay loam. The upper part of the substratum is pink clay loam that has a high content of lime. The lower part is pinkish white and pink clay loam containing many soft masses and crystals of gypsum.

It is difficult to determine the Reeves and Holloman soils by surface features.

Reeves soils have moderate shrink-swell potential and are moderately suited to community development. Holloman soils are very shallow to shallow to gypsum beds and are moderately suited to poorly suited to community development. Sinkholes are common. This association is used for grazing, wildlife habitat, watershed, and community development.

Deep, Well Drained and Moderately Well Drained, Moderately Slowly Permeable, Very Slowly Permeable, and Moderately Rapidly Permeable, Level to Nearly Level Soils of Various Textures; on Flood Plains

The soils in this group are along the major drainageways at elevations ranging from 3,300 to 4,500 feet. These soils formed under mid and tall grasses, forbs, and sparse shrubs in sandy to clayey alluvium that is modified by gravel and cobblestones in places. The soils are rarely to frequently flooded and some soils are affected by salts.

4. *Bigetty-Dev-Pecos association*

Rarely or frequently flooded, level to nearly level loams, cobbly loams, and silty clay loams

This association consists of well drained soils that have slopes of 0 to 3 percent. Vegetation is mainly burrograss, tobosa, three-awn, side-oats grama, giant sacaton, cholla cactus, and mesquite. Native walnut and desert-willow grow in the stream channels. Elevation ranges from 3,300 to 4,500 feet. The mean annual precipitation is 10 to 14 inches, and the mean annual soil temperature is 59° to 65° F. The frost-free season is 190 to 215 days.

This association makes up 3 percent of the survey area. It is about 35 percent Bigetty soils, 30 percent Dev soils, and 20 percent Pecos soils. The remaining 15 percent is mainly Balmorhea, Reakor, Tencee, Ector, and Lozier soils.

Bigetty soils are deep and level to nearly level. They are on high areas of flood plains and are only rarely flooded. They have a surface layer of dark grayish brown and dark brown loam. The subsoil is dark brown silty clay loam. The substratum is light brown loam.

Dev soils are deep and level to nearly level. They are on the lower areas along the streams and are frequently flooded. They have a surface layer of dark grayish brown cobbly loam. The underlying material is dark grayish brown very gravelly loam and very gravelly sandy loam.

Pecos soils are deep and level to nearly level. They are on high areas of the flood plains, commonly in slight depressions, and are only rarely flooded. They have a surface layer of dark grayish brown silty clay loam. The underlying material is brown and light brown silty clay loam.

The soils of this association are subject to flooding; therefore, they are poorly suited to dwellings. Bigetty and Pecos soils are well suited to earthen stock tanks. This association is used for grazing, irrigated crops, watershed, wildlife habitat, and community development. The main irrigated crops grown on Bigetty and Pecos soils are alfalfa, cotton, grain sorghum, and silage sorghum.

5. *Glendale-Pecos-Vinton association*

Rarely or occasionally flooded, level fine sandy loams, silty clay loams, and loamy fine sands

This association consists of well drained soils that have slopes of 0 to 1 percent. Vegetation is mainly alkali sacaton, sand dropseed, saltcedar, and fourwing saltbush. Elevation ranges from 3,300 to 3,500 feet. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

This association makes up about 2 percent of the survey area. It is about 35 percent Glendale soils, 30 percent Pecos soils, and 15 percent Vinton soils. The remaining 20 percent is Balmorhea, Bigetty, Holloman, and Reeves soils.

Glendale soils are deep and level. They are on high areas of flood plains and are rarely flooded. They have a surface layer of reddish brown fine sandy loam. The underlying material is light brown very fine sandy loam over stratified light brown, reddish brown, and dark grayish brown silty clay loam, loamy fine sand, and silty clay.

Pecos soils are deep and level and are affected by salts. They are on high areas of flood plains and are rarely flooded. They have a surface layer of dark reddish gray silty clay loam and reddish brown silty clay. The underlying material is reddish brown and reddish gray clay over light reddish brown sandy clay loam.

Vinton soils are deep and level. They are on the lower areas along streams and are occasionally flooded. They have a surface layer of brown loamy fine sand. The underlying material is stratified reddish yellow, brown, and light brown fine sand, loamy fine sand, and fine sandy loam.

This association is used for irrigated crops, grazing, watershed, and wildlife habitat. The main irrigated crops grown on Pecos and Glendale soils are alfalfa, cotton, grain sorghum, and silage sorghum.

Very Shallow to Shallow, Well Drained, Moderately Permeable, Nearly Level to Very Steep Cobbly Loams and Gravelly Loams; on Uplands

The soils in this group are at elevations ranging from 3,400 to 6,800 feet. These soils formed under short and mid grasses, forbs, and shrubs. They are 4 to 20 inches deep over limestone or indurated caliche.

6. *Ector-Lozier-Tencee association*

Nearly level to hilly cobbly loams and gravelly loams that are 4 to 20 inches deep over limestone or indurated caliche

This association consists of well drained soils that have slopes of 0 to 30 percent. Vegetation is mainly blue grama, black grama, side-oats grama, three-awn, broom snakeweed, and creosotebush. Elevation ranges from 3,400 to 5,800 feet. The mean annual precipitation is 10 to 14 inches, and the mean annual soil temperature is 59° to 65° F. The frost-free season is 190 to 215 days.

This association makes up about 20 percent of the survey area. It is about 45 percent Ector soils, 20 percent Lozier soils, and 15 percent Tencee soils. The remaining 20 percent is minor soils and Rock outcrop, mostly limestone. The minor soils are mainly Atoka, Bigetty, Upton, Reakor, and Pecos soils.

Ector soils are very shallow to shallow and nearly level to hilly. They are on low hills and mostly in the southern part of the association. They have a surface layer and underlying material of dark brown cobbly loam. Fractured limestone is at a depth of 4 to 20 inches.

Lozier soils are very shallow to shallow and gently undulating to gently rolling. They are on hills and are mostly in the northern part of the association. They have a surface layer of brown cobbly loam. The underlying material is light yellowish brown cobbly loam. Fractured bedrock is at a depth of 6 to 15 inches.

Tencee soils are very shallow to shallow and nearly level to hilly. They are on hills and are mostly in the northern part of the association. They have a surface layer of yellowish brown gravelly loam. The subsoil is brown loam. Indurated caliche is at a depth of 6 to 20 inches.

This association is used for grazing, wildlife habitat, and watershed.

7. Ector-Rock outcrop association

Rolling to hilly cobbly loams that are 4 to 16 inches deep over limestone, and Rock outcrop

This association consists of well drained soils that have slopes of 9 to 30 percent. Vegetation is mainly blue grama, black grama, side-oats grama, three-awn, mat muhly, wolftail, rough tridens, Spanish-dagger, agave, sotol, and soaptree yucca. Elevation ranges from 4,000 to 5,800 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 205 days.

This association makes up about 16 percent of the survey area. It is about 60 percent Ector soils and 25 percent Rock outcrop. The remaining 15 percent is Reakor, Bigetty, Dev, and Pecos soils.

Ector soils are very shallow to shallow and rolling to hilly. They have a surface layer and underlying material of dark brown cobbly loam. Fractured limestone is at depths of 6 to 15 inches.

Rock outcrop is mostly bare limestone bedrock and is intermingled with Ector soils.

This association is used for grazing, watershed, and wildlife habitat.

8. Deama-Rock outcrop association

Gently undulating to very steep cobbly loams that are 7 to 18 inches deep over limestone, and Rock outcrop

This association consists of well drained soils that have slopes of 1 to 50 percent. Vegetation is mainly blue grama, black grama, side-oats grama, mountain muhly, three-awn, wolftail, one-seed juniper, pinyon pine, Spanish-dagger, agave, sotol, and yucca. Elevation ranges from 5,600 to 6,800 feet. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 56° F. The frost-free season is 170 to 185 days.

This association makes up about 9 percent of the survey area. It is about 70 percent Deama soils and 20 percent Rock outcrop. The remaining 10 percent is Remunda, Gabaldon, Ancho, Penasco, Shanta, Cuevoland, and Pena soils.

Deama soils are very shallow to shallow and gently undulating to very steep. They have a surface layer of dark grayish brown cobbly loam and cobbly light clay loam. The underlying material is dark brown stony light clay loam. Fractured limestone is at depths of 7 to 18 inches.

Rock outcrop is mostly limestone and is intermingled with Deama soils.

This association is used for grazing, watershed, and wildlife habitat.

Deep to Very Shallow, Well Drained, Moderately Permeable and Moderately Slowly Permeable, Level to Hilly Cobbly Loams, Gravelly Loams, Silt Loams and Loams; in High Valleys

The soils in this group are at elevations ranging from 5,500 to 6,200 feet. These soils formed under mid and short grasses, forbs, and shrubs in alluvium.

9. Penasco-Gabaldon-Ancho association

Deep, level to gently sloping silt loams and loams and gently undulating to hilly cobbly loams and gravelly loams that are 7 to 20 inches deep over indurated caliche

This association consists of well drained soils that have slopes of 0 to 30 percent. Vegetation is mainly blue grama, side-oats grama, three-awn, wolftail, cholla cactus, soaptree yucca, one-seed juniper, algerita, and littleleaf sumac. Elevation ranges from 5,500 to 6,200 feet. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 185 days.

This association makes up about 3 percent of the survey area. It is about 40 percent Penasco soils, 30 percent Gabaldon soils, and 10 percent Ancho soils. The remaining 20 percent is mainly Shanta, Deama, Dev, Pena, Remunda, and Cuevoland soils.

Penasco soils are very shallow to shallow and gently undulating to hilly. They are on terraces and fans. They have a surface layer of dark grayish brown cobbly and gravelly loam. The underlying material is brown gravelly loam. Indurated caliche is at depths of 7 to 20 inches.

Gabaldon soils are deep and level to nearly level. They are on flood plains. They have a surface layer of dark grayish brown silt loam. The subsoil is dark brown and brown silty clay loam. The substratum is brown silt loam.

Ancho soils are deep and nearly level to gently sloping. They are on valley fans. They have a surface layer of dark brown loam. The underlying material is brown and reddish brown clay loam.

This association is used for grazing, wildlife habitat, watershed, and irrigated crops. The main irrigated crops grown on the Shanta and Gabaldon soils are alfalfa, grain sorghum, silage sorghum, corn, silage, barley, pasture, and orchards. Ancho soils are not used for irrigated crops.

Very Shallow to Shallow, Well Drained, Moderately Permeable, Level to Gently Undulating Gravelly Fine Sandy Loams and Gravelly Loams; on Uplands

The soils in this group are along the eastern side of the survey area, at elevations of 4,300 to 4,400 feet. Annual precipitation is 14 to 16 inches. These soils formed under mid and short grasses, forbs, and sparse shrubs in gravelly aeolian and alluvial material. They are underlain by indurated caliche and are strongly calcareous.

10. Kimbrough association

Level to gently undulating, gravelly fine sandy loams and gravelly loams that are 7 to 18 inches deep over indurated caliche

This association consists of well drained soils that have slopes of 0 to 3 percent. Vegetation is mainly blue grama, black grama, side-oats grama, broom snakeweed, and mesquite. Elevation is 4,300 to 4,400 feet. The mean annual precipitation is 14 to 16 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 205 days.

This association makes up about 3 percent of the survey area. It is about 60 percent Kimbrough soils. The remaining 40 percent is Stegall, Slaughter, and Sharvana soils and Torriorthents.

Kimbrough soils are very shallow and shallow over indurated caliche. These soils are nearly level to gently undulating. They are on low ridges. They have a surface layer of brown gravelly fine sandy loam or gravelly loam. The underlying material is brown gravelly loam. White indurated caliche is at depths of 7 to 18 inches.

The soils of this association are used for grazing and wildlife habitat.

Deep to Very Shallow, Well Drained to Excessively Drained, Moderately Slowly Permeable to Rapidly Permeable, Level to Rolling Fine Sands, Loamy Fine Sands, Fine Sandy Loams and Gravelly Fine Sandy Loams; on Uplands

The soils of this group are in the eastern part of the survey area, at elevations ranging from 3,500 to 4,200 feet. These soils formed under mid and tall grasses, forbs, and sparse shrubs, mostly in sandy or gravelly aeolian and alluvial sediments.

11. Roswell-Faskin-Jalmar association

Deep, level to rolling, rapidly permeable and moderately permeable fine sands

This association consists of excessively drained and well drained soils that have slopes of 0 to 15 percent. Vegetation is mainly sand dropseed, little bluestem, sand bluestem, sandbur, three-awn, shinnery oak, yucca, and sand sagebrush. Elevation ranges from 3,500 to 4,100 feet. The mean annual precipitation is 12 to 13 inches, and the mean annual soil temperature is 59° to 61° F. The frost-free season is 190 to 205 days.

This association makes up about 10 percent of the survey area. It is about 40 percent Roswell soils, 25 percent Faskin soils, and 15 percent Jalmar soils. The remaining 20 percent is Ima, Simona, and Malstrom soils and Dune land.

Roswell soils are deep, gently undulating to rolling, and rapidly permeable. They are in hummocky or billowy areas of deep sands. They have a surface layer of light brown fine sand. The underlying material is pink fine sand.

Faskin soils are deep, level to nearly level, and moderately permeable. They are intermingled with Roswell soils in depressions. They have a surface layer of brown and strong brown fine sand and loamy fine sand. The subsoil is yellowish red and red sandy clay loam and reddish brown clay loam.

Jalmar soils are deep, level to nearly level, and moderately permeable. They are intermingled with Roswell soils in depressions. They have a surface layer of brown, reddish yellow, and yellowish red fine sand and loamy fine sand. The subsoil is light reddish brown, heavy loamy fine sand and sandy clay loam.

The soils of this association are used for grazing and wildlife habitat.

12. Berino-Pintura-Pajarito association

Deep, level to rolling, moderately permeable to rapidly permeable fine sandy loams and loamy fine sands

This association consists of somewhat excessively drained to well drained soils that have slopes of 0 to 15 percent. Vegetation is mainly sand dropseed, black grama, plains bristlegrass, broom snakeweed, mesquite, fourwing saltbush, and shinnery oak. Elevation ranges from 3,400 to 3,900 feet. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 190 to 215 days.

This association makes up 5 percent of the survey area. It is about 40 percent Berino soils, 10 percent Pintura soils, and 10 percent Pajarito soils. The remaining 40 percent is Cacique, Tencee, Simona, Jal, and Alama soils and Torriorthents.

Berino soils are level to nearly level and are moderately permeable. They are on low positions. They have a surface layer of reddish brown fine sandy loam. The subsoil is reddish brown, yellowish red, and reddish yellow sandy clay loam. The substratum is pink sandy clay loam and is strongly influenced by lime.

Pintura soils are undulating to rolling and are rapidly permeable. They are on the recent, windblown, hummocky deposits. They have a profile of yellowish red loamy fine sand over red sandy clay loam.

Pajarito soils are level to gently sloping and are moderately rapidly permeable. They are on fans. They have a surface layer of reddish brown loamy fine sand and fine sandy loam. The subsoil is reddish brown fine sandy loam. The substratum is light red sandy loam and fine sandy loam.

The soils of this association are used for grazing and wildlife habitat.

13. Tencee-Simona-Sotim association

Level to gently rolling, moderately permeable and moderately rapidly permeable gravelly fine sandy loams and fine sandy loams that are 6 to 20 inches deep over indurated caliche; and deep, level to gently sloping, moderately slowly permeable fine sandy loams

This association consists of well drained soils that have slopes of 0 to 9 percent. Vegetation is mainly black grama, blue grama, three-awn, burrograss, bush muhly, broom snakeweed, yucca, mesquite, and creosotebush. Elevation ranges from 3,400 to 4,200 feet. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

This association makes up 9 percent of the survey area. It is about 40 percent Tencee soils, 20 percent

Simona soils, and 20 percent Sotim soils. The remaining 20 percent is Russler, Reeves, Berino, and Holloman soils; Gypsum land; and very steep Torriorthents.

Tencee soils are very shallow to shallow, nearly level to gently rolling and are moderately permeable. They are on ridges. They have a surface layer of yellowish brown gravelly fine sandy loam and a subsoil of brown gravelly fine sandy loam. White indurated caliche is at depths of 6 to 20 inches.

Simona soils are very shallow to shallow, level to undulating, and moderately rapidly permeable. They are on ridges. They have a surface layer of reddish yellow fine sandy loam. The subsoil is reddish brown and light reddish brown fine sandy loam. White indurated caliche is at depths of 7 to 20 inches.

Sotim soils are deep, level to gently sloping, and moderately slowly permeable. They are in depressions. They have a surface layer of reddish brown fine sandy loam. The subsoil is reddish brown and reddish yellow light clay loam. The substratum is light red light clay loam.

The soils of this association are used for grazing, wildlife habitat, and watershed.

Descriptions of the Soils

This section describes the soil series and mapping units in Chaves County, Southern Part. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

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

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

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit, range site, or other interpretative group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*15*).

Descriptions, names, and delineations of soils in this soil survey do not fully agree with soil maps in adjacent counties published at a different date. Differences are the result of better knowledge of soils within the survey areas. In some places it is more feasible to combine small acreages of similar soils that respond to use and management in much the same way than it is to separate these soils and give them names. Unless otherwise noted, the soil reaction was determined with colorimetric indicators by using soil and water in a ratio of 1 to 5. If such features as roots, coarse fragments, and carbonates (calcareous material) are not mentioned in the description of a horizon, that feature was absent.

Alama Series

The Alama series consists of deep, well drained soils. These soils formed in alluvium on flood plains that are rarely flooded. Slopes are 0 to 3 percent. Elevation is 3,400 to 3,600 feet. Vegetation is mainly tobosa, buffalo grass, vine-mesquite, mesquite, and cactus. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is brown loam about 3 inches thick. The subsoil is reddish brown clay loam and silty clay loam about 16 inches thick. The substratum is stratified reddish brown and light reddish brown sandy clay loam, silty clay loam, and loam to a depth of 69 inches or more. The soil profile is strongly calcareous and moderately alkaline throughout.

Permeability is moderately slow, and available water capacity is 11 to 12 inches. Effective rooting depth is 69 inches or more.

This soil is used for grazing, watershed, and wildlife habitat.

Representative profile of Alama loam, 142 feet west of road and 0.8 mile south of windmill in sec. 33, T. 12 S., R. 28 E.:

A1—0 to 3 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; many very fine roots; few very fine tubular pores; strongly calcareous; moderately alkaline; abrupt smooth boundary.

B12—3 to 8 inches; reddish brown (5YR 5/4) clay loam; yellowish red (5YR 4/6) when moist; moderate medium subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many very fine roots; common very fine tubular pores; strongly calcareous; moderately alkaline; abrupt smooth boundary.

B22—8 to 19 inches; reddish brown (5YR 5/4)

TABLE 1.—*Acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent
Aa	Alama loam	8,050	0.4
AN	Ancho-Penasco association	8,693	0.4
AtA	Atoka loam, 0 to 1 percent slopes	1,528	0.1
AtB	Atoka loam, 1 to 3 percent slopes	1,566	0.1
Ba	Balmorhea loam	3,033	0.2
Bd	Balmorhea loam, drained	4,198	0.2
BE	Berino-Cacique association	35,222	1.7
Bf	Berino-Pintura complex	16,374	0.8
BgA	Bigetty loam, 0 to 1 percent slopes	10,488	0.5
BgB	Bigetty loam, 1 to 3 percent slopes	1,181	0.1
Bh	Bigetty loam, moderately saline	670	([1])
BP	Bigetty-Pecos association	14,858	0.7
CA	Cuevoland-Ancho association	5,905	0.3
De	Deama-Rock outcrop complex	212,862	10.5
DR	Deama-Remunda association	10,139	0.5
Du	Dune land	2,314	0.1
EcC	Ector-Rock outcrop complex, 0 to 9 percent slopes	180,180	8.9
EcD	Ector-Rock outcrop complex, 9 to 30 percent slopes	283,532	14.0
Fa	Faskin fine sand	21,083	1.0
FM	Faskin-Malstrom association	23,123	1.1
Fr	Faskin-Roswell complex	35,705	1.8
GD	Gabaldon-Dev association	9,133	0.5
Ge	Glendale fine sandy loam	7,349	0.4
Gf	Glendale loam	5,261	0.3
Ho	Holloman loam, thick solum	3,693	0.2
Hp	Holloman-Gypsum land complex, 0 to 3 percent slopes	23,640	1.2
HrC	Holloman-Gypsum land complex, 3 to 5 percent slopes	27,039	1.3
HSE	Holloman-Gypsum land complex, 30 to 50 percent slopes	7,390	0.4
Im	Ima fine sandy loam	10,671	0.5
Ja	Jal fine sandy loam	2,837	0.1
Km	Kimbrough gravelly loam	13,112	0.7
Ks	Kimbrough-Sharvana complex	3,434	0.2
Kt	Kimbrough-Stegall-Slaughter complex	36,335	1.8
Lr	Lozier-Reakor complex	10,549	0.5
Lt	Lozier-Tencee complex	89,798	4.4
Pa	Pajarito loamy fine sand	2,131	0.1
Pb	Pajarito-Pintura complex	18,625	0.9
Pe	Pecos silty clay loam	10,650	0.5
PfA	Pecos silty clay loam, nonsaline, 0 to 1 percent slopes	10,410	0.5
PGB	Pecos silty clay loam, nonsaline, 0 to 3 percent slopes	5,648	0.3
PH	Pecos-Dev association	55,046	2.7
PK	Pena-Penasco association	2,739	0.1
PL	Penasco-Ancho association	16,831	0.8
PN	Penasco-Gabaldon association	17,565	0.9
Ra	Reakor sandy loam	3,015	0.2
ReA	Reakor loam, 0 to 1 percent slopes	105,799	5.2
ReB	Reakor loam, 1 to 3 percent slopes	18,335	0.9
RF	Reakor loam, 0 to 3 percent slopes	59,973	3.0
Rg	Reakor loam, gravelly subsoil variant	1,492	0.1
RH	Reakor-Pecos association	65,826	3.3
RI	Reakor-Tencee association	19,923	1.0
RkA	Reeves loam, 0 to 1 percent slopes	8,074	0.4
RkB	Reeves loam, 1 to 3 percent slopes	2,804	0.1
RL	Reeves-Holloman association	21,985	1.1
RM	Remunda-Penasco association	11,984	0.6
Rn	Roswell-Jalmar complex	108,018	5.3
Ru	Russler silty clay loam	5,052	0.3
Sh	Shanta silt loam	1,993	0.1
Sm	Simona fine sandy loam	40,975	2.0
So	Sotim fine sandy loam	38,382	1.9
Te	Tencee gravelly sandy loam	42,704	2.1
TfD	Tencee cobbly loam, 5 to 30 percent slopes	12,320	0.6
Tg	Tencee-Upton complex	65,020	3.2
TS	Tencee-Sotim association	45,434	2.3
TOF	Torriorthents, very steep	14,010	0.7
UA	Upton-Atoka association	46,789	2.3
VG	Vinton-Glendale association	8,867	0.4
	Dumps	277	([1])
	Intermittent lakes	1,832	0.1
	Pits	440	([1])
	Water	1,558	0.1
	Total	2,023,471	100.0

[1] Less than 0.1 percent.

silty clay loam, reddish brown (5YR 4/4) when moist; weak prismatic structure parting to moderate medium subangular blocks; very hard, firm when moist, sticky and plastic when wet; common very fine roots; many very fine tubular pores; few medium soft masses of lime in lower part; strongly calcareous; moderately alkaline; clear smooth boundary.

C1—19 to 22 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; weak fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common very fine roots; few very fine tubular pores; few medium soft masses of lime; strongly calcareous; moderately alkaline; abrupt smooth boundary.

C2ca—22 to 30 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) when moist; moderate medium prismatic structure; very hard, firm when moist, sticky and plastic when wet; common very fine roots; few very fine tubular pores; common medium soft masses of lime; strongly calcareous; moderately alkaline; abrupt smooth boundary.

C3ca—30 to 58 inches; light reddish brown (5YR 6/4) silty clay loam, reddish brown (5YR 4/4) when moist; moderate medium subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; common medium soft masses of lime; strongly calcareous; moderately alkaline; clear smooth boundary.

C4—58 to 69 inches; light reddish brown (5YR 6/4) loam, reddish brown (5YR 5/4) when moist; massive; slightly hard, friable when moist, sticky and plastic when wet; few very fine tubular pores; strongly calcareous; moderately alkaline.

The A horizon has hue of 2.5YR through 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The B horizon has hue of 5YR or 2.5YR, value of 4 or 5 when dry and moist, and chroma of 3 through 6 when dry and moist. The C horizon has hue of 5YR or 2.5YR, value of 3 through 5 when moist, and chroma of 4 through 6 when dry and moist. The C horizon is stratified silty clay loam, silt loam, loam, or sandy clay loam. Loamy fine sand and fine sand strata are common below a depth of 40 inches.

Aa—Alama loam. This level to nearly level soil occurs on flood plains and in swales. It is rarely flooded. Slopes are 0 to 3 percent. Mapped areas are long and narrow in shape.

Included with this soil in mapping are Pajarito, Berino, and Pintura soils that make up about 5 percent of the mapped areas. Also included is a soil that is similar to this Alama soil except it lacks a subsoil; it makes up about 5 percent of the mapped areas. These included soils are scattered but generally are along the outer edges of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for grazing, watershed, and wildlife habitat.

Nonirrigated capability subclass VIe; range site Bottomland SD–3.

Ancho Series

The Ancho series consists of deep, well drained soils. These soils formed in alluvium on valley fans and terraces. Slopes are 1 to 5 percent. Elevation is 5,600 to 6,000 feet. Vegetation is mainly blue grama, mat muhly, creeping muhly, mountain muhly, cholla cactus, oneseed juniper, and algerita. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 185 days.

In a representative profile the surface layer is dark brown loam about 7 inches thick. The underlying material to a depth of 36 inches is brown clay loam. Below this, it is reddish brown clay loam to a depth of 60 inches or more. The surface layer is slightly calcareous and the underlying material is moderately calcareous. The soil is mildly alkaline throughout.

Permeability is moderately slow, and available water capacity is 11 to 12 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing, watershed, and wildlife habitat.

Representative profile of Ancho loam in an area of Ancho-Penasco association, 0.9 mile west and 1.1 miles south of cattleguard in the SE¼ of sec. 11, T. 19 S., R. 16 E.:

A11—0 to 3 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak fine granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine, very fine, and medium roots; few very fine tubular pores; slightly calcareous; mildly alkaline; clear smooth boundary.

A12—3 to 7 inches; dark brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) when moist; weak fine subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine, very fine, medium, and coarse roots; few very fine tubular pores; slightly calcareous; mildly alkaline; clear smooth boundary.

C1—7 to 18 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; weak medium subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; common very fine and fine roots; many very fine tubular pores; few lime filaments; moderately calcareous; mildly alkaline; clear smooth boundary.

C2ca—18 to 36 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; moderate medium subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; common very fine roots; common very fine tubular pores; common lime filaments; moderately calcareous; mildly alkaline; clear wavy boundary.

C3ca—36 to 60 inches; reddish brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) when moist; weak medium subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; few very fine roots; common fine, very fine, and medium tubular pores; many lime filaments; moderately calcareous; mildly alkaline.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The C horizon has hue of 5YR through 10YR, value of 4 through 6 when dry and 3 through 5 when moist, and chroma of 2 through 4 when dry and moist. It is clay or loam and contains few to many lime filaments. A few pebbles are in some horizons in places.

AN—Ancho-Penasco association. This association occurs in valley fans below hills in limestone areas. Slopes are 1 to 9 percent. Mapped areas are elongated in shape and about 200 to 2,000 acres in size.

This association consists of about 60 percent Ancho loam, 30 percent Penasco cobbly loam, and 10 percent less extensive soils.

Included with these soils in mapping are Deama, Pena, Remunda, and Cuevoland soils; areas of soils that are similar to the Penasco soils except that they are more than 20 inches deep to indurated caliche; and areas of soils that are similar to Ancho soils except that they have a dark brown surface layer thicker than 20 inches. Deama and Pena soils and the soils similar to Penasco soils are on ridges. Remunda and Cuevoland soils are in depressional areas in association with Ancho soils.

The nearly level to gently sloping Ancho soil is in the depressional areas. It has the profile described as representative of the series. The undulating to gently rolling Penasco soil is on ridges.

For the Ancho and Penasco soils runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are common in areas of Ancho soils.

This association is used for grazing, wildlife habitat, and watershed. Ancho soil in nonirrigated capability subclass VIe, Loamy CP–4 range site; Penasco soil in nonirrigated capability subclass VIIs, Shallow CP–4 range site.

Atoka Series

The Atoka series consists of moderately deep, well drained soils. These soils formed in alluvium on uplands. Slopes are 0 to 3 percent. Elevation is 3,300 to 3,900 feet. Vegetation is mainly burrograss, tobosa, cactus, mormon-tea, mesquite, and broom snakeweed. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is light yellowish brown and light brown loam about 12 inches thick. The subsoil is brown clay loam about 9 inches thick. The substratum is light brown clay loam about 7 inches thick. Pinkish white indurated caliche is at a depth of 28 inches. The soil profile is strongly calcareous and moderately alkaline throughout.

Permeability is moderate, and available water capacity is 4 to 5.5 inches. Effective rooting depth to indurated caliche is 20 to 34 inches.

These soils are used for grazing, irrigated crops, wildlife habitat, watershed, and community development.

Representative profile of Atoka loam, 0 to 1 percent slopes, 0.2 mile south and 0.2 mile west of intersection of McGaffey and Brown Roads at the northeast corner of sec. 10, T. 12 S., R. 23 E.:

A11—0 to 3 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) when moist; weak thin platy structure parting to weak fine granules; soft, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common fine and very fine tubular pores; strongly calcareous; moderately alkaline; abrupt smooth boundary.

A12—3 to 12 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) when moist; weak medium subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine and very fine tubular pores; common worm casts; strongly calcareous; moderately alkaline; abrupt smooth boundary.

B2—12 to 21 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) when moist; moderate medium subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine and very fine tubular pores; common worm casts; many fine lime filaments; 10 percent caliche pebbles; strongly calcareous; moderately alkaline; clear smooth boundary.

C1ca—21 to 28 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; moderate medium subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine and very fine tubular pores; 10 percent caliche pebbles; strongly calcareous; moderately alkaline; clear wavy boundary.

C2cam—28 inches; pinkish white (7.5YR 8/2) indurated caliche; laminar in the upper part becoming weakly cemented with depth.

The depth to indurated caliche is 20 to 34 inches. The A horizon has value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 through 4 when dry and moist. The B horizon has value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 through 4 when dry or moist. It is clay loam or loam and has weak or moderate, fine or medium subangular blocky structure. The Cca horizon has value of 5 through 7 when dry and 4 through 6 when moist, and chroma of 4 or 5 when dry and moist. It is clay loam, gravelly clay loam or gravelly loam and is 10 to 30 percent caliche and limestone pebbles. The Ccam horizon is 2 to 10 inches thick.

AtA—Atoka loam, 0 to 1 percent slopes. This level soil occurs on uplands west of the Pecos River. Mapped areas are rounded in shape and about 5 to 80 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are scattered areas of Reakor loam, gravelly subsoil variant; Reakor, Tencee, and Upton soils; Atoka loam, 1 to 3 percent slopes; and small areas of Atoka sandy loams. These included soils make up about 15 percent of the mapped areas.

Runoff is medium. The hazard of erosion is slight.

This soil is used for grazing, irrigated crops, wildlife habitat, and community development. Irrigated capability unit IIIs–7, nonirrigated capability subclass VIIs; range site Loamy SD–3.

AtB—Atoka loam, 1 to 3 percent slopes. This nearly level soil occurs on uplands west of the Pecos River. Mapped areas are elongated in shape and about 5 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has depths of about 22 inches to indurated caliche and contains more pebbles. The irrigated cropland has generally been bench leveled. The benches are about 100 feet wide or less. Small areas of caliche and limestone pebbles and cobblestones have been exposed where deep land leveling cuts were made.

Included with this soil in mapping are scattered areas of Reakor, Upton, and Tencee soils; Atoka loam that has slopes of 3 to 5 percent; and small areas of Atoka sandy loams and Reakor loam, gravelly subsoil variant. These included soils make up about 15 percent of the mapped areas.

Runoff is medium, The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for grazing, irrigated crops, watershed, wildlife habitat, and community development. Irrigated capability unit IIIe–12, nonirrigated capability subclass VIIe; range site Loamy SD–3.

Balmorhea Series

The Balmorhea series consists of deep, somewhat poorly drained, moderately saline soils that are moderately high in content of gypsum and organic material. These soils formed in stratified alluvium on flood plains. They are rarely flooded. Slopes are 0 to 1 percent. Elevation is 3,300 to 3,700 feet. Vegetation is mainly alkali sacaton, saltgrass, giant reedgrass, sedges, rushes, and saltcedar. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 59° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is about 40 inches thick. The upper 19 inches is dark gray and gray loam and silt loam. The lower 21 inches is very dark gray silty clay loam. The underlying material to a depth of 50 inches is gray silty clay. Below this it is white gypsiferous fine sandy loam to a depth of 60 inches or more. The soil profile is slightly calcareous through strongly calcareous, neutral through strongly alkaline, and moderately saline.

Permeability is moderately slow, and available water capacity is 6 to 7.5 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing, wildlife habitat, irrigated crops, and community development.

Representative profile of Balmorhea loam, drained, in the NW¼NW¼SE¼SW¼ of sec. 4, T. 10 S., R. 24 E.:

A11—0 to 4 inches; dark gray (10YR 4/1) loam, dark brown (10YR 3/3) when moist; weak medium granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many very fine and fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

A12—4 to 10 inches; gray (10YR 5/1) loam, black (10YR 2/1) when moist; moderate fine subangular blocky structure; hard, firm when moist, slightly sticky and slightly plastic when wet; many fine roots; many very fine and fine tubular pores; moderately saline; common gypsum and lime filaments; strongly calcareous; moderately alkaline; clear wavy boundary.

A13—10 to 19 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak fine granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many very fine and fine tubular pores; moderately saline; few fine soft masses of gypsum and lime; strongly calcareous; mildly alkaline; clear smooth boundary.

A14g—19 to 40 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) when moist; weak medium prismatic structure parting to moderate medium subangular blocks; very hard, firm when moist, very sticky and very plastic when wet; many fine roots; many very fine and fine tubular pores; moderately saline; few fine soft masses of gypsum and lime; strongly calcareous; neutral; clear wavy boundary.

IIC1g—40 to 50 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) when moist; olive yellow mottles (5Y 6/6) and olive (5Y 5/6) moist; moderate medium prismatic structure; very hard, firm when moist, very sticky and very plastic when wet; common fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

IIC2—50 to 60 inches; white (5Y 8/1) gypsiferous fine sandy loam, light gray (5Y 7/1) when moist; massive, slightly hard, very friable when moist; many fine and very fine tubular pores; strongly calcareous; moderately alkaline.

The A horizon has chroma of 1 through 3 when dry and moist. The IIC horizon is stratified clay loam, silty clay, silty clay loam, silt loam, or loam. Strata of fine sandy loam or sand are below a depth of 40 inches in some places.

Ba—Balmorhea loam. This level, somewhat poorly drained soil occurs on the flood plains along the Pecos River and west of it. This soil is rarely flooded. Slopes are 0 to 1 percent. Mapped areas are elongated in shape and about 10 to 640 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a seasonal water table within depths of 2 to 4 feet.

Included with this soil in mapping are scattered areas of Gypsum land, Pecos, Holloman, Bigetty, and Glendale soils; and small areas of soils that are similar to Balmorhea soils except that they have a dark brown surface layer to a depth of less than 20 inches or they have a peaty surface layer. The latter soils commonly have a seasonal water table within 2 to 4 feet of the surface. These included soils make up about 20 percent of the mapped areas.

Runoff is slow. The hazard of erosion is slight. The seasonal water table may be absent during years of below mean annual precipitation.

This soil is used for grazing, irrigated crops, and wildlife habitat. Irrigated capability unit IVw–3, nonirrigated capability subclass VIw; range site Salt Meadow SD–3.

Bd—Balmorhea loam, drained. This level soil occurs on flood plains along the Pecos River and west of it. It is rarely flooded. Slopes are 0 to 1 percent. Mapped areas are enlongated in shape and about 10 to 640 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are scattered areas of Balmorhea loam; Balmorhea silty clay loam; Holloman, Pecos, Bigetty, and Glendale soils; Gypsum land; and small areas of soils that are similar to this Balmorhea soil but have a dark brown surface layer slightly affected by salt and less than 20 inches thick. These included soils make up about 20 percent of the mapped areas.

Runoff is slow. The hazard of erosion is slight. Commonly the water table is below a depth of 5 feet during years of above mean annual precipitation.

This soil is used for grazing, wildlife habitat, irrigated crops, and community development. Irrigated capability unit IIIs–9, nonirrigated capability subclass VIs; range site Salty Bottomland SD–3.

Berino Series

The Berino series consists of deep, well drained soils. These soils formed in aeolian and alluvial sediments on uplands. Slopes are 0 to 3 percent. Elevation is 3,400 to 3,800 feet. Vegetation is mainly three-awn, sand dropseed, black grama, plains bristlegrass, mesquite, shinnery oak, and broom snakeweed. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is 1 inch of reddish-yellow loamy fine sand over 6 inches of reddish brown fine sandy loam. The upper part of the subsoil is reddish brown light sandy clay loam about 8 inches thick. The lower part is yellowish red and reddish yellow sandy clay loam about 32 inches thick. The substratum is pink sandy clay loam to a depth of 60 inches or more. The soil profile is noncalcareous in the upper part and slightly to strongly calcareous in the lower part. It is neutral in the upper part and is mildly alkaline to moderately alkaline in the lower part.

Permeability is moderate, and available water capacity is 8 to 9.5 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing and wildlife habitat.

Representative profile of Berino fine sandy loam in an area of Berino-Cacique association in the NW¼SE¼ sec. 9, T. 12 S., R. 28 E.:

A11—0 to 1 inch; reddish yellow (7.5YR 6/6) loamy fine sand, strong brown (7.5YR 5/6) when moist; single grained; loose when dry and moist; common very fine roots; common very fine interstitial pores; neutral; abrupt smooth boundary.

A12—1 to 6 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak medium subangular blocky structure; soft, very friable when moist; nonsticky and nonplastic when wet; common very fine roots; few very fine tubular pores; neutral; clear smooth boundary.

B1—6 to 14 inches; reddish brown (5YR 5/4) light sandy clay loam, reddish brown (5YR 4/4) when moist; moderate medium subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many very fine tubular pores; mildly alkaline; clear smooth boundary.

B21t—14 to 26 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak coarse subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; few very fine roots; few very fine tubular pores; thin patchy clay films on peds and clay bridging between sand grains; mildly alkaline; clear smooth boundary.

B22t—26 to 35 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate coarse subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; few very fine roots; many very fine and fine tubular pores; thin patchy clay films on peds, and clay bridging between sand grains; common lime filaments; slightly calcareous; moderately alkaline; clear smooth boundary.

B23tca—35 to 46 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; moderate coarse subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; common very fine tubular pores; thin patchy clay films on peds; common lime filaments and soft masses of lime; moderately calcareous; moderately alkaline; clear wavy boundary.

Cca—46 to 60 inches; pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; 40 to 50 percent disseminated lime; strongly calcareous; moderately alkaline.

The Bt horizon has hue of 2.5YR or 5YR and chroma of 4 or 6 when dry and moist. It is sandy clay loam or heavy fine sandy loam. It has weak to strong coarse prismatic or weak or moderate medium subangular blocky structure. The Cca horizon has hue of 10YR or 5YR, value of 6 through 8 when dry and 5 through 7 when moist, and chroma of 3 through 6 when dry and moist. It is fine sandy loam, sandy clay loam, or clay loam. The calcium carbonate equivalent of the Cca horizon is 25 to 60 percent. The Cca horizon is weakly cemented in places.

BE—Berino-Cacique association. This association occurs in aeolian and alluvial deposits on uplands east of the Pecos River. Slopes are 0 to 3 percent. Mapped areas are elongated in shape and about 400 to 4,500 acres in size.

This association consists of about 50 percent Berino fine sandy loam, 30 percent Cacique loamy fine sand, and 20 percent less extensive soils.

Included with these soils in mapping are Simona, Tencee, and Pintura soils; Cacique fine sandy loams; and small areas of shallow soils that have a surface layer of loamy fine sand over indurated caliche. Simona and Tencee soils and the loamy fine sands are on the ridges. Pintura soils are on the sand hummocks.

The level to nearly level Berino soil is in depressions and on plane surfaces. The nearly level to gently undulating Cacique soils are generally on ridges. Berino and Cacique soils have the profiles described as representative of their respective series.

For the Berino soil runoff is very slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. For the Cacique soil runoff is slow. The hazard of water erosion is slight. The hazard of soil blowing is severe; however, a moderate hazard of soil blowing is common.

This association is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; range site Sandy SD–3.

Bf—Berino-Pintura complex. This complex occurs on severely windblown areas on uplands east of the Pecos River. Slopes are 0 to 15 percent. Mapped areas are elongated in shape and about 300 to 2,500 acres in size.

This complex consists of about 50 percent severely eroded Berino sandy clay loam, 30 percent Pintura loamy fine sand, and 20 percent less extensive soils.

Included with these soils in mapping are Berino fine sandy loams and Pajarito, Sotim, and Jal soils. These soils make up about 5 percent of the mapped areas. The Berino fine sandy loams have a thin surface layer and are in areas where there is no soil blowing to moderate soil blowing. Pajarito, Sotim, and Jal soils have had most or all the surface layer removed by soil blowing. Also included are soils that are similar to Jalmar soils but are somewhat drier. These soils make up about 15 percent of the mapped areas. They are on hummocks less than 4 feet high and are intermixed with Pintura soils.

The level to nearly level Berino soil is in soil blown areas and is almost bare of vegetation. It has a profile that is similar to the one described as representative of the series, but the surface layer and in some places the subsoil has been removed by soil blowing. Erosion has exposed the sandy clay loam subsoil or the strongly calcareous substratum.

The undulating to rolling Pintura soil is on rounded to oval hummocks about 5 to 50 feet in diameter and about 4 to 8 feet high. The hummocks are partially stabilized by brush and sparse grasses (fig. 1). This soil has the profile described as representative of the series.

For the Berino soil, runoff is medium; the hazard of water erosion is slight, and the hazard of soil blowing is moderate. For the Pintura soil, runoff is very slow; the hazard of water erosion is slight, and the hazard of soil blowing is severe.

This complex is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; Berino soil in Sandy SD–3 range site, and Pintura soil in Deep Sand SD–3 range site.

Bigetty Series

The Bigetty series consists of deep, well drained soils. These soils formed in alluvium on channeled flood plains. They are rarely flooded. Slopes are 0 to 3 percent. Elevation is 3,300 to 4,500 feet. Vegetation is mainly burrograss, tobosa, three-awn, black grama, vine-mesquite, mesquite, and cholla cactus. The mean annual precipitation is 10 to 14 inches, and the mean annual soil temperature is 59° to 65° F. The frost-free season is 190 to 215 days.

In a representative profile the surface layer is dark grayish brown and dark brown loam about 11 inches thick. The subsoil is dark brown silty clay loam about 12 inches thick. The substratum is light brown loam to a depth of 60 inches or more. The soil profile is moderately calcareous and moderately alkaline throughout.

Permeability is moderately slow, and available water capacity is 11.5 to 12.5 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing, irrigated crops, community development, watershed, and wildlife habitat.

Representative profile of Bigetty loam, 0 to 1 percent slopes, 560 feet east and 0.4 mile north of the southwest corner of sec. 13, T. 11 S., R. 23 E.:

A11—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown

Figure 1.—Mesquite, fourwing saltbush, shinnery oak, and broom snakeweed on Berino-Pintura complex. The brush has partially stabilized the hummocks of Pintura soils that were formed by sand blown from the Berino soils.

(10YR 3/2) when moist; moderate very thin platy structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

A12—3 to 11 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; clear smooth boundary.

B2—11 to 23 inches; dark brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; few very fine roots; many very fine tubular pores; few lime filaments; moderately calcareous; moderately alkaline; gradual smooth boundary.

C1—23 to 41 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many very fine tubular pores; few lime filaments in upper part; moderately calcareous; moderately alkaline; gradual smooth boundary.

C2—41 to 60 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine tubular pores; moderately calcareous; moderately alkaline.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist. The B horizon has hue of 10YR or 7.5YR when dry and moist, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry and moist. It is silty clay loam, clay loam, or loam. The C horizon has hue of 10YR or 7.5YR, value of 4 through 6 when dry and 4 or 5 when moist, and chroma of 2 through 4 when dry and moist. Above a depth of 40 inches it is loam, clay loam, silt loam, and silty clay loam, and it is stratified in many places. Below a depth of 40 inches it ranges from silty clay loam to fine sandy loam. Strata of gravelly and cobbly loam are in some areas at a depth of 5 feet or more.

BgA—Bigetty loam, 0 to 1 percent slopes. This level soil occurs on channeled flood plains of the Rio Hondo, Berrendo Creek, Rio Felix and minor drainageways. It is rarely flooded. Mapped areas are elongated in shape and about 80 to 2,500 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are scattered areas of silty clay loam, Pecos nonsaline and Reakor soils and areas of stratified medium and coarse textured soils adjacent to the stream channels. These inclusions make up about 10 percent of the mapped areas.

Runoff is slow. The hazard of erosion is slight. A few areas next to the stream channels are commonly flooded. The flooded areas support a stand of giant sacaton.

This soil is used for irrigated crops, grazing, community development, and wildlife habitat. Most areas used for community development are protected from flooding. Irrigated capability class I, nonirrigated capability subclass VIc; range site Loamy SD–3.

BgB—Bigetty loam, 1 to 3 percent slopes. This nearly level soil occurs adjacent to channeled flood plains of the Rio Hondo, Berrendo Creek, Rio Felix, and minor drainageways. Mapped areas are narrow and elongated in shape and about 10 to 380 acres in size.

Included with this soil in mapping are scattered areas of Bigetty loam, 0 to 1 percent slopes, Pecos silty clay loam, nonsaline, and Reakor soils. These included soils make up about 5 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for grazing, irrigated crops, watershed, and wildlife habitat. The irrigated cropland is mostly bench leveled to a width of about 100 feet or less. Irrigated capability unit IIe–6, nonirrigated capability subclass VIe; range site Loamy SD–3.

Bh—Bigetty loam, moderately saline. This level soil occurs on channeled flood plains west of the Pecos River. It is rarely flooded. Slopes are 0 to 1 percent. Mapped areas are rounded or elongated in shape and about 60 to 300 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is moderately saline and gypsum occurs as crystals, splotches, or filaments in most layers in the profile. Some layers have high accumulations of lime and gypsum. The vegetation is predominately alkali sacaton.

Included with this soil in mapping are scattered areas of Balmorhea and Pecos soils and Bigetty loam, 0 to 1 percent slopes that make up about 5 percent of the mapped areas. Also included are small areas of strongly saline Bigetty soils.

Runoff is slow. The hazard of erosion is slight. Available water capacity is 7 to 9.5 inches.

This soil is used for irrigated crops, grazing, and wildlife habitat. Irrigated capability unit IIIs–9, nonirrigated capability subclass VIIs; range site Salt Flats SD–3.

BP—Bigetty-Pecos association. This association occurs on the channeled flood plains of the Rio Hondo and Rio Felix. It is rarely flooded. Slopes are 0 to 1 percent. Mapped areas are generally narrow, and as much as several miles long, and are about 80 to 3,000 acres in size.

This association consists of about 60 percent Bigetty loam and silt loam, 20 percent Pecos silty clay loam, nonsaline, and 20 percent less extensive soils.

Included in mapping are Reakor and Dev soils and areas of stratified medium and coarse textured soils adjacent to the stream channels. Reakor soils are along the outer boundaries of the mapped areas. Dev soils are adjacent to the stream channels and are commonly flooded.

The Bigetty soils have a profile similar to the one described as representative of the series, but some areas have a surface layer of silt loam.

The level Pecos soil is in slight depressions. It has a profile similar to the one described as representative of the series, but it is brown, nonsaline, and moderately alkaline throughout.

Runoff is slow, and the hazard of erosion is slight. A few areas along the stream channel are commonly flooded. These flooded areas support a stand of giant sacaton.

This association is used for grazing and wildlife habitat. Bigetty soil in nonirrigated capability subclass VIc, range site Loamy SD–3; Pecos soil in nonirrigated capability subclass VIs, range site Bottomland SD–3.

Cacique Series

The Cacique series consists of moderately deep, well drained soils. These soils formed in aeolian and alluvial sediment on uplands. Slopes are 0 to 3 percent. Elevation is 3,400 to 3,800 feet. Vegetation is mainly threeawn, sand dropseed, black grama, plains bristlegrass, mesquite, shinnery oak, yucca, and broom snakeweed. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days. Cacique soils are mapped only in association with Berino soils.

In a representative profile the surface layer is reddish yellow and reddish brown fine sand and loamy fine sand about 9 inches thick. The upper part of the subsoil is yellowish red loamy fine sand about 7 inches thick. The lower part of the subsoil is yellowish red sandy clay loam about 13 inches thick. Pinkish white indurated caliche is at a depth of 29 inches. The soil profile is noncalcareous and mildly alkaline in the surface layer and noncalcareous to moderately calcareous and mildly alkaline to moderately alkaline in the subsoil.

Permeability is moderate, and available water capacity is 3 to 5 inches. Effective rooting depth to indurated caliche is 20 to 40 inches.

This soil is used for grazing and wildlife habitat.

Representative profile of Cacique loamy fine sand in an area of Berino-Cacique association, 45 feet north and 0.4 mile west of road intersection at the northeast corner of the SE¼SE¼SE¼, sec. 23, T. 15 S., R. 29 E.:

A11—0 to 3 inches; reddish yellow (5YR 6/6) fine sand, yellowish red (5YR 5/6) when moist; single grained; loose when dry and moist; many fine and very fine roots; many very fine interstitial pores; mildly alkaline; abrupt wavy boundary.

A12—3 to 9 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; many very fine interstitial pores; mildly alkaline; clear smooth boundary.

B1—9 to 16 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; weak coarse prismatic structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; few very fine tubular pores; mildly alkaline; clear smooth boundary.

B21t—16 to 20 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak coarse prismatic structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; patchy clay films on peds and clay bridging between sand grains; mildly alkaline; clear smooth boundary.

B22t—20 to 25 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist, weak coarse prismatic structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; patchy clay films on peds and clay bridging between sand grains; slightly calcareous; moderately alkaline; abrupt wavy boundary.

IIB3tca—25 to 29 inches; yellowish red (5YR 5/6) very gravelly sandy clay loam, yellowish red (5YR 4/6) when moist, massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; 50 percent caliche pebbles; moderately calcareous; moderately alkaline.

IICcam—29 inches; pinkish white (7.5YR 8/2) moist, indurated caliche with laminar surface; becoming strongly to noncemented with depth.

Depth to indurated caliche is 20 to 40 inches. The A horizon has hue of 7.5YR or 5YR, value of 4 through 6 when dry and 3 through 5 when moist. The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5 when dry, 3 or 4 when moist, and chroma of 5 or 6 when dry and moist. The Bt horizon has weak or moderate coarse prismatic and weak or moderate medium subangular blocky structure. The B2t horizon is sandy clay loam or heavy fine sandy loam.

Cuevoland Series

The Cuevoland series consists of deep, well drained soils. These soils formed in alluvium on valley fans and terraces. Slopes are 1 to 3 percent. Elevation is 5,800 to 6,000 feet. Vegetation is mainly blue grama, mat muhly, mountain muhly, one-seed juniper, algerita, cholla cactus, and yucca. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 185 days.

In a representative profile the surface layer is brown and dark brown loam about 8 inches thick. The subsoil is brown loam and heavy loam about 18 inches thick. The substratum is pink clay loam to a depth of 60 inches or more. The soil profile is slightly calcareous to strongly calcareous. The surface layer and subsoil are moderately alkaline and the substratum is moderately alkaline and strongly alkaline.

Permeability is moderate, and available water capacity is 10 to 12 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing, wildlife habitat, and watershed.

Representative profile of Cuevoland loam in an area of Cuevoland-Ancho association in the NW¼NW¼ sec. 7, T. 20 S., R. 16 E.:

A11—0 to 1 inch; brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak fine granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; many very fine tubular pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

A12—1 to 8 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; moderate fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

B21—8 to 13 inches; brown (7.5YR 4/4) loam, dark brown (7.5YR 3/4) when moist; moderate fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine roots; common very fine tubular pores; few lime filaments; moderately calcareous; moderately alkaline; clear smooth boundary.

B22—13 to 26 inches; brown (7.5YR 5/4) heavy loam, brown (7.5YR 4/4) when moist; moderate medium subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common very fine tubular pores; few lime filaments; strongly calcareous; moderately alkaline; abrupt smooth boundary.

C1ca—26 to 43 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) when moist, massive; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores;

disseminated lime; strongly calcareous; strongly alkaline; clear wavy boundary.

C2ca—43 to 60 inches; pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) when moist; massive, hard, very friable when moist, slightly sticky and plastic when wet; many very fine tubular pores; disseminated lime; strongly calcareous; moderately alkaline.

The depth to the Cca horizon is 19 to 34 inches. The A horizon has hue of 7.5YR or 10YR and chroma of 2 or 3 when dry and moist. The B horizon has hue of 7.5YR or 10YR when dry and moist, value of 4 through 6 when dry, and chroma of 2 through 4 when dry and moist. It is loam or clay loam and has weak or moderate fine or medium subangular blocky structure. The C horizon has value of 6 through 8 when dry and 4 through 8 when moist, and chroma of 4 or 5 when dry and moist. The Cca horizon is loam or clay loam. The calcium carbonate equivalent of the Cca horizon is 30 to 50 percent. A few pebbles are in some profiles.

CA—Cuevoland-Ancho association. This association occurs in the southwestern part of the survey area on valley fans below hills in limestone uplands. Slopes are 1 to 9 percent. Mapped areas are elongated in shape and about 300 to 700 acres in size.

This association consists of about 45 percent Cuevoland loam, 20 percent Ancho loam, 15 percent Pena cobbly loam, and 20 percent less extensive soils.

Included with these soils in mapping are Penasco, Deama, Gabaldon, and Remunda soils and Rock outcrop. Penasco soils and Rock outcrop are on ridges and Gabaldon soils are on the flood plains. Remunda soils are on valley fans.

The nearly level Cuevoland soil is on valley fans. It has the profile described as representative of the series.

The nearly level Ancho soil is on valley fans. The undulating to gently rolling Pena soil is on ridges. It has a profile that is similar to the one described as representative of the series, but it has a surface layer of cobbly loam.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are few.

This association is used for grazing, wildlife habitat, and watershed. Nonirrigated capability subclass VIe; Cuevoland and Ancho soils in Loamy CP–4 range site, Pena soil in Hills CP–4 range site.

Deama Series

The Deama series consists of very shallow and shallow, well drained soils. These soils formed in cobbly residual materials on limestone hills. Slopes are 1 to 50 percent. Elevation is 5,600 to 6,800 feet. Vegetation is mainly blue grama, black grama, side-oats grama, mountain muhly, three-awn, wolftail, one-seed juniper, pinyon pine, Spanish-dagger, agave, sotol, and yucca. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 56° F. The frost-free season is 170 to 185 days.

In a representative profile the surface layer is dark grayish brown cobbly loam and cobbly light clay loam about 8 inches thick. The underlying material is dark brown stony light clay loam about 7 inches thick. Fractured limestone bedrock is at a depth of 15 inches. The surface layer is moderately calcareous and the underlying material is strongly calcareous. The soil is moderately alkaline throughout.

Permeability is moderate, and available water capacity is 1.5 to 2 inches. Effective rooting depth to limestone bedrock is 7 to 18 inches.

These soils are used for grazing, watershed, and wildlife habitat.

Representative profile of Deama cobbly loam in an area of Deama-Rock outcrop complex in the NW¼NE¼NW¼ of sec. 7, T. 16 S., R. 17 E.:

A11—0 to 2 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular structure; slightly hard, very friable when moist, slightly sticky and plastic when wet; many very fine roots; common very fine tubular pores; 30 percent cobblestones, stones, and gravel; moderately calcareous; moderately alkaline; abrupt smooth boundary.

A12ca—2 to 8 inches; dark grayish brown (10YR 4/2) cobbly light clay loam; very dark grayish brown (10YR 3/2) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and plastic when wet; many very fine roots; common very fine tubular pores; 35 percent cobblestones, pebbles, and stones coated with lime on all surfaces; moderately calcareous; moderately alkaline; clear wavy boundary.

Cca—8 to 15 inches; dark brown (10YR 4/3) stony light clay loam, dark brown (10YR 3/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and plastic when wet; common very fine roots; few very fine tubular pores; 45 percent stones, cobblestones, and pebbles coated with lime on all surfaces and some lime pendants on the under sides; strongly calcareous; moderately alkaline; abrupt wavy boundary.

R—15 inches; fractured limestone.

Cobblestones, stones, and pebbles cover 70 to 80 percent of the soil surface. The depth to bedrock varies from 7 to 18 inches. The A horizon has hue of 10YR or 7.5YR when dry and moist, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The Cca horizon has hue of 10YR or 7.5YR when dry and moist, value of 3 or 4 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. It is silt loam, loam, or light clay loam. The profile is 35 to 80 percent cobblestones, pebbles, and stones.

De—Deama-Rock outcrop complex. This complex occurs on the limestone hills along the Chaves, Otero, and Lincoln county lines. Slopes are 1 to 50 percent. Mapped areas are rounded or elongated in shape and about 600 to 17,000 acres in size.

This complex consists of about 70 percent Deama stony loam, 20 percent Rock outcrop, and 10 percent less extensive soils.

Included in mapping are very steep Deama soils, areas of Remunda, Ancho, Penasco, Pena, Cuevoland soils, and areas of a soil that is similar to Remunda soils except that it is dark brown to a depth of more than 20 inches. These included soils occur on the terraces, fans, and flood plains in the numerous narrow valleys. Also included are areas of soils that are similar to Deama soils except that they lack a layer of lime accumulation. These soils are at a higher elevation than that of the Deama soils.

The gently undulating to steep Deama soil has the profile described as representative of the series.

For the Deama soil, runoff is medium or rapid; the hazard of water erosion is moderate, and the hazard of soil blowing is slight. For Rock outcrop, runoff is rapid. Gullies are common in the soils on the fans and flood plains of the narrow valleys.

This complex is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIs; Deama soil in Limestone Hills CP–4 range site, Rock outcrop not assigned to a range site.

DR—Deama-Remunda association. This association occurs on low limestone hills and in valleys along the Chaves and Otero county line. Slopes are 0 to 9 percent. Mapped areas are few, rounded, and elongated in shape and about 1,000 to 2,000 acres in size.

This association consists of about 65 percent Deama cobbly loam, 30 percent Remunda loam, and 5 percent less extensive soils.

Included with these soils in mapping are areas of Deama stony loam that has slopes of 9 to 50 percent, Rock outcrop, and some areas of soils that are similar to the Remunda soils except that they are underlain by bedrock at depths of 20 to 40 inches. The Rock outcrop is on low limestone hills and is intermixed with the Deama soil. The soils similar to Remunda soils are nearly level and are in the valleys.

The gently undulating to gently rolling Deama soil is on low limestone hills. It has a profile similar to the one described as representative of the series, but it has a dark brown surface layer.

The nearly level to gently sloping Remunda soil is in the valleys. It has the profile described as representative of the series.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. A few gullies are in areas of Remunda soils.

This association is used for grazing, wildlife habitat, and watershed. Deama soil in nonirrigated capability subclass VIIs, Shallow CP–4 range site. Remunda soil in nonirrigated capability subclass VIe, Loamy CP–4 range site.

Dev Series

The Dev series consists of deep, well drained soils. These soils formed in gravelly and cobbly stratified alluvium on flood plains. They are frequently flooded. Slopes are 0 to 3 percent. Elevation is 3,300 to 5,000 feet. Vegetation is mainly tobosa, three-awn, black grama, side-oats grama, giant sacaton, apache-plume, cactus, native walnut, and desert-willow. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 215 days. Dev soils in this survey area are mapped only in association with Gabaldon and Pecos soils.

In a representative profile the surface layer is dark grayish brown cobbly loam about 7 inches thick. The underlying material to a depth of 22 inches is dark grayish brown very gravelly loam. Below this, it is dark grayish brown very gravelly sandy loam to a depth of 60 inches or more. The soil profile is moderately calcareous and moderately alkaline throughout.

Permeability is moderately rapid, and available water capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing, watershed, and wildlife habitat.

Representative profile of Dev cobbly loam in an area of Pecos-Dev association, 600 feet east of the road where it crosses the Rio Felix in the NW¼NE¼ sec. 12, T. 16 S., R. 19 E.:

A1—0 to 7 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; few very fine tubular pores; 30 percent gravel and 5 percent cobblestones; moderately calcareous; moderately alkaline; gradual wavy boundary.

C1—7 to 22 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) when moist; massive; soft, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; few very fine tubular pores; 50 percent gravel, 10 percent cobblestones, and few stones; moderately calcareous; moderately alkaline; clear wavy boundary.

C2—22 to 60 inches; dark grayish brown (10YR 4/2) very gravelly sandy loam; very dark grayish brown (10YR 3/2) when moist; single grained; loose when dry and moist, slightly sticky and slightly plastic when wet; few very fine roots; many very fine interstitial pores; 60 percent gravel, 10 percent cobblestones, and few stones; moderately calcareous; moderately alkaline.

About 40 to 50 percent of the soil surface is covered by cobblestones, pebbles, and stones. The A and C1 horizons have hue of 7.5YR or 10YR, value of 4 or 5 when dry and 3 or 2 when moist, and chroma of 2 or 3 when dry and moist. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 through 4 when dry and moist. It is stratified cobbly, gravelly, or very gravelly loam and very gravelly coarse sandy loam. Between depths of 10 and 40 inches, the soil is 50 to 80 percent limestone gravel, cobblestones, and stones. Clay loam or loam strata 1 to 12 inches thick commonly occur in the C horizon. Lime filaments are in the clay loam or loam strata and the pebbles and cobblestones are commonly coated with lime.

Dune Land

Du—Dune land. This mapping unit consists of fine sand dunes that are free to drift and blow with the wind. The dunes are 5 to 30 feet high. Mapped areas are mostly rounded in shape and about 40 to 70 acres in size. Slopes are 3 to 30 percent. The largest area is in the eastern part of the survey area below the High Plains. Smaller areas are in the vicinity of windmills where the soils have been extensively grazed by cattle.

Included with Dune land in mapping are Roswell soils that make up about 5 percent of the mapped areas.

Mapped areas are mostly barren of vegetation. Establishing vegetation is difficult because of the low precipitation and blowing sand.

Runoff is very slow. The hazard of water erosion is slight, and the hazard of soil blowing is severe. Nonirrigated capability subclass VIIIe; not assigned to a range site.

Ector Series

The Ector series consists of very shallow and shallow, well drained soils. These soils formed in cobbly residual material on limestone hills. Slopes are 0 to 30 percent. Elevation is 4,000 to 5,800 feet. Vegetation is mainly blue grama, black grama, side-oats grama, three-awn, mat muhly, wolftail, rough tridens, Spanish-dagger, agave, sotol, and soaptree yucca. The mean annual precipitation is 12 to 14 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 205 days.

In a representative profile the surface layer is dark brown cobbly loam about 6 inches thick. The underlying material is dark brown cobbly loam about 8 inches thick. Fractured limestone is at a depth of 14 inches. The soil is strongly calcareous and moderately alkaline throughout.

Permeability is moderate, and available water capacity is 1 to 1.5 inches. Effective rooting depth to bedrock is 4 to 20 inches.

These soils are used for grazing, watershed, and wildlife habitat.

Representative profile of Ector cobbly loam in an area of Ector-Rock outcrop complex, 9 to 30 percent slopes, 710 feet west and 0.1 mile north of oil well standpipe in the SE¼NW¼ of sec. 28, T. 17 S., R. 20 E.:

A1—0 to 6 inches; dark brown (10YR 4/3) cobbly loam, dark brown (10YR 3/3) when moist; weak fine granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; 25 percent cobblestones and gravel; strongly calcareous; moderately alkaline; abrupt smooth boundary.

Cca—6 to 14 inches; dark brown (10YR 4/3) cobbly loam; dark brown (10YR 3/3) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine and very fine roots; common very fine tubular pores; 65 percent cobblestones and pebbles with coatings of lime and lime pendants on the lower side; strongly calcareous; moderately alkaline; abrupt wavy boundary.

R—14 inches; fractured limestone.

Cobblestones, pebbles, and stones cover 40 to 60 percent of the soil surface. The depth to limestone is 4 to 20 inches. The A1 horizon has value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The Cca horizon has value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The calcium carbonate equivalent of the fine earth fraction of the Cca horizon is 15 to 30 percent. The profile is 40 to 70 percent cobblestones and pebbles.

EcC—Ector-Rock outcrop complex, 0 to 9 percent slopes. This mapping unit is nearly level to gently rolling Ector soils and Rock outcrop on the limestone hills in the western and southwestern part of the survey area. Mapped areas are rounded to elongated in shape, and about 200 to 2,000 acres in size.

This complex consists of about 70 percent Ector cobbly loam, 15 percent Rock outcrop, and 15 percent less extensive soils.

Included in mapping are strongly sloping and moderately steep Ector cobbly loam; Reakor, Dev, Pecos, and Bigetty soils; areas of soils that are similar to Ector soils except that they lack a layer of lime accumulation; and scattered areas of the Lozier, Tencee, and Upton soils. The soils similar to Ector soils and Lozier, Tencee, and Upton soils are intermixed with Ector soils. Dev, Pecos, and Bigetty soils are on the flood plains of the narrow valleys. Reakor soils are on the valley fans.

For the Ector soil runoff is medium; the hazard of water erosion is moderate, and the hazard of soil blowing is slight. For Rock outcrop runoff is rapid.

This complex is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIs; Ector soil in Shallow CP–4 range site, Rock outcrop not assigned to a range site.

EcD—Ector-Rock outcrop complex, 9 to 30 percent slopes. This complex occurs on the limestone hills in the western and southwestern part of the survey area. Mapped areas are rounded and elongated in shape and about 200 to 4,000 acres in size.

This complex consists of about 60 percent Ector cobbly loam, 25 percent Rock outcrop, and 15 percent less extensive soils.

Included in mapping are nearly level to gently rolling Ector soils; Reakor, Pecos, Bigetty, and Dev soils; areas of soils that are similar to Ector soils, except that they lack a layer of lime accumulation; and scattered areas of Tencee, Lozier, and Upton soils. The nearly level to gently rolling Ector soils are generally on ridge tops. Pecos, Bigetty, and Dev soils are on the flood plains of the numerous narrow valleys. Reakor soils are on valley fans. Tencee and Lozier soils are intermixed with the Ector soils.

The rolling to hilly Ector soil has the profile described as representative of the series.

Runoff is rapid. For the Ector soils the hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are common in the soils on the fans and flood plains of the valleys.

This complex is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIs; Ector soil in Limestone Hills CP–4 range site, Rock outcrop not assigned to a range site.

Faskin Series

The Faskin series consists of deep, well drained soils. These soils formed in aeolian and alluvial sediments on uplands. Slopes are 0 to 3 percent. Elevation is 3,500 to 4,100 feet. Vegetation is mainly spike dropseed, three-awn, sandbur, red lovegrass, bush muhly, yucca, sand sagebrush, and shinnery oak. The mean annual precipitation is 12 to 13 inches, and the mean annual soil temperature is 59° to 61° F. The frost-free season is 190 to 205 days.

In a representative profile the surface layer is brown and strong brown fine sand and loamy fine sand about 18 inches thick. The upper part of the subsoil is yellowish red and red sandy clay loam about 25 inches thick. The lower part of the subsoil is reddish brown clay loam that extends to a depth of 60 inches or more. The soil profile is noncalcareous in the upper part and slightly calcareous in the lower part, and it is mildly alkaline throughout.

Permeability is moderate, and available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing and wildlife habitat.

Representative profile of Faskin fine sand, 240 feet west and 240 feet south of the fence corner at the northeast corner of the NW¼NE¼ of sec. 30, T. 11 S., R. 30 E.:

A11—0 to 5 inches; brown (7.5YR 5/4) fine sand, brown (7.5YR 4/4) when moist; single grained; loose when dry and moist, nonsticky and nonplastic when wet; many very fine roots; few very fine interstitial pores; mildly alkaline; clear wavy boundary.

A12—5 to 18 inches; strong brown (7.5YR 5/6) loamy fine sand, strong brown (7.5YR 4/6) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; few very fine tubular pores; mildly alkaline; abrupt wavy boundary.

B21t—18 to 27 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak coarse prismatic structure; slightly hard, very friable when moist, sticky and plastic when wet; many very fine and fine roots; common very fine tubular pores; patchy clay films on peds; mildly alkaline; clear smooth boundary.

B22t—27 to 33 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate coarse prismatic structure; hard, friable when moist, sticky and plastic when wet; common very fine and fine roots; common very fine tubular pores; thin clay bridges between sand grains; few lime filaments; slightly calcareous; mildly alkaline; clear smooth boundary.

B23tca—33 to 43 inches; red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) when moist; weak coarse prismatic structure; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; patchy clay films on peds; common lime seams and few lime filaments; slightly calcareous; mildly alkaline; clear wavy boundary.

B24tca—43 to 60 inches; reddish brown (2.5YR 5/4) clay loam, reddish brown (2.5YR 4/4) when moist; moderate medium prismatic structure; hard, friable when moist, very sticky and very plastic when wet; few very fine roots; common very fine tubular pores; patchy clay films on peds; slightly calcareous; many lime seams; mildly alkaline.

The A horizon has hue of 7.5YR or 5YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 through 6 when dry and moist. The Bt horizon has value of 4 through 6 when dry and 3 through 5 when most, and chroma of 4 through 8 when dry and moist. The calcium carbonate equivalent of the Btca horizon is 10 to 30 percent. The lime is in seams, soft masses, or filaments or is disseminated. In places, the Btca horizon is weakly cemented below a depth of 40 inches. Loamy fine sand, fine sand, and fine sandy loam strata are commonly below a depth of 40 inches.

Fa—Faskin fine sand. This soil occurs on uplands in the eastern part of the survey area and west of the High Plains. Slopes are 0 to 1 percent. Mapped areas are elongated in shape and about 500 to 1,500 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are scattered areas of Faskin loamy fine sand and Roswell, Malstrom, and Jalmar soils that make up about 10 percent of the mapped areas.

Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is severe.

This soil is used for grazing and wildlife habitat. Nonirrigated capability subclass VIe; range site Deep Sand CP–2.

FM—Faskin-Malstrom association. This association occurs on uplands in the eastern part of the survey area and west of the High Plains. Slopes are 0 to 3 percent. Mapped areas are elongated in shape and about 160 to 2,500 acres in size.

This association consists of 50 percent Faskin fine sand, 40 percent Malstrom loamy fine sand, and 10 percent less extensive soils.

Included with these soils in mapping are scattered areas of Roswell and Jalmar soils and areas of soils that are similar to the Malstrom soil but that are calcareous in the surface layer. Roswell soils are in hummocky deep sand areas. Jalmar soils are in areas where the fine sand and loamy fine sand textures are more than 20 inches in depth.

The level Faskin soil is in slight depressions. The level to nearly level Malstrom soil is on very low ridges. It has the profile described as representative of the series.

Runoff is slow or very slow. The hazard of water erosion is slight, and the hazard of soil blowing is severe. Moderate soil blowing is common.

This association is used for grazing and wildlife habitat. Nonirrigated capability subclass VIe; range site Deep Sand CP–2.

Fr—Faskin-Roswell complex. This complex occurs on severely wind-blown uplands in the eastern part of the survey area and west of the High Plains. Slopes are 0 to 15 percent. Mapped areas are elongated in shape and about 300 to 4,000 acres in size.

This complex consists of about 50 percent severely eroded Faskin sandy clay loam, 30 percent Roswell loamy fine sand, and 20 percent less extensive soils.

Included in mapping are small scattered areas of Faskin fine sand or loamy fine sand and Malstrom and Jalmar soils. The Faskin fine sand or loamy fine sand is in areas where soil blowing has not occurred. Malstrom soils have had their surface layer removed by wind and the lime substratum is exposed. Jalmar soils are on hummocks less than 4 feet high.

The level to nearly level Faskin soil is mostly barren. It has a profile similar to the one described as representative of the series, but the surface layer and, in places, part of the subsoil have been removed by soil blowing, exposing the sandy clay loam subsoil.

The undulating to rolling Roswell soil is on round to oval hummocks about 5 to 50 feet in diameter and 4 to 8 feet high. The hummocks are partially stabilized by vegetation. This soil has a profile similar to the one described as representative of the series, but the surface layer and substratum are loamy fine sand and layers of sandy loam or sandy clay loam are below a depth of 40 inches.

Faskin soils runoff is medium, the hazard of water erosion is slight, and the hazard of soil blowing is moderate. For Roswell soils runoff is very slow, the hazard of water erosion is slight, and the hazard of soil blowing is severe.

This complex is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; Faskin soil in Sandy CP–2 range site, Roswell soil in Sand Hills CP–2 range site.

Gabaldon Series

The Gabaldon series consists of deep, well drained soils. These soils formed in alluvium on flood plains and in swales that are rarely flooded. Slopes are 0 to 2 percent. Elevation is 5,600 to 5,900 feet. Vegetation is mainly blue grama, side-oats grama, wolftail, and cholla cactus. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 285 days.

In a representative profile the surface layer is dark grayish brown silt loam about 14 inches thick. The subsoil is dark brown and brown silty clay loam about 21 inches thick. The substratum is brown silt loam to a depth of 60 inches or more. The soil profile is slightly calcareous and mildly alkaline in the surface layer and is moderately calcareous and moderately alkaline in the subsoil and substratum.

Permeability is moderate, and available water capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing, wildlife habitat, and watershed; small acreages are used for irrigated crops.

Representative profile of Gabaldon silt loam in an area of Gabaldon-Dev association, 0.3 mile south and 225 feet east of old house in the SE¼ sec. 12, T. 15 S., R. 17 E.:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist, weak fine granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine, very fine, and medium roots; common fine and very fine tubular pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

A12—4 to 14 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak medium subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; many fine and very fine tubular pores; slightly calcareous; mildly alkaline; clear smooth boundary.

B21—14 to 23 inches; dark brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/3) when moist; moderate medium subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common very fine and fine roots; many fine and very fine tubular pores; common lime filaments; moderately calcareous; moderately alkaline; clear wavy boundary.

B22—23 to 35 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 3/4) when moist; moderate medium prismatic structure parting to moderate medium subangular blocks; hard, friable when moist, sticky and plastic when wet; few fine and very fine roots; many fine and very fine tubular pores; common lime filaments; moderately calcareous; moderately alkaline; clear wavy boundary.

C—35 to 60 inches; brown (7.5YR 5/4) silt loam, brown (7.5YR 3/4) when moist; weak medium subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The B horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist, and chroma of 2 through 4 when dry and moist. It is silty clay loam or clay loam, and it has moderate medium prismatic to weak or moderate medium subangular blocky structure. The C horizon has hue of 5YR through 10YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 through 4 when dry and moist. It is silt loam, silty clay loam, or loam, and it has weak medium subangular blocky structure or is massive.

GD—Gabaldon-Dev association. This association occurs in valleys of the limestone hills in the southwestern part of the survey area. Slopes are 0 to 3 percent. Mapped areas are narrow and elongated in shape and about 200 to 1,000 acres in size.

This association consists of about 60 percent Gabaldon silt loam, 25 percent Dev gravelly loam, and 15 percent less extensive soils.

Included with these soils in mapping are areas of Pena and Penasco soils, Gabaldon loams, and areas of soils that are similar to Gabaldon soils except that they have a gravelly and cobbly surface layer or substratum. The latter soils are on ridges and fans.

The level Gabaldon soil is on flood plains. It is rarely flooded. It has the profile described as representative of the series.

The level to nearly level Dev soil is on the flood plains adjacent to the stream channel. It is frequently flooded. The Dev soil is cooler and more moist than is typical for the Dev series.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This association is used for grazing, wildlife habitat, and watershed. Small acreages of Gabaldon soil are used for irrigated crops. Gabaldon soil in irrigated capability class I, nonirrigated capability subclass VIc, and Loamy CP–4 range site; Dev soil in nonirrigated capability subclass VIw, Bottomland CP–4 range site.

Glendale Series

The Glendale series consists of deep, well drained soils. These soils formed in stratified alluvium on flood plains. They are rarely or occasionally flooded. Slopes are 0 to 1 percent. Elevation is 3,300 to 3,500 feet. Vegetation is alkali sacaton, sand dropseed, saltcedar, and fourwing saltbush. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is reddish brown fine sandy loam about 16 inches thick. The underlying material to a depth of 31 inches is light brown very fine sandy loam. Below this it is stratified reddish brown, dark grayish brown, and light brown silty clay loam, loamy fine sand, and silty clay to a depth of 60 inches or more. The soil profile is moderately calcareous and moderately alkaline throughout.

Permeability is moderately slow, and available water capacity is 9 to 12 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing, irrigated crops, and wildlife habitat.

Representative profile of Glendale fine sandy loam, 357 feet east of second bend of ditch in the SE¼SE¼ sec. 12, T. 15 S., R. 26 E.:

Ap1—0 to 6 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; many very fine interstitial pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

Ap2—6 to 16 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; common very fine interstitial pores; moderately calcareous; moderately alkaline; gradual smooth boundary.

C1—16 to 31 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) when moist; nonsticky and nonplastic when wet; few very fine roots; many very fine interstitial pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

IIC2—31 to 34 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) when moist; weak medium subangular blocky structure; slightly hard, very friable when moist, slightly sticky and plastic when wet; few very fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

IIC3—34 to 36 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, very friable when moist, sticky and plastic when wet; few very fine roots; many very fine tubular pores; few gypsum filaments; moderately calcareous; moderately alkaline; abrupt smooth boundary.

IIC4—36 to 45 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; few gypsum crystals and filaments; moderately calcareous; moderately alkaline; abrupt wavy boundary.

IIIC5—45 to 54 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common very fine interstitial pores; moderately calcareous; moderately alkaline; abrupt wavy boundary.

IVC6—54 to 60 inches; reddish brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) when moist; moderate medium subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; common very fine tubular pores; common gypsum crystals and filaments; moderately calcareous; moderately alkaline.

The A and C horizons have chroma of 2 through 6 when dry and moist. The C horizon is stratified fine sandy loam, loamy fine sand, loam, silt loam, clay loam, silty clay loam, and silty clay, but it is dominantly silty clay loam or clay loam. These stratified layers range in thickness from 2 to 24 inches.

Ge—Glendale fine sandy loam. This level soil occurs on flood plains of the Pecos River and on the channeled Berrendo Creek and Rio Felix. It is rarely flooded. Slopes are 0 to 1 percent. Mapped areas are elongated in shape and about 30 to 400 acres in size.

This soil has the profile described as representative of the series. Gypsum accumulation and the reddish colors are more common in mapped areas along the Pecos River than along Berrendo Creek or Rio Felix.

Included with this soil in mapping are scattered areas of Pecos and Vinton soils; Glendale loam; and, along the Pecos River, small areas of soils that are similar to Glendale soils except that they have salt accumulations and are in areas that have a high water table. These included soils make up about 5 percent of the mapped areas.

Runoff is medium to slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. Sufficient deep moisture is present to maintain bottom land vegetation. Seedling damage from blowing sand is common during periods of high wind.

This soil is used for irrigated crops, grazing, and wildlife habitat. Irrigated capability unit IIe–2, nonirrigated capability subclass VIIe; range site Bottomland SD–3.

Gf—Glendale loam. This level soil occurs on second bottoms of the Pecos River flood plain. It is rarely flooded. Slopes are 0 to 1 percent. Mapped areas are elongated in shape and about 10 to 500 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer of loam about 16 inches thick.

Included with this soil in mapping are scattered areas of Glendale silt loam and fine sandy loam; Pecos and Vinton soils; and areas of soils that are similar to Pecos soils except that they have less clay throughout the profile. These included soils make up about 15 percent of the mapped areas.

Runoff is slow. The hazard of erosion is slight. Sufficient deep moisture is present to maintain bottomland vegetation.

This soil is used for irrigated crops, wildlife habitat, and grazing. Irrigated capability class I, nonirrigated capability subclass VIIc; range site Bottomland SD–3.

Gypsum Land

This miscellaneous area consists of exposed soft or cemented gypsiferous bedrock on broad uplands and valley breaks. Slopes range from 0 to 50 percent, but slopes of 0 to 5 percent are most common. It is mapped only in complex with the Holloman soils.

Runoff is rapid. The hazard of water erosion is moderate or severe. The hazard of soil blowing is severe. This miscellaneous area is mostly barren. It is unsuited to crops and grazing. It is used for watershed.

Holloman Series

The Holloman series consists of well drained soils that are very shallow and shallow over gypsum. These soils formed in alluvium over soft to hard gypsum on uplands. Slopes are 0 to 9 percent. Elevation is 3,300 to 3,600 feet. Vegetation is mainly tobosa, burrograss, alkali sacaton, three-awn, gyp grama, gyp muhly, coldenia, Mormon-tea, broom snakeweed, and mesquite. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is pale brown loam about 3 inches thick. The upper 5 inches of the underlying material is brown heavy loam. Below this, the underlying material is white and very pale brown gypsum to a depth of 60 inches or more (fig. 2).

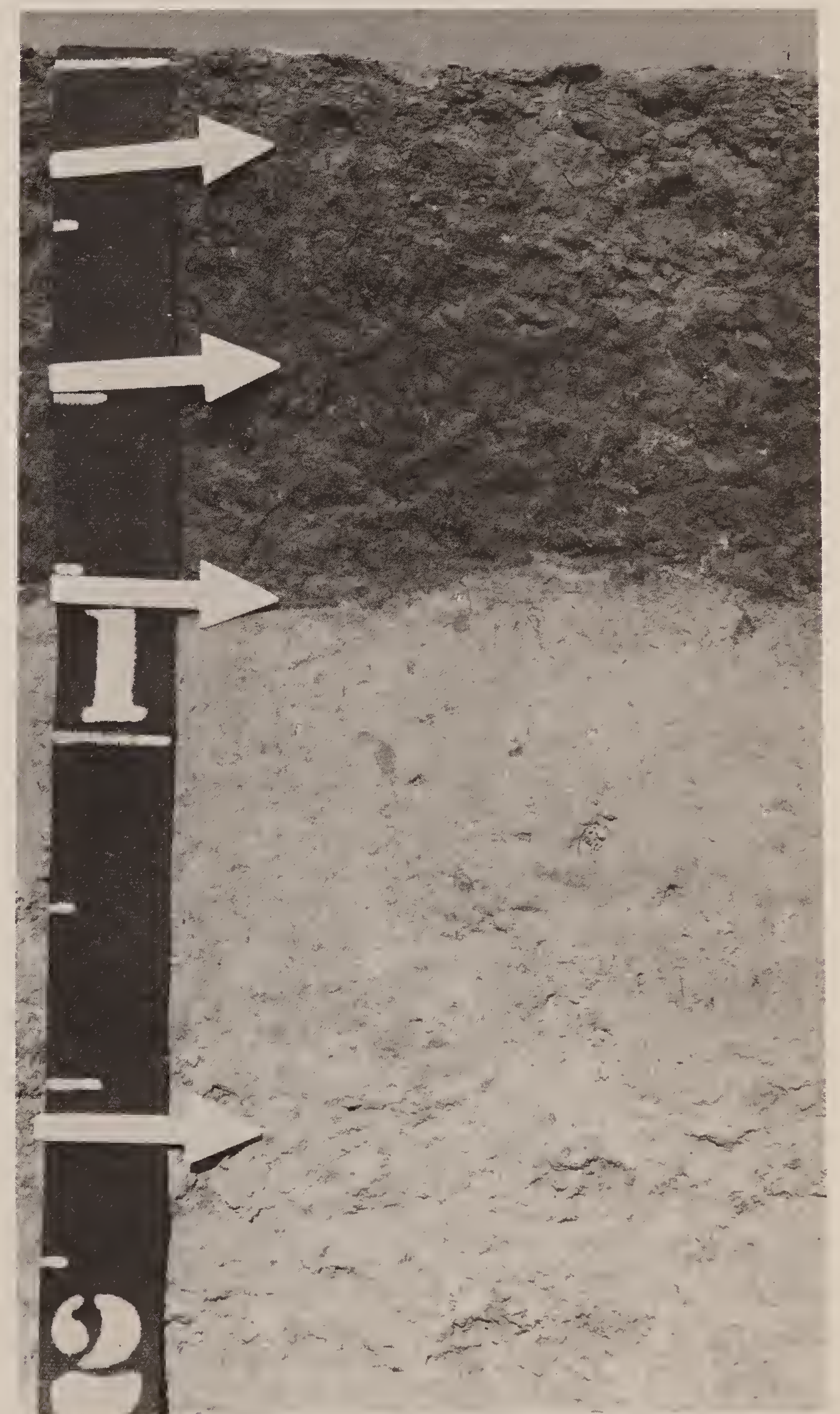

Figure 2.—Profile of Holloman loam. The surface layer is thin, and the gypsum layer restricts root development.

The soil profile is strongly calcareous and moderately alkaline.

Permeability is moderate, and available water capacity is 1.5 to 2.5 inches. Effective rooting depth is less than 20 inches.

These soils are used for grazing, wildlife habitat, watershed, irrigated crops, and community development.

Representative profile of Holloman loam in an area of Holloman-Gypsum land complex, 0 to 3 percent slopes, at the southwest corner of the SE¼SE¼ sec. 12, T. 10 S., R. 24 E.:

A1—0 to 3 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) when moist; weak thin platy structure parting to weak fine subangular blocks; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C1—3 to 8 inches; brown (10YR 5/3) heavy loam, brown (10YR 4/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; many fine and very fine roots; common very fine tubular pores; common fine specks of lime and gypsum; strongly calcareous; moderately alkaline; abrupt wavy boundary.

C2r—8 to 60 inches; white (10YR 8/2) gypsum, very pale brown (10YR 7/3) when moist; massive.

The depth to gypsum is less than 20 inches. The A horizon has hue of 5YR through 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 through 4 when dry and moist. The C1 horizon has hue of 5YR through 10YR, value of 5 through 7 when dry and 4 through 6 when moist, and chroma of 2 through 4 when dry and moist. It is fine sandy loam, loam, or clay loam. The C2r horizon is variable in color but is mostly white or very pale brown. It is soft or hard and is one foot to more than 5 feet thick.

Ho—Holloman loam, thick solum. This level to nearly level soil occurs on uplands west of the Pecos River. Slopes are 0 to 3 percent. Mapped areas are rounded in shape and about 5 to 80 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is 10 to 20 inches deep to gypsum.

The irrigated cropland has generally been leveled and small areas of gypsum material have been exposed. It is a common local practice to overcut these areas and backfill them to eliminate the exposed gypsum material.

Included with this soil in mapping are scattered areas of Holloman loam that is less than 10 inches deep to gypsum and areas of Reeves soils and Gypsum land. These included soils make up about 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is moderate. Available water capacity is 1.5 to 2.5 inches.

This soil is used for irrigated crops, grazing, and wildlife habitat. Irrigated capability unit IVs–2, nonirrigated capability subclass VIIs; range site Loamy SD–3.

Hp—Holloman-Gypsum land complex, 0 to 3 percent slopes. This complex occurs on uplands west of the Pecos River. Mapped areas are rounded and elongated in shape and about 10 to 3,000 acres in size.

This complex consists of about 40 percent Holloman loam; 20 percent Holloman loam, thick solum; 30 percent Gypsum land; and 10 percent less extensive soils.

Included in mapping are areas of Reeves, Reakor, Balmorhea, and Glendale soils. Reeves and Reakor soils are in the depressions on uplands. Balmorhea and Glendale soils are on the flood plains of the Pecos River.

The level to nearly level Gypsum land is nearly barren.

The level to nearly level Holloman soils have an alkali sacaton plant cover. The Holloman loam has the profile that is described as representative of the series.

For the Holloman soils runoff is medium, the hazard of water erosion is moderate, and the hazard of soil blowing is moderate. For the Gypsum land runoff is rapid, the hazard of water erosion is moderate, and the hazard of soil blowing is severe.

The gypsum is subject to solution where water is concentrated. This can cause failure of building foundations and engineering structures.

This complex is used for grazing, wildlife habitat, and community development. Nonirrigated capability subclass VIIs; Holloman loam in Gyp SD–3 range site; Holloman loam, thick solum, in Loamy SD–3 range site; Gypsum land not assigned to a range site.

HrC—Holloman-Gypsum land complex, 3 to 5 percent slopes. This complex occurs on uplands paralleling the east side of the Pecos River. Mapped areas are elongated in shape and about 200 to 3,000 acres in size.

This complex consists of 30 percent Holloman loam; 15 percent Holloman loam, thick solum; 35 percent Gypsum land; and 20 percent less extensive soils.

Included with this complex in mapping are areas of Reeves and Russler soils and Rock outcrop. The level and nearly level Reeves and Russler soils are in depressions and swales. The Russler soils receive runoff from higher lying areas.

The gently sloping Holloman soils are in depressions. They have a profile that is similar to the one described as representative of the series, but they are light brown and light reddish brown. The undulating Gypsum land is on small very low knolls.

For the Holloman soils runoff is medium, and the hazards of water erosion and soil blowing are moderate. For Gypsum land runoff is rapid, the hazard of water erosion is moderate, and the hazard of soil blowing is severe.

This complex is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIs; Holloman loam in Gyp SD–3 range site; Holloman loam, thick solum, in Loamy SD–3 range site; Gypsum land not assigned to a range site.

HSE—Holloman-Gypsum land complex, 30 to 50 percent slopes. This complex occurs on the breaks paralleling the east side of the Pecos River. Mapped areas are narrow and elongated in shape and about 20 to 1,800 acres in size.

This complex consists of 35 percent Holloman loam; 30 percent Gypsum land; 30 percent interbedded siltstone, shale, and gypsum Rock outcrops; and 5 percent less extensive soils.

Included with this complex in mapping are areas of Reeves, Russler, and Pecos soils. The gently undulating Reeves and Russler soils are on the upper parts of the areas and are intermixed with Holloman soils. Pecos soils are in the drainages.

The Holloman soil has slopes of 5 to 9 percent. It is on the upper parts of the mapped areas. It has a profile that is similar to the one described as representative of the series, but it is light brown and light reddish brown. The steep Gypsum land and Rock outcrop are on the severely eroded and gullied parts of the mapped areas.

Runoff is rapid. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

This complex is used for watershed, wildlife habitat, and grazing. Nonirrigated capability subclass VIIe; Holloman soil in Gyp SD–3 range site, Gypsum land and Rock outcrop not assigned to a range site.

Ima Series

The Ima series consists of deep, well drained soils. These soils formed in alluvium on fans. Slopes are 1 to 5 percent. Elevation is 4,000 to 4,100 feet. Vegetation is mainly three-awn, sand dropseed, black grama, bush muhly, broom snakeweed, mesquite, yucca, and sand sagebrush. The mean annual precipitation is 12 to 13 inches, and the mean annual soil temperature is 59° to 61° F. The frost-free season is 190 to 205 days.

In a representative profile the surface layer is yellowish brown fine sandy loam about 8 inches thick. The subsoil is light brown and pink fine sandy loam about 21 inches thick. The substratum is pink loamy fine sand that extends to a depth of 60 inches or more. The soil profile is noncalcareous in the surface layer, moderately calcareous in the upper part of the subsoil, and strongly calcareous in the lower part of the subsoil and in the substratum. It is mildly alkaline throughout.

Permeability is moderately rapid, and available water capacity is 7 to 9 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing, watershed, and wildlife habitat.

Representative profile of Ima fine sandy loam, 640 feet north of road and 0.8 mile west of cattleguard east of headquarters in the SE¼ of sec. 14, T. 14 S., R. 31 E.:

A11—0 to 3 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) when moist; weak fine granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; few very fine interstitial pores; mildly alkaline; abrupt smooth boundary.

A12—3 to 8 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) when moist; weak moderate subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; common very fine interstitial pores; few caliche pebbles; mildly alkaline; clear smooth boundary.

B21—8 to 16 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; common very fine interstitial pores; few caliche pebbles; moderately calcareous; mildly alkaline; clear smooth boundary.

B22ca—16 to 29 inches; pink (7.5YR 7/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; common very fine interstitial pores; few lime filaments; few caliche pebbles; strongly calcareous; mildly alkaline; gradual smooth boundary.

C—29 to 60 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 5/4) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; common very fine interstitial pores; common lime filaments; few caliche pebbles; strongly calcareous; mildly alkaline.

The A horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The B2 horizon has hue of 5YR or 7.5YR, value of 5 through 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The C horizon has value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. It is fine sandy loam or loamy fine sand. Loam layers that have a high content of lime commonly occur below a depth of 40 inches.

Im—Ima fine sandy loam. This nearly level to gently sloping soil occurs in the eastern part of the survey area on alluvial fans below breaks on the High Plains. Slopes are 1 to 5 percent. Mapped areas are narrow and elongated in shape and about 10,000 acres in size.

Included with this soil in mapping are scattered areas of Faskin, Roswell, and Jalmar soils and Torriorthents that make up about 5 percent of the mapped areas. Faskin, Roswell, and Jalmar soils are along the lower part of the mapped area. Torriorthents are along the upper part of the mapped area.

Runoff is medium or slow. The hazard of water erosion is severe, and the hazard of soil blowing is moderate. Gullies on this soil are caused by runoff from the steep and higher lying areas.

This soil is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIe; range site Sandy CP–2.

Jal Series

The Jal series consists of deep, well drained soils. These soils formed in alluvial and lacustrine sediments in depressions on uplands. Slopes are 0 to 3 percent.

Elevation is 3,500 to 3,800 feet. Vegetation is mainly blue grama, black grama, sand dropseed, three-awn, mesquite, yucca, and desertholly. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is pale brown fine sandy loam about 4 inches thick. The upper 5 inches of the underlying material is very pale brown fine sandy loam. Below this is light gray and white clay loam that has a high content of lime to a depth of 60 inches or more. The soil profile is moderately calcareous and moderately alkaline in the surface layer and strongly calcareous and strongly alkaline in the underlying material.

Permeability is moderate, and available water capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing and wildlife habitat.

Representative profile of Jal fine sandy loam, 75 feet east of water tank in the NE¼SE¼ of sec. 29, T. 12 S., R. 29 E.:

A1—0 to 4 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; weak medium granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; many very fine interstitial pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

C1—4 to 9 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) when moist; weak fine subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C2ca—9 to 14 inches; light gray (10YR 7/1) clay loam, gray (10YR 6/1) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; many very fine roots; common very fine tubular pores; strongly calcareous; strongly alkaline; clear smooth boundary.

C3ca—14 to 28 inches; light gray (10YR 7/1) clay loam, gray (10YR 6/1) when moist; moderate medium prismatic structure; hard, friable when moist, sticky and plastic when wet; few very fine roots; few very fine tubular pores; strongly calcareous; strongly alkaline; clear smooth boundary.

C4ca—28 to 60 inches; white (10YR 8/1) clay loam, light gray (10YR 7/1) when moist; weak coarse prismatic structure; hard, friable when moist, sticky and plastic when wet; few very fine tubular pores; strongly calcareous; strongly alkaline.

The depth to the Cca horizon is 6 to 20 inches. The A horizon has hue of 10YR or 7.5YR, value of 6 or 7 when dry and 4 through 6 when moist, and chroma of 2 or 3 when dry and moist. The C1 horizon has hue of 10YR or 7.5YR, value of 6 or 7 when dry and 5 or 6 when moist, and chroma of 1 through 3 when dry and moist. It is fine sandy loam or loam. The Cca horizon has hue of 10YR or 7.5YR, value of 6 through 8 when dry and 5 through 7 when moist, and chroma of 1 through 4 when dry and moist. It is clay loam, silty clay loam, or loam. The calcium carbonate equivalent of the Cca horizon is 30 to 55 percent. In places, a few caliche pebbles occur throughout the profile. Thin strata of sandy loam, fine sand, or loamy fine sand are in the Cca horizon in places.

Ja—Jal fine sandy loam. This level to nearly level soil occurs in depressions on uplands east of the Pecos River. Slopes are 0 to 3 percent. Mapped areas are elongated and rounded in shape and about 60 to 640 acres in size.

Included with this soil in mapping are scattered areas of Berino and Simona soils and some areas of soils that are similar to the Jal soils but that have lime accumulation that is at depths of more than 20 inches. These included soils make up about 10 percent of the mapped areas.

Runoff is medium to slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

This soil is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; range site Limy SD–3.

Jalmar Series

The Jalmar series consists of deep, well drained soils. These soils formed in aeolian and alluvial sediments on uplands. Slopes are 0 to 3 percent. Elevation is 3,500 to 4,100 feet. Vegetation is mainly three-awn, little bluestem, sand bluestem, sandbur, spike dropseed, shinnery oak, sand sagebrush, and yucca. The mean annual precipitation is 12 to 13 inches, and the mean annual soil temperature is 59° to 61° F. The frost-free season is 190 to 205 days. Jalmar soils are mapped only in a complex with Roswell soils.

In a representative profile the surface layer is brown, reddish yellow, and yellowish red fine sand and loamy fine sand about 23 inches thick. The upper part of the subsoil is light reddish brown heavy loamy fine sand about 9 inches thick. The lower part of the subsoil is light reddish brown sandy clay loam about 28 inches thick. The substratum is white clay loam, that has a high content of lime, that extends to a depth of 64 inches or more. The soil profile is noncalcareous to the substratum. It is neutral in the surface layer and becomes mildly alkaline in the lower part of the subsoil and moderately alkaline in the substratum.

Permeability is moderate, and available water capacity is 5.5 to 7.5 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing and wildlife habitat.

Representative profile of Jalmar fine sand in an area of Roswell-Jalmar complex, 600 feet north and 95 feet west of cattleguard in the NE¼NW¼ sec. 9, T. 15 S., R. 30 E.:

A11—0 to 6 inches; brown (7.5YR 5/4) fine sand, brown (7.5YR 4/4) when moist; single grained; loose when dry and moist, nonsticky and nonplastic when wet; many very fine and fine roots; many very fine interstitial pores; neutral; clear smooth boundary.

A12—6 to 14 inches; reddish yellow (7.5YR 6/6) fine sand, strong brown (7.5YR 5/6) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; many very fine interstitial pores; neutral; clear wavy boundary.

A3—14 to 23 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; many very fine interstitial pores; neutral; clear wavy boundary.

B1—23 to 32 inches; light reddish brown (5YR 6/4) heavy loamy fine sand, reddish brown (5YR 5/4) when moist; weak coarse prismatic structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common very fine and fine roots; common very fine interstitial pores; few patchy clay films on peds; neutral; clear wavy boundary.

B21t—32 to 47 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) when moist; moderate coarse prismatic structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; few coarse and very fine roots; common very fine interstitial pores; common patchy clay films on peds and clay bridging between sand grains; neutral; abrupt wavy boundary.

B22t—47 to 60 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 4/3) when moist; few fine prominent mottles of very pale brown (10YR 7/3), pale brown (10YR 6/3) when moist; moderate coarse prismatic structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine interstitial pores; many clay bridges between sand grains; mildly alkaline; abrupt wavy boundary.

Cca—60 to 64 inches; white (N 8/0) clay loam, white (N 8/0) when moist; massive; very hard, extremely firm when moist, sticky and plastic when wet; strongly calcareous; moderately alkaline.

The A horizon has hue of 7.5YR or 10YR and chroma of 3 through 6 when dry and moist. It is 20 to 40 inches thick. The B2t horizon has hue of 2.5YR through 7.5YR, value of 5 or 6 when dry, and chroma of 3 through 6 when dry and moist. It has weak or moderate coarse prismatic structure. The mottles in the lower part of the B2t horizon are absent in some profiles. The Cca horizon is absent in some profiles. Calcareous fine sand, loamy fine sand, or clay textured strata are below a depth of 40 inches in places.

Kimbrough Series

The Kimbrough series consists of well drained soils that are very shallow and shallow to indurated caliche. These soils formed in gravelly aeolian and alluvial sediments on the High Plains. Slopes are 0 to 3 percent. Elevation is 4,300 to 4,400 feet. Vegetation is mainly blue grama, black grama, side-oats grama, three-awn, broom snakeweed, and mesquite. The mean annual precipitation is 14 to 16 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 205 days.

In a representative profile the surface layer is brown gravelly fine sandy loam about 6 inches thick. The underlying material is brown gravelly loam about 5 inches thick. White indurated caliche is at a depth of 11 inches (fig. 3). The soil profile is moderately calcareous and moderately alkaline.

Permeability is moderate, and available water capacity is 1.5 to 2.5 inches. Effective rooting depth to indurated caliche is 7 to 18 inches.

These soils are used for grazing, wildlife habitat, and as a source of crushed caliche.

Representative profile of Kimbrough gravelly fine sandy loam in an area of Kimbrough-Stegall-Slaughter complex, 75 feet south of road and 0.15 mile east of the northwest corner marker of sec. 11, T. 13 S., R. 31 E.:

A1—0 to 6 inches; brown (10YR 5/3) gravelly fine sandy loam, dark brown (10YR 3/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; common fine and medium tubular pores; 20 percent caliche pebbles; moderately calcareous; moderately alkaline; clear smooth boundary.

C1—6 to 11 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; few very fine tubular pores; 40 percent caliche pebbles and cobblestones; moderately calcareous; moderately alkaline; abrupt wavy boundary.

C2cam—11 inches; white (N 8/0) indurated caliche containing few fractures, white (10YR 8/2) when moist; caliche several feet thick; surface and upper part laminated.

Caliche pebbles and cobblestones cover 20 to 50 percent of the soil surface. The depth to indurated caliche is 7 to 18 inches. The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. It is 0 to 25 percent caliche pebbles. The C1 horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. It is gravelly fine sandy loam or gravelly loam and is 20 to 45 percent caliche pebbles and cobblestones.

Km—Kimbrough gravelly loam. This level to gently undulating soil occurs along the Chaves and Lea County

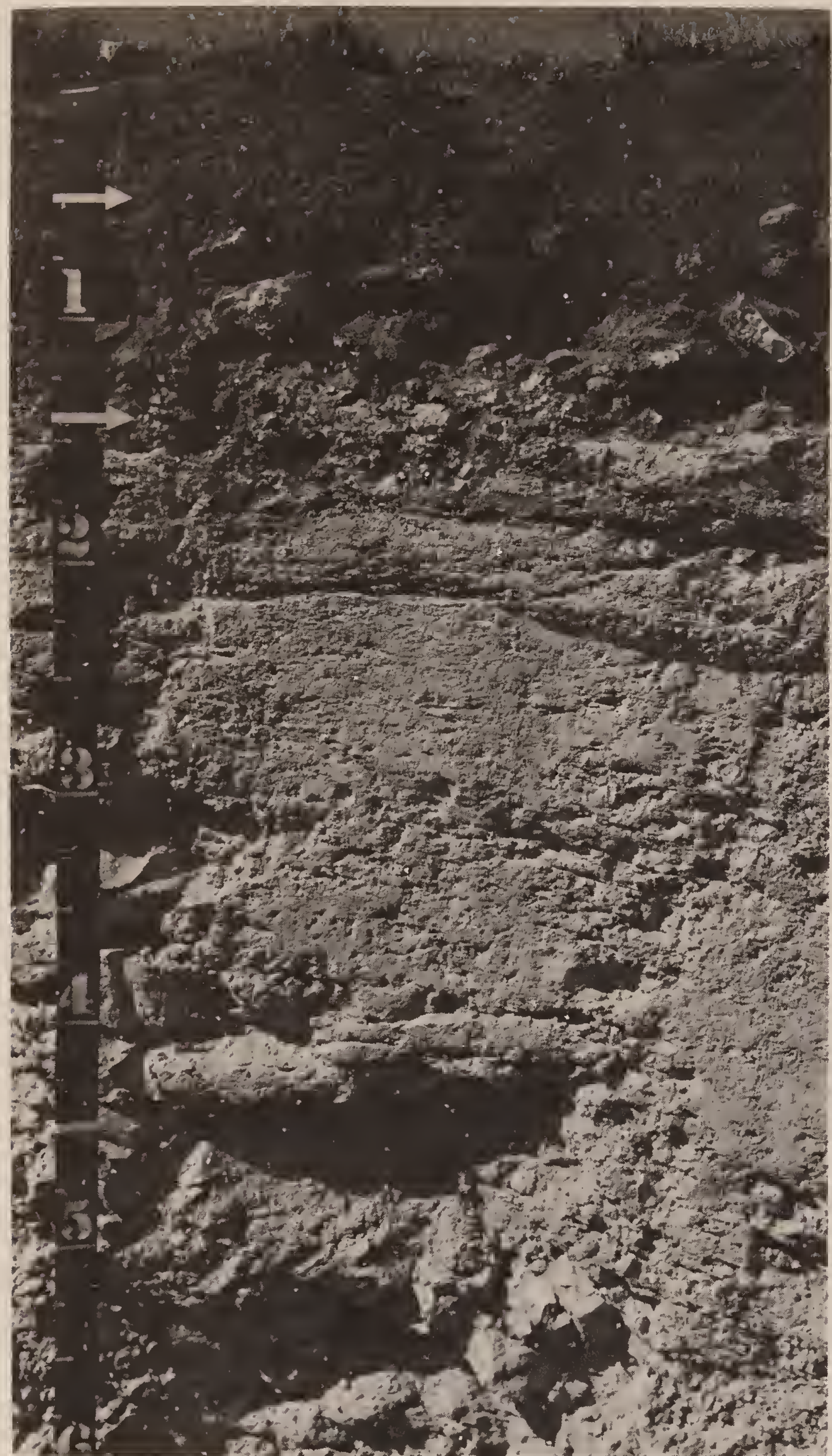

Figure 3.—Profile of Kimbrough gravelly loam. The surface layer is thin over a layer of indurated caliche that is a good source of crushed caliche.

line. Slopes are 0 to 3 percent. Mapped areas are narrow and elongated in shape and about 200 to 1,500 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer of gravelly loam.

Included with this soil in mapping are scattered intermixed areas of Stegall, Slaughter, and Sharvana soils that make up about 20 percent of the mapped areas. These soils are in small rounded depressions.

Runoff is medium. The hazard of erosion is slight.

This soil is used for grazing, wildlife habitat, and as a source of crushed caliche. Nonirrigated capability subclass VIIs; range site Shallow HP–3.

Ks—Kimbrough-Sharvana complex. This complex occurs along the Chaves and Lea County line. Slopes are 1 to 3 percent. The one mapped area is elongated in shape and about 3,400 acres in size.

This complex consists of about 60 percent Kimbrough gravelly fine sandy loam, 35 percent Sharvana fine sandy loam, and 5 percent less extensive soils.

Included with this complex in mapping are areas of Slaughter and Stegall soils and small areas of a soil that is similar to the Sharvana soils except that it has a layer of indurated caliche below a depth of 20 inches.

The nearly level to gently undulating Kimbrough soil is on low ridges. It has a profile similar to the one described as representative of the series, but it is more reddish in color.

The level Sharvana soil is in slight depressions. It has the profile described as representative of the series.

Runoff is medium. For Kimbrough soil the hazard of erosion is slight. For the Sharvana soil the hazard of water erosion is slight and the hazard of soil blowing is moderate.

This complex is used for grazing, wildlife habitat, and as a source of crushed caliche. Nonirrigated capability subclass VIIs; range site Shallow HP–3.

Kt—Kimbrough-Stegall-Slaughter complex. This complex occurs along the Chaves and Lea County line. Slopes are 0 to 3 percent. The soils of this complex occupy most of the High Plains. Mapped areas are 200 to 12,000 acres in size.

This complex consists of about 55 percent Kimbrough gravelly fine sandy loam, 20 percent Stegall loam, 20 percent Slaughter loam, and 5 percent less extensive soils.

Included in mapping are scattered areas of Sharvana soils and small areas of soils that have a loam profile that is 20 to 40 inches deep over indurated caliche. Also included is a soil that has a loam profile and a layer that is high in lime content at depths of 20 to 40 inches.

The nearly level to gently undulating Kimbrough soil is on low ridges. The level Stegall and Slaughter soils are in slight, small to large, rounded or elongated depressions. The Kimbrough, Stegall, and Slaughter soils have the profile described as representative of their respective series.

For the Kimbrough soil runoff is medium. For Stegall and Slaughter soils runoff is slow. The hazard of erosion for this complex is slight.

This complex is used for grazing, wildlife habitat, and as a source of crushed caliche. Nonirrigated capability subclass VIIs; Kimbrough soil in Shallow HP–3 range site, Stegall and Slaughter soils in Clayey HP–3 range site.

Lozier Series

The Lozier series consists of very shallow and shallow, well drained soils. These soils formed in cobbly residual materials on low limestone hills. Slopes are 1 to 9 percent. Elevation is 3,900 to 4,200 feet. Vegetation is mainly blue grama, black grama, side-oats grama, three-awn, tridens, cholla cactus, broom snakeweed, mesquite, and creosotebush. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is brown cobbly loam about 6 inches thick. Underlying material is light yellowish brown cobbly loam about 7 inches thick. Fractured limestone is at a depth of 13 inches. The soil profile is moderately calcareous in the surface layer and strongly calcareous in the underlying material. It is moderately alkaline throughout.

Permeability is moderate, and available water capacity is 1.5 to 2.5 inches. Effective rooting depth to limestone bedrock is 6 to 15 inches.

This soil is used for grazing, watershed, wildlife habitat, and community development.

Representative profile of Lozier cobbly loam in an area of Lozier-Tencee complex, 150 feet south and 0.1 mile west of road intersection, 0.5 mile south of cattleguard at the south end of Diamond A Dam in sec. 10, T. 12 S., R. 22 E.:

A11—0 to 2 inches; brown (10YR 5/3) cobbly loam, brown (10YR 4/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; few very fine tubular pores; 40 percent cobblestones and pebbles coated with lime; moderately calcareous; moderately alkaline; abrupt smooth boundary.

A12—2 to 6 inches; brown (10YR 5/3) cobbly loam, brown (10YR 4/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; few very fine tubular pores; 25 percent cobblestones and pebbles coated with lime; moderately calcareous; moderately alkaline; clear smooth boundary.

Cca—6 to 13 inches; light yellowish brown (10YR 6/4) cobbly loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; few very fine tubular pores; 75 percent cobblestones and pebbles coated with lime; few lime filaments; strongly calcareous; moderately alkaline; abrupt wavy boundary.

R—13 inches; fractured limestone coated with lime.

The depth to limestone is 6 to 15 inches. The A horizon has value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. It is 10 to 40 percent cobblestones and pebbles. The Cca horizon has value of 5 through 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. It is 40 to 80 percent cobblestones and pebbles.

Lr—Lozier-Reakor complex. This complex occurs on low limestone hills west of Roswell. Slopes are 1 to 9 percent. The main mapped area is elongated in shape and about 10,000 acres in size.

This complex consists of about 40 percent Lozier cobbly loam, 30 percent Tencee cobbly loam, 20 percent Reakor loam, and 10 percent less extensive soils.

Included in mapping are Bigetty, Pecos, and Atoka soils, and Rock outcrop. Bigetty and Pecos soils are on flood plains. Rock outcrop is intermixed with Lozier soils. Atoka soils are in depressions and intermixed with Reakor soils.

The gently undulating to gently rolling Lozier soil and the nearly level to gently sloping Reakor soil have profiles similar to the ones that are described as representative of their respective series. The Reakor soil is in valleys and in the numerous round and oblong depressions 5 to 300 feet in diameter.

The gently undulating to gently rolling Tencee soil has a profile similar to the one that is described as representative of the series, but it has fractured limestone underlying the indurated caliche layer.

For the Lozier and Tencee soils runoff is medium. For the Reakor soil runoff is medium or slow. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is slight.

This complex is used for grazing, watershed, community development, and wildlife habitat. Nonirrigated capability subclass VIIs; Lozier and Tencee soils in Gravelly SD–3 range site, Reakor soil in Loamy SD–3 range site.

Lt—Lozier-Tencee complex. This complex occurs mostly in the west-central part of the survey area on low, limestone and indurated caliche hills. Slopes are 1 to 9 percent. Mapped areas are elongated in shape and about 80 to 7,000 acres in size.

This complex consists of about 50 percent Lozier cobbly loam, 30 percent Tencee cobbly loam, and 20 percent less extensive soils.

Included in mapping are Rock outcrop and Upton, Reakor, Atoka, Pecos, and Dev soils. The Rock outcrop is intermingled with Lozier soils. Upton soils are intermingled with Tencee soils. Reakor and Atoka soils are in depressions. Pecos and Dev soils are on flood plains.

The Lozier soil has the profile that is described as representative of the series.

The Tencee soil has a profile similar to the one that is described as representative of the series, but in most places it has fractured limestone underlying the indurated caliche layer.

For the Lozier and Tencee soils, runoff is medium. The hazard of water erosion is slight or moderate, and the hazard of soil blowing is slight.

This complex is used for range, watershed, and wildlife habitat. Nonirrigated capability subclass VIIs; range site Gravelly SD–3.

Malstrom Series

The Malstrom series consists of deep, well drained soils. These soils formed in aeolian and alluvial sediments on uplands. Slopes are 0 to 3 percent. Elevation is 3,500 to 4,100 feet. Vegetation is mainly three-awn, sand dropseed, black grama, blue grama, little bluestem, spike dropseed, sandbur, yucca, shinnery oak, sand sagebrush, and mesquite. The mean annual precipitation is 12 to 13 inches, and the mean annual soil temperature is 59° to 61° F. The frost-free season is 190 to 205 days. Malstrom soils in this survey area are mapped only in association with Faskin soils.

In a representative profile the surface layer is light brown loamy fine sand about 6 inches thick. The subsoil is brown loamy fine sand about 13 inches thick. The substratum to a depth of 25 inches is light brown loamy fine sand. Below this it is very pale brown loam and fine sandy loam to a depth of 60 inches or more. The surface layer and subsoil are noncalcareous and mildly alkaline. The substratum is strongly calcareous and moderately alkaline and strongly alkaline.

Permeability is moderately rapid, and available water capacity is 5.5 to 7.0 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing and wildlife habitat.

Representative profile of Malstrom loamy fine sand in an area of Faskin-Malstrom association, 51 feet north of old road and 0.9 mile west of windmill, in the NW¼ of sec. 2, T. 13 S., R. 30 E.:

A1—0 to 6 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; single grained; loose when dry and moist; many fine roots; many very fine interstitial pores; mildly alkaline; abrupt smooth boundary.

B2—6 to 19 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) when moist; weak fine subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; many very fine interstitial pores; mildly alkaline; clear smooth boundary.

C1—19 to 25 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; many very fine interstitial pores; few lime filaments and few soft masses of lime; strongly calcareous; moderately alkaline; abrupt wavy boundary.

C2ca—25 to 53 inches; very pale brown (10YR 8/3) loam, very pale brown (10YR 7/3) when moist; massive; hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine tubular pores; disseminated lime and few lime filaments; strongly calcareous; strongly alkaline; clear wavy boundary.

C3ca—53 to 60 inches; very pale brown (10YR 8/3) fine sandy loam, very pale brown (10YR 7/3) when moist; massive; soft, very friable when moist, slightly sticky and slightly plastic when wet; few caliche pebbles; strongly calcareous; strongly alkaline.

The depth to Cca horizon is 20 to 30 inches. The A horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The B2 horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. It is loamy fine sand or fine sandy loam, and it has weak fine subangular blocky structure or is massive. The C1 horizon has hue of 7.5YR or 10YR, value of 6 or 7 when dry and 5 or 6 when moist, and chroma of 3 or 4 when dry and moist. It is loamy fine sand or fine sandy loam. The Cca horizon has hue of 10YR through 5YR when dry and moist, value of 7 or 8 when dry and 6 or 7 when moist, and chroma of 1 through 4 when dry and moist. Calcium carbonate equivalent of the Cca horizon is 15 to 40 percent. Some profiles contain a few caliche pebbles and strata of loamy fine sand and fine sand below a depth of 50 inches.

Pajarito Series

The Pajarito series consists of deep, well drained soils. These soils formed in aeolian and alluvial sediments on uplands and fans. Slopes are 0 to 5 percent. Elevation is 3,400 to 3,900 feet. Vegetation is mainly sand dropseed, black grama, plains bristlegrass, threeawn, mesquite, yucca, and broom snakeweed. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is reddish brown loamy fine sand and fine sandy loam about 6 inches thick. The subsoil is reddish brown fine sandy loam about 32 inches thick. The substratum is light red sandy loam and fine sandy loam to a depth of 60 inches or more. The soil profile is slightly calcareous in the surface layer and becomes strongly calcareous in the substratum. It is moderately alkaline throughout.

Permeability is moderately rapid, and available water capacity is 7.5 to 9.0 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing and wildlife habitat.

Representative profile of Pajarito loamy fine sand in an area of Pajarito-Pintura complex, 80 feet north and 0.4 mile southwest of the cattleguard in the SE¼ NE¼ of sec. 4, T. 12 S., R. 27 E.:

A11—0 to 3 inches; reddish brown (5YR 4/4) loamy fine sand, dark reddish brown (5YR 3/4) when moist; single grained; loose when dry and moist; common very fine roots; few fine interstitial pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

A12—3 to 6 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; few very fine tubular pores; moderately calcareous; moderately alkaline; clear smooth boundary.

B1—6 to 17 inches; reddish brown (2.5YR 4/4) fine sandy loam, dark reddish brown (2.5YR 3/4) when moist; weak medium subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; few very fine tubular pores; few lime filaments; moderately calcareous; moderately alkaline; gradual smooth boundary.

B21—17 to 30 inches; reddish brown (2.5YR 5/4) fine sandy loam, dark reddish brown (2.5YR 3/4) when moist; weak medium subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; few very fine tubular pores; few lime filaments; moderately calcareous; moderately alkaline; clear smooth boundary.

B22—30 to 38 inches; reddish brown (2.5YR 5/4) fine sandy loam, reddish brown (2.5YR 4/4) when moist; weak medium subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common very fine tubular pores; common lime filaments; few caliche pebbles; strongly calcareous; moderately alkaline; clear smooth boundary.

C1ca—38 to 46 inches; light red (2.5YR 6/6) sandy loam, red (2.5YR 4/6) when moist; massive; hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; common very fine tubular pores; many lime filaments; few caliche pebbles; strongly calcareous; moderately alkaline; clear smooth boundary.

C2ca—46 to 60 inches; light red (2.5YR 6/6) fine sandy loam, red (2.5YR 4/6) when moist; massive; hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; common very fine tubular pores; common soft masses of lime; strongly calcareous; moderately alkaline.

The A horizon has hue of 2.5YR through 7.5YR, value of 4 through 6 when dry and 3 through 5 when moist, and chroma of 3 through 6 when dry and moist. The B horizon has hue of 2.5YR or 5YR, value of 4 through 6 when dry and 3 through 5 when moist, and chroma of 3 through 6 when dry and moist. It is fine sandy loam or sandy loam and has medium or fine subangular blocky structure. The C horizon has hue of 2.5YR or 5YR, value of 4 through 7 when dry and 4 through 6 when moist, and chroma of 3 through 6 when dry and moist. It is fine sandy loam, loamy sand, sandy loam, or loamy fine sand.

Pa—Pajarito loamy fine sand. This soil occurs on uplands and fans that are below indurated caliche-capped breaks east of the Pecos River. Slopes are 0 to 5 percent. Mapped areas are elongated in shape and about 80 to 2,500 acres in size.

This soil has a profile similar to the one described as representative of the series, but the subsoil is loamy very fine sand.

Included with this soil in mapping are Alama and Simona soils and Rock outcrop that make up about 5 percent of the mapped areas. Alama soils are on flood plains. Simona soils and Rock outcrop are on ridges.

Runoff is medium or slow. The hazard of water erosion is moderate, and the hazard of soil blowing is severe. Common gullies are caused by runoff from steep breaks.

This soil is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; range site Sandy SD–3.

Pb—Pajarito-Pintura complex. This complex occurs on uplands and fans below indurated caliche breaks east of the Pecos River. Slopes are 1 to 15 percent. Mapped areas are elongated in shape and about 300 to 2,000 acres in size.

This complex consists of about 50 percent severely eroded Pajarito fine sandy loam, 30 percent Pintura loamy fine sand, and 20 percent less extensive soils.

Included with this complex in mapping are scattered areas of Berino, Alama, and Simona soils and Rock outcrop. Berino soils are in windblown areas and are severely eroded. Alama soils are on flood plains. Simona soils and Rock outcrop are on ridges.

The nearly level to gently sloping Pajarito soil is in windblown areas. It has the profile that is described as representative of the series.

The undulating to rolling Pintura soil is on rounded to oval hummocks about 5 to 50 feet in diameter and about 4 to 8 feet high. The hummocks are partially stabilized by brush and sparse grasses.

For the Pajarito soil runoff is medium to slow, the hazard of water erosion is moderate, and the hazard of soil blowing is severe. For the Pintura soil runoff is very slow, the hazard of water erosion is slight, and the hazard of soil blowing is severe. Few gullies occur on the fans.

This complex is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; Pajarito soil in Sandy SD–3 range site, Pintura soil in Deep Sand SD–3 range site.

Pecos Series

The Pecos series consists of deep, moderately well drained soils. These soils formed in alluvium on flood plains that are rarely flooded. Slopes are 0 to 3 percent. Elevation is 3,300 to 4,500 feet. Vegetation is mainly alkali sacaton, saltcedar, and mesquite. The mean annual precipitation is 10 to 14 inches, and the mean annual soil temperature is 59° to 65° F. The frost-free season is 190 to 215 days.

In a representative profile the surface layer is 1 inch of light reddish brown fine sandy loam over 16 inches of dark reddish gray silty clay loam and reddish brown silty clay. The underlying material to a depth of 47 inches is reddish brown and reddish gray clay. Below this it is light reddish brown sandy clay loam to a depth of 66 inches or more. The soil profile is slightly calcareous in the surface layer and becomes strongly calcareous in the underlying material. The upper part of the profile is moderately saline and moderately alkaline and the lower part is strongly alkaline. Common gypsum and salt crystals occur below the surface layer.

Permeability is very slow, and available water capacity is 6 to 9 inches. Effective rooting depth is 66 inches or more.

These soils are used for grazing, irrigated crops, watershed, wildlife habitat, and community development.

Representative profile of Pecos silty clay loam in the SW¼SE¼SW¼ of sec. 28, T. 15 S., R. 26 E.:

A11—0 to 1 inch; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist; many very fine tubular pores; many very fine roots; slightly calcareous; moderately alkaline; abrupt smooth boundary.

A12—1 to 9 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 3/2) when moist; moderate fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many fine and very fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

A13—9 to 16 inches; reddish brown (5YR 5/3) silty clay, dark reddish brown (5YR 3/3) when moist; strong medium subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; many very fine roots; common very fine tubular pores; few cracks ½ inch wide; moderately calcareous; strongly alkaline; gradual smooth boundary.

C1—16 to 34 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) when moist; moderate coarse prismatic structure; very hard, firm when moist, very sticky and very plastic when wet; common very fine roots; common very fine tubular pores; common pressure faces; few cracks 1 inch wide; moderately saline; moderately calcareous; strongly alkaline; clear smooth boundary.

C2cs—34 to 47 inches; reddish gray (5YR 5/2) clay, dark reddish gray (5YR 4/2) when moist; weak coarse prismatic structure; very hard, firm when moist, very sticky and very plastic when wet; few very fine roots; common tubular pores; moderately saline; many gypsum crystals; strongly calcareous; strongly alkaline; abrupt wavy boundary.

IIC3—47 to 66 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 4/4) when moist; massive; hard, friable when moist; sticky and plastic when wet; few very fine roots; many very fine pores; few gypsum crystals; strongly calcareous; strongly alkaline.

The A horizon has hue of 10YR through 5YR and value of 2 or 3 when moist. The C horizon has hue of 10YR through 5YR and value 3 through 5 when moist. It is stratified clay, heavy silty clay loam, and silty clay. Cracks of ½ to 1 inch wide are common in the C horizon, and this horizon contains thin layers of fine sandy loam or sandy clay loam in places. Strata of sandy clay loam, fine sandy clay loam, sand or silty texture occur below a depth of 40 inches.

Pe —Pecos silty clay loam. This level soil occurs on the part of the Pecos River flood plain that is rarely flooded. Slopes are 0 to 1 percent. Mapped areas are elongated in shape and about 40 to 200 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are scattered areas of Glendale loam, Glendale fine sandy loam, and Pecos loam that make up about 5 percent of the mapped areas. Also included are areas of soils similar to the Pecos soils except that they are somewhat poorly drained. These latter areas have sparse salt tolerant vegetation. They make up about 10 percent of the mapped areas.

Runoff is slow. The hazard of erosion is slight. Sufficient deep moisture is available to maintain bottom land vegetation.

This soil is used for grazing, irrigated crops, watershed, and wildlife habitat. Irrigated capability unit IVs–11, nonirrigated capability subclass VIIs; range site Salty Bottomland SD–3.

PfA—Pecos silty clay loam, nonsaline, 0 to 1 percent slopes. This level soil occurs on flood plains of the Rio Hondo, Rio Felix, and other minor drainages. It is rarely flooded. Mapped areas are elongated in shape and about 80 to 2,500 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is nonsaline, the surface layer is dark grayish brown silty clay loam about 6 inches thick, and the underlying material is brown and light brown silty clay loam to a depth of 65 inches or more. The soil profile is moderately calcareous and moderately alkaline throughout. The available water capacity is 9 to 11 inches. Vegetation is mainly tobosa, side-oats grama, cholla, and yucca.

Included with this soil in mapping are scattered areas of Bigetty and Reakor soils that make up about 5 percent of the mapped areas.

Runoff is slow. The hazard of erosion is slight.

This soil is used for irrigated crops, grazing, community development, watershed, and wildlife habitat. Most areas used for community development are protected from flooding. Irrigated capability unit IIs–1, nonirrigated capability subclass VIs; range site Bottomland SD–3.

PGB—Pecos silty clay loam, nonsaline, 0 to 3 percent slopes. This level to nearly level soil occurs on flood plains that are rarely flooded and that are in the limestone valleys in the western part of the survey area. Mapped areas are elongated and rounded in shape and about 40 to 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is nonsaline, the surface layer is dark brown silty clay loam about 10 inches thick, underlying material is brown silty clay loam to a depth of 31 inches, and below that, it is brown and light brown silty clay loam to a depth of 60 inches or more. Small amounts of lime are in the upper part of the underlying material but large amounts of lime occur below a depth of 40 inches. The soil profile is moderately alkaline throughout. Vegetation is mainly tobosa, cholla, and yucca.

Included with this soil in mapping are scattered areas of Reakor soils that make up about 5 percent of the mapped areas.

Runoff is medium or slow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are few.

This soil is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIe; range site Bottomland SD–3.

PH—Pecos-Dev association. This association occurs in valleys of the limestone hills and along drainages in the west and southwest of the survey area. Slopes are 0 to 5 percent. Mapped areas are narrow in shape, few to many miles long, and about 60 to 3,000 acres in size.

This association consists of about 35 percent Pecos silty clay loam, nonsaline; 30 percent Dev cobbly loam; and 35 percent less extensive soils.

Included with these soils in mapping are scattered areas of Bigetty, Tencee, Reakor, and Ector soils and areas of soils that are similar to Bigetty soils except that they have strata of gravelly and cobbly loam below a depth of 20 inches. Reakor soils, which make up about 10 percent of the mapped areas, are on ridges and valley fans.

The level to nearly level Pecos soil is on flood plains. It is rarely flooded. It has a profile similar to the one that is described as representative of the series, but it is nonsaline, the surface layer is dark brown silty clay loam about 10 inches thick, and the underlying material is brown silty clay loam to a depth of about 31 inches and is brown and light brown silty clay loam to a depth of 60 inches or more. Small amounts of lime are in the upper part of the underlying material but large amounts of lime occur below a depth of 40 inches. The soil profile is moderately alkaline throughout. Vegetation is mainly tobosa, cholla, and yucca.

The level to nearly level Dev soil is on flood plains. It is frequently flooded. It has the profile that is described as representative of the series.

Runoff is medium or slow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This association is used for grazing, watershed, and wildlife habitat. Pecos soil in nonirrigated capability subclass VIe, Bottomland SD–3 range site; Dev soil in nonirrigated capability subclass VIw, Bottomland CP–4 range site.

Pena Series

The Pena series consists of deep, well drained soils. These soils formed in gravelly and cobbly alluvium on valley terraces and fans. Slopes are 1 to 15 percent. Elevation is 5,600 to 6,000 feet. Vegetation is mainly blue grama, mat muhly, three-awn, vine-mesquite, oneseed juniper, cholla cactus, Apache-plume, algerita, and littleleaf sumac. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 185 days.

In a representative profile (fig. 4) the surface layer is dark brown gravelly loam about 3 inches thick. The next layer is dark brown gravelly loam about 7 inches thick. The upper part of the substratum is brown very gravelly loam about 10 inches thick and the lower part is light brown very cobbly loam to a depth of 65 inches or more. The soil profile is slightly calcareous in the upper part and strongly calcareous in the lower part and is moderately alkaline.

Permeability is moderate, and available water capacity is 3 to 6 inches. Effective rooting depth is 60 inches or more.

Figure 4.—**Profile of Pena cobbly loam. This soil has a high content of pebbles and cobblestones.**

This soil is used for grazing, wildlife habitat, and watershed.

Representative profile of Pena gravelly loam in an area of Pena-Penasco association, 30 feet west of road crossing of drainage and 1 mile southwest on road to Mathews Canyon from U.S. 82 in the SE¼NW¼ of sec. 3, T. 16 S., R. 17 E.:

A1—0 to 3 inches; dark brown (7.5YR 4/2) gravelly loam, dark brown (7.5YR 3/2) when moist; weak thin platy structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; many very fine tubular pores; 30 percent limestone pebbles and cobblestones coated with lime; slightly calcareous; moderately alkaline; clear smooth boundary.

AC—3 to 10 inches; dark brown (7.5YR 4/2) gravelly loam, dark brown (7.5YR 3/2) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine and fine tubular pores; few worm casts; 15 percent limestone pebbles coated with lime; few lime filaments; slightly calcareous; moderately alkaline; clear smooth boundary.

C1ca—10 to 20 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; 65 percent limestone pebbles and cobblestones coated with lime; many lime filaments; strongly calcareous; moderately alkaline; clear wavy boundary.

C2ca—20 to 65 inches; light brown (7.5YR 6/4) very cobbly loam, brown (7.5YR 5/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; 60 to 70 percent limestone cobblestones and pebbles coated with lime; common lime filaments; strongly calcareous; moderately alkaline.

Pebbles and cobblestones cover 25 to 35 percent of the soil surface. The depth to the Cca horizon is 10 to 30 inches. The A and AC horizons have hue of 10YR or 7.5YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The Cca horizon has hue of 10YR or 7.5YR, value of 4 through 7 when dry and 3 through 5 when moist, and chroma of 2 through 4 when dry and moist. It is mainly stratified very gravelly, gravelly, or very cobbly loam, but strata of cobbly or gravelly sandy loam are common. The calcium carbonate equivalent is more than 15 percent in the Cca horizon. Between 10 and 40 inches the C horizon is about 40 to 80 percent pebbles and cobblestones.

PK—Pena-Penasco association. This association occurs in narrow limestone valleys in the southwestern part of the survey area. Slopes are 1 to 30 percent. Mapped areas are elongated in shape, 1 to 5 miles long, and about 60 to 400 acres in size.

This association consists of about 45 percent Pena gravelly loam, 30 percent Penasco cobbly loam, and 25 percent less extensive soils.

Included with these soils in mapping are Ancho, Cuevoland, Shanta, Dev, Gabaldon, and Remunda soils that make up about 15 percent of the mapped areas. Also included are Deama soils that make up about 10 percent of the mapped areas. The nearly level to gently sloping Ancho, Cuevoland, and Remunda soils are in depressional areas. The nearly level Shanta, Dev, and Gabaldon soils are on flood plains. The undulating to hilly Deama soils are on hills.

The gently undulating to hilly Pena and Penasco soils are on the valley terraces and fans. The Pena soil has the profile that is described as representative of the series.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are common in the soils of the depressions and flood plains.

This association is used for grazing, wildlife habitat, and watershed. Pena soil in nonirrigated capability subclass VIe, Hills CP–4 range site; Penasco soil in nonirrigated capability subclass VIIs, Shallow CP–4 range site.

Penasco Series

The Penasco series consists of well drained soils that are very shallow and shallow to indurated caliche. These soils formed in cobbly and gravelly alluvium on valley terraces and fans. Slopes are 2 to 30 percent. Elevation is 5,500 to 6,200 feet. Vegetation is mainly blue grama, three-awn, wolftail, mat muhly, one-seed juniper, littleleaf sumac, algerita, soaptree yucca, and cholla cactus. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 185 days.

In a representative profile the surface layer is dark grayish brown cobbly loam and gravelly loam about 9 inches thick. The underlying material is brown gravelly loam about 3 inches thick over a layer of gravelly and cobbly, indurated caliche about 5 inches thick. Below this are moderately and weakly cemented, lime coated pebbles and cobblestones to a depth of 30 inches or more. The soil profile is slightly and moderately calcareous in the surface layer and strongly calcareous in the underlying material; it is moderately alkaline throughout.

Permeability is moderate, and available water capacity is 1.5 to 2 inches. Effective rooting depth to indurated caliche is 7 to 20 inches.

These soils are used for grazing, wildlife habitat, and watershed.

Representative profile of Penasco cobbly loam in an area of Penasco-Ancho association, 0.1 mile north of fence corner that is north of windmill in the NE¼NE¼ of sec. 11, T. 15 S., R. 17 E.:

A11—0 to 3 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular and weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; 30 percent cobblestones and pebbles; slightly calcareous; moderately alkaline; abrupt smooth boundary.

A12—3 to 9 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; 40 percent pebbles and cobblestones coated with lime; moderately calcareous; moderately alkaline; abrupt wavy boundary.

C1ca—9 to 12 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; few very fine tubular pores; 45 percent pebbles and cobblestones coated with lime; strongly calcareous; moderately alkaline; abrupt wavy boundary.

C2cam—12 to 17 inches; white (N 8/0) continuously indurated, gravelly and cobbly caliche; abrupt wavy boundary.

C3ca—17 to 30 inches; white (N 8/0) moderately cemented grading to weakly cemented lime coated pebbles and cobblestones.

Pebbles and cobblestones cover 50 to 60 percent of the soil surface. The depth to indurated caliche is 7 to 20 inches. The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry, 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The C1ca horizon has hue of 10YR or 7.5YR when dry and moist, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry and moist. It has weak fine subangular blocky structure or is massive. It is gravelly loam, gravelly clay loam, cobbly loam, or cobbly clay loam. It is 35 to 50 percent caliche and limestone pebbles and cobblestones.

PL—Penasco-Ancho association. This association occurs on valley terraces and fans below limestone hills in the southwestern part of the survey area. Slopes are 1 to 15 percent. Mapped areas are elongated in shape, and about 60 to 2,000 acres in size.

This association consists of about 60 percent Penasco cobbly loam, 30 percent Ancho loam, and 10 percent less extensive soils.

Included with these soils in mapping are Pena, Remunda, Deama, and Cuevoland soils. Remunda soils are at the higher elevations. Pena and Deama soils are on ridges. The Cuevoland soils are on fans in association with the Ancho soils.

The gently undulating to rolling Penasco soil is on ridges. It has the profile that is described as representative of the series. The nearly level to gently sloping Ancho soil is in depressional areas.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are common in Ancho soils.

This association is used for grazing, watershed, and wildlife habitat. Penasco soil in nonirrigated capability subclass VIIs, Shallow CP–4 range site; Ancho soil in nonirrigated capability subclass VIe, Loamy CP–4 range site.

PN—Penasco-Gabaldon association. This association occurs in valleys between limestone hills in the southwestern part of the survey area. Slopes are 0 to 5 percent. Mapped areas are elongated in shape and about 1,200 to 2,500 acres in size.

This association consists of about 55 percent Penasco gravelly loam, 30 percent Gabaldon silt loam, and 15 percent less extensive soils.

Included with these soils in mapping are Cuevoland, Pena, and Dev soils. Cuevoland soils are on fans. Pena soils are on terraces adjacent to drainageways. Dev soils are on flood plains adjacent to stream channels.

The gently undulating to undulating Penasco soil is on ridges. It has a profile that is similar to the one described as representative of the series, but it has a surface layer of gravelly loam.

The level to nearly level Gabaldon soil is on flood plains. It is rarely flooded.

Runoff is medium. For the Gabaldon soil the hazard of erosion is slight. For the Penasco soil the hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This association is used for grazing, watershed, and wildlife habitat. Penasco soil in nonirrigated capability subclass VIIs, Shallow CP–4 range site; Gabaldon soil in nonirrigated capability subclass VIc, Loamy CP–4 range site.

Pintura Series

The Pintura series consists of deep, somewhat excessively drained soils. These soils formed in recent, wind deposited materials on uplands (fig. 5). Slopes are 3 to 15 percent. Elevation is 3,400 to 3,800 feet. Vegetation is mainly mesquite, broom snakeweed, mesa dropseed, three-awn, plains bristlegrass, and fourwing saltbush. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 190 to 215 days. Pintura soils in this survey area are mapped only in complex with Berino and Pajarito soils.

In a representative profile the soil is yellowish red loamy fine sand to a depth of about 48 inches. Below this is red sandy clay loam to a depth of 60 inches or more. The soil profile is noncalcareous. It is neutral to a depth of 48 inches and mildly alkaline below.

Permeability is rapid, and available water capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing and wildlife habitat.

Representative profile of Pintura loamy fine sand in an area of Berino-Pintura complex, in the center of sec. 20, T. 14 S., R. 29 E.:

C1—0 to 3 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; single grained; loose when dry and moist; many very fine and fine roots; many very fine interstitial pores; neutral; gradual smooth boundary.

C2—3 to 48 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine, fine, and few coarse roots; many very fine interstitial pores; few thin lenses of silt; neutral; clear smooth boundary.

B2tb—48 to 60 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when

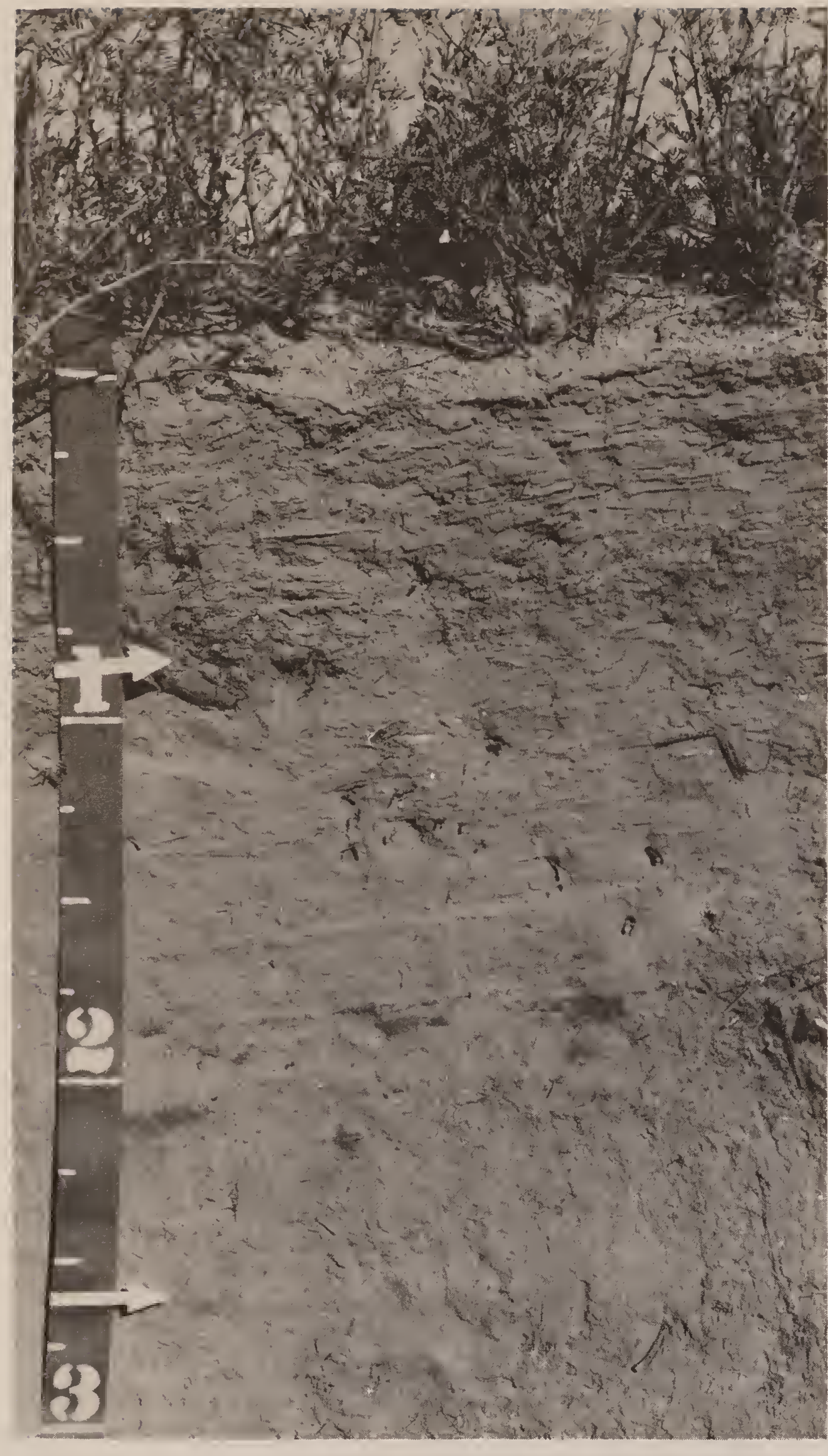

Figure 5.—**Profile of Pintura loamy fine sand. Thin lenses of silt and sand were deposited as the hammock was built up by soil blowing**

moist; weak coarse prismatic structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine tubular pores; common clay bridges between sand grains; mildly alkaline.

The C horizon has hue of 2.5YR or 5YR, value of 4 through 6 when dry and 3 or 4 when moist, and chroma of 4 through 6 when dry and moist. It is loamy fine sand or fine sand. The Btb horizon has hue of 2.5YR or 5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 6 through 8 when dry and moist. It is sandy clay loam or heavy fine sandy loam. Depth to the Btb horizon ranges from 42 to 70 inches or more. The soil is noncalcareous to moderately calcareous and neutral to moderately alkaline.

Reakor Series

The Reakor series consists of deep, well drained soils. These soils formed in alluvium on uplands and valley fans. Slopes are 0 to 3 percent. Elevation is 3,300 to 3,900 feet. Vegetation is mainly burrograss, tobosa, black grama, blue grama, vine-mesquite, three-awn, alkali sacaton, broom snakeweed, and Mormon-tea. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is brown and light brown loam about 7 inches thick. The subsoil is light brown heavy loam and clay loam about 23 inches thick. The substratum is pink clay loam high in content of lime to a depth of 65 inches or more. The soil profile is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Permeability is moderate, and available water capacity is 9 to 12 inches. Effective rooting depth is 65 inches or more (fig. 6).

These soils are used for irrigated crops, grazing, wildlife habitat, watershed, and community development.

Representative profile of Reakor loam, 0 to 1 percent slopes, 0.2 mile east of railroad track and 275 feet south of fence in the NW¼SW¼ of sec. 25, T. 12 S., R. 25 E.:

A11—0 to 2 inches; brown (10YR 5/3) loam, brown (10YR 4/3) when moist; moderate thin platy structure parting to fine granules; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubuar pores; moderately calcareous; moderately alkaline; clear smooth boundary.

A12—2 to 7 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 4/4) when moist; moderate fine subangular blocky structure parting to fine granules; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common fine and very fine and few medium tubular pores; few worm casts; moderately calcareous; moderately alkaline; clear smooth boundary.

B21—7 to 17 inches; light brown (7.5YR 6/4) heavy loam, brown (7.5YR 4/4) when moist, moderate fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine and few fine tubular pores; common worm casts; common lime filaments; strongly calcar-

Figure 6.—**Profile of Reakor loam. The effective rooting zone is deep, and soft masses of lime are in the substratum.**

eous; moderately alkaline; clear smooth boundary.

B22—17 to 30 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; weak fine subangular blocky structure; hard, friable when moist; sticky and plastic when wet; few very fine roots; common very fine tubular pores; common worm casts; common lime filaments; strongly calcareous; moderately alkaline; clear smooth boundary.

C1ca—30 to 44 inches; pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) when moist; massive; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; common fine and medium soft masses of lime; few fine hard lime pebbles; few lime coated limestone pebbles; strongly calcareous; moderately alkaline; gradual smooth boundary.

C2—44 to 65 inches; pink (7.5YR 8/4) clay loam, light brown (7.5YR 6/4) when moist; massive; hard, friable when moist, sticky and plastic when wet; common very fine tubular pores; common soft masses of lime in upper part; strongly calcareous; moderately alkaline.

Depth to the Cca horizon is 20 to 40 inches. The A horizon has value of 3 or 4 when moist and chroma of 2 through 4 when dry and moist. The B horizon has hue of 7.5YR or 10YR when dry and moist, value of 6 or 7 when dry, and chroma of 3 or 4 when dry and moist. It is heavy loam, clay loam, or silty clay loam and has fine or medium subangular blocky structure. The C horizon has value of 6 through 8 when dry and 5 through 7 when moist, and chroma of 3 through 5 when dry and moist. The calcium carbonate equivalent of the C horizon is 20 to 50 percent. The lime in the C horizon occurs as common or many soft masses or is disseminated. Accumulations of gypsum occur below a depth of 40 inches in places. Few pebbles occur throughout the profile in some places.

Ra—Reakor sandy loam. This level soil occurs on uplands mainly along Berrendo Creek. Slopes are 0 to 1 percent. Mapped areas are elongated in shape and about 60 to 640 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer of sandy loam about 12 inches thick. The substratum commonly contains reddish yellow mottles.

The irrigated cropland has generally been leveled to a grade of 0.2 to 0.3 percent for irrigation water management. In areas where land has been cut deeply while leveling, the clay loam subsoil has been exposed.

Included with this soil in mapping are scattered areas of Reakor loam, Atoka, Tencee, and Upton soils that make up about 5 percent of the mapped areas.

Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

This soil is used for irrigated crops, grazing, and community development. Irrigated capability unit IIe–2, nonirrigated capability subclass VIIe; range site Sandy SD–3.

ReA—Reakor loam, 0 to 1 percent slopes. This level soil occurs on uplands west of the Pecos River. The mapped areas are rounded and elongated in shape and about 60 to 1,200 acres in size.

This soil has the profile described as representative of the series. In the northwest part of the city of Roswell, this soil commonly has a clay layer below a depth of 40 inches, and foundation failures are common.

In most areas this soil has been land leveled to a grade of 0.2 to 0.3 percent for water management. In areas where land has been deeply cut while leveling, the clay loam subsoil has been exposed.

Included with this soil in mapping are scattered areas of Reeves, Holloman, Atoka, Tencee, and Upton soils and Reakor loam, 1 to 3 percent slopes. These included soils make up about 15 percent of the mapped areas.

Runoff is medium or slow. The hazard of erosion is slight.

This soil is used for irrigated crops, grazing, community development, and wildlife habitat. Irrigated capability class I, nonirrigated capability subclass VIIc; range site Loamy SD–3.

ReB—Reakor loam, 1 to 3 percent slopes. This nearly level soil occurs on uplands west of the Pecos River. Mapped areas are elongated in shape and about 10 to 200 acres in size.

This soil has a profile similar to the one described as representative of the series but depth to the strongly calcareous substratum is less.

The irrigated cropland has generally been bench leveled to a width of about 100 feet or less. The depth to the substratum of high lime content and, in places, the amount of exposed lime depend upon the depth of the land-leveling cuts. Chlorosis and reduced crop yields occur on exposed lime areas.

Included with this soil in mapping are scattered areas of Reeves, Holloman, Tencee, Upton, and Atoka soils, and Reakor sandy loam and Reakor loam, 0 to 1 percent slopes. These included soils make up about 10 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for irrigated crops, grazing, wildlife habitat, and community development. Irrigated capability unit IIe–6, nonirrigated capability subclass VIIe; range site Loamy SD–3.

RF—Reakor loam, 0 to 3 percent slopes. This level to nearly level soil occurs on uplands west of the Pecos River. Mapped areas are rounded and are elongated in shape and about 40 to 6,000 acres in size.

Included with this soil in mapping are Tencee, Upton, and Atoka soils, and Pecos silty clay loam, nonsaline soils that make up about 5 percent of the mapped areas. The gently undulating Tencee and Upton soils are on ridges. The nearly level Atoka soils are intermixed with Tencee and Upton soils. The level Pecos soils are on flood plains.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIe; range site Loamy SD–3.

RH—Reakor-Pecos association. This association occurs in valleys between low hills in limestone areas. Slopes are 0 to 3 percent. Mapped areas are elongated and are rounded in shape and about 100 to 1,000 acres in size.

This association consists of about 55 percent Reakor loam, 35 percent nonsaline Pecos silty clay loam, and 10 percent less extensive soils.

Included with these soils in mapping are Tencee, Atoka, Dev, and Bigetty soils and areas of soils that are similar to Reakor soils except that they have a dark colored surface layer containing more than 1 percent organic matter. Tencee and Atoka soils are on ridges. Dev and Bigetty soils are on flood plains. The soils similar to Reakor soils are in the transitional area between Reakor soils and nonsaline Pecos soils.

The level to nearly level Reakor soil is on fans. It has a profile that is similar to the one described as representative of the series, but the surface layer is a brown loam about 8 inches thick.

The level to nearly level Pecos soil is on flood plains. It has a profile that is similar to the one described as representative of the series except that it is nonsaline, it has a dark colored surface layer, the subsoil is about 35 inches thick, and soft masses and filaments of lime are below a depth of 30 inches.

Runoff is medium or slow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are few.

This association is used for grazing, wildlife habitat, and watershed. Reakor soil in nonirrigated capability subclass VIIe, Loamy SD–3 range site; Pecos soil in nonirrigated capability subclass VIe, Bottomland SD–3 range site.

RI—Reakor-Tencee association. This association occurs on uplands west of the Pecos River. Slopes are 0 to 5 percent. Mapped areas are rounded in shape and about 100 to 2,000 acres in size.

This association consists of 55 percent Reakor loam, 30 percent Tencee gravelly loam, and 15 percent less extensive soils.

Included with these soils in mapping are Upton, Atoka, Bigetty, and Pecos soils. Upton and Atoka soils are on the ridges intermixed with Tencee soils. Bigetty and Pecos soils are on flood plains.

The level to nearly level Reakor soil is in depressions. The gently undulating to undulating Tencee soil is on ridges. It has the profile that is described as representative of the series.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This association is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIe; Reakor soil in Loamy SD–3 range site, Tencee soil in Gravelly SD–3 range site.

Reakor, Gravelly Subsoil Variant

The Reakor, gravelly subsoil variant, consists of deep, well drained soils. These soils formed in alluvium over gravelly materials on uplands. Slopes are 0 to 3 percent. Elevation is 3,300 to 3,500 feet. Vegetation is mainly burrograss, tobosa, three-awn, black grama, and broom snakeweed. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is pale brown and brown loam about 11 inches thick. The subsoil is brown clay loam about 9 inches thick. The upper part of the substratum is pink clay loam about 11 inches thick. The lower part is pink very gravelly clay loam to a depth of 60 inches or more. The soil profile is moderately calcareous and moderately alkaline throughout.

Permeability is moderate, and available water capacity is 6.5 to 7.5 inches. Effective rooting depth is 60 inches or more.

This soil is used for irrigated crops, grazing, wildlife habitat, watershed, and as a source of gravel.

Representative profile of Reakor loam, gravelly subsoil variant, 282 feet north and 159 feet west of the southwest fence of the Chaves County gravel pit in the NW¼ of sec. 24, T. 11 S., R. 23 E:

A11—0 to 6 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; weak fine subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary

A12—6 to 11 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak fine subangular blocky structure; soft, friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; many fine tubular pores; few worm casts; 5 percent pebbles; moderately calcareous; moderately alkaline; clear smooth boundary.

B2—11 to 20 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; moderate fine subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many fine tubular pores; few worm casts; 10 percent pebbles; few lime filaments; moderately calcareous; moderately alkaline; gradual smooth boundary.

C1ca—20 to 31 inches; pink (7.5YR 8/4) clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many fine tubular pores; 10 percent pebbles; few lime filaments; moderately calcareous; moderately alkaline; gradual smooth boundary.

IIC2ca—31 to 60 inches; pink (7.5YR 8/4) very gravelly clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, friable when moist, sticky and plastic when wet; many fine tubular pores; 45 percent pebbles and cobblestones; few soft masses of lime; moderately calcareous; moderately alkaline.

Depth to gravelly material is 20 to 35 inches. The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist, and chroma of 2 through 4 when dry and moist. The B horizon has hue of 7.5YR or 10YR and value of 5 or 6 when dry and 4 or 5 when moist. It is heavy loam or clay loam and has weak or moderate, fine or medium subangular blocky structure. The C horizon has value of 6 through 8 when dry and 5 through 7 when moist and chroma of 3 through 5 when dry and moist. The pebble content of the IIC2ca horizon averages 30 to 80 percent with 10 to 20 percent cobblestones.

Rg—Reakor loam, gravelly subsoil variant. This level to nearly level soil occurs on uplands west of the Pecos River. Slopes are 0 to 3 percent. Mapped areas are elongated in shape and about 20 to 340 acres in size.

Included with this soil in mapping are scattered areas of Reakor, Atoka, and Bigetty soils that make up about 5 percent of the mapped areas.

Runoff is medium or slow. The hazard of erosion is slight.

This mapping unit is used for grazing, irrigated crops, wildlife habitat, watershed, and as a gravel source. Irrigated capability unit IIs–4, nonirrigated capability subclass VIIe; range site Loamy SD–3.

Reeves Series

The Reeves series consists of deep, well drained soils. These soils formed in gypsiferous alluvium on uplands (fig. 7). Slopes are 0 to 3 percent. Elevation is 3,300 to 3,700 feet. Vegetation is mainly burrograss, three-awn, tobosa, alkali sacaton, broom snakeweed, and fourwing saltbush. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is brown and light brown loam about 7 inches thick. The subsoil is light brown clay loam about 15 inches thick. The upper 9 inches of the substratum is pink clay loam. Below this is pink clay loam to a depth of 79 inches or more. The soil profile is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Permeability is moderate, and available water capacity is 5 to 6 inches. Effective rooting depth to gypsiferous material is 20 to 40 inches.

These soils are used for irrigated crops, grazing, wildlife habitat, and community development.

Representative profile of Reeves loam, 0 to 1 percent slopes, 400 feet east and 293 feet south of the northwest corner of the NE¼ of sec. 11, T. 12 S., R. 25 E.:

A11—0 to 3 inches; brown (10YR 5/3) loam, brown (10YR 4/3) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

A12—3 to 7 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 4/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common fine tubular pores; common worm casts; moderately calcareous; moderately alkaline; clear smooth boundary.

B21ca—7 to 15 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; moderate fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common fine tubular pores; common lime

Figure 7.—**Profile of Reeves loam showing a moderate depth to the gypsum layer that restricts root development.**

filaments; strongly calcareous; moderately alkaline; clear smooth boundary.

B22ca—15 to 22 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist; slightly sticky, slightly plastic when wet; many fine and very fine roots; common fine tubular pores; few fine lime filaments; strongly calcareous; moderately alkaline; clear smooth boundary.

C1ca—22 to 31 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) when moist; massive; slightly hard, very friable when moist, sticky and plastic when wet; few very fine roots; common fine tubular pores; few soft lime masses; strongly calcareous; moderately alkaline; abrupt wavy boundary.

C2cs—31 to 40 inches; pinkish white (7.5YR 8/2) gypsiferous loam, pink (7.5YR 7/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many soft masses and crystals of gypsum; strongly calcareous; moderately alkaline; clear wavy boundary.

C3—40 to 79 inches; pink (7.5YR 8/4) clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, very friable when moist, sticky and plastic when wet; many soft masses and crystals of gypsum; strongly calcareous; moderately alkaline.

The depth to the gypsum horizon is 20 to 40 inches. The A horizon has value of 5 through 7 when dry and 4 or 5 when moist. The B horizon has hue of 5YR through 10YR, value of 5 through 7 when dry and 4 through 6 when moist, and chroma of 3 through 5 when dry and moist. It is clay loam or loam. The Cca horizon has hue of 5YR through 10YR when dry and moist, value of 6 through 8 when dry and 5 through 7 when moist, and chroma of 3 through 5 when dry and moist.

RkA—Reeves loam, 0 to 1 percent slopes. This level soil occurs on uplands west of the Pecos River. Mapped areas are rounded in shape and about 40 to 640 acres in size.

This soil has the profile described as representative of the series. In most areas used for irrigated crops, this soil has been leveled to grades of 0.2 to 0.3 percent for irrigation water management. In areas where deep cuts have been made during land leveling, the gypsiferous material has been exposed.

Included with this soil in mapping are scattered areas of Holloman and Reakor soils and Reeves loam, 1 to 3 percent slopes. Also included are areas of a soil that is similar to Reeves soils except that it has a clayey gypsum layer at depths of 20 to 40 inches; it is mainly in the northwestern part of the city of Roswell. These included areas make up about 15 percent of the mapped areas.

Runoff is medium, and the hazard of erosion is slight.

This soil is used for irrigated crops, grazing, wildlife habitat, and community development. Irrigated capability unit IIIs–9, nonirrigated capability subclass VIIs; range site Loamy SD–3.

RkB—Reeves loam, 1 to 3 percent slopes. This nearly level soil occurs on uplands west of the Pecos River. Mapped area are narrow and elongated in shape and about 40 to 160 acres in size.

In areas used for irrigated crops the land has generally been bench leveled to a width of about 100 feet or less. In areas where land has been cut deeply while leveling, many small areas of gypsiferous material have been exposed.

Included with this soil in mapping are scattered areas of Reeves loam, 0 to 1 percent slopes; Reakor soils; and Holloman soils that make up about 10 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for irrigated crops, grazing, wildlife habitat, and community development. Irrigated capability unit IIIe–12; nonirrigated capability subclass VIIe; range site Loamy SD–3.

RL—Reeves-Holloman association. This association occurs on uplands paralleling the east side of the Pecos River. Slopes are 0 to 5 percent. Mapped areas are elongated in shape and about 1,000 to 3,000 acres in size.

This association consists of 40 percent Reeves loam; 17 percent Holloman loam; 13 percent Holloman loam, thick solum; 20 percent Gypsum land; and 10 percent less extensive soils.

Included with these soils in mapping are scattered areas of Russler and Sotim soils and a few scattered areas of Rock outcrop. The level to nearly level Russler and Sotim soils are in depressions.

The level to nearly level Reeves soil is in depressions. It has a profile that is similar to the one described as representative of the series, but it has a reddish brown subsoil.

The nearly level to gently sloping Holloman soil is in depressions and intermixed with the Gypsum land. It has a profile that is similar to one described as representative of the series, but it is reddish brown. The undulating Gypsum land is on knolls.

For Reeves and Holloman soils runoff is medium, and the hazards of water erosion and soil blowing are moderate. For Gypsum land runoff is rapid, the hazard of water erosion is moderate, and the hazard of soil blowing is severe.

This association is used for grazing, watershed, and wildlife habitat. Reeves soil in nonirrigated capability subclass VIIe, Loamy SD–3 range site; Holloman soils in nonirrigated capability subclass VIIs; Holloman loam in Gyp SD–3 range site, Holloman loam, thick solum, in Loamy SD–3 range site.

Remunda Series

The Remunda series consists of deep, well drained soils. These soils formed in alluvium on fans. Slopes are 0 to 9 percent. Elevation is 5,800 to 6,600 feet. Vegetation is mainly blue grama, hairy grama, wolftail, mountain muhly, three-awn, one-seed juniper, pinyon pine, and algerita. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 185 days.

In a representative profile the surface layer is dark brown loam and clay loam about 6 inches thick. The subsoil is dark brown and reddish brown clay loam and heavy clay loam about 28 inches thick. The substratum is reddish brown and light reddish brown sandy clay loam to a depth of 60 inches or more. The soil profile is noncalcareous and neutral.

Permeability is slow, and available water capacity is 10 to 11 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing, watershed, and wildlife habitat.

Representative profile of Remunda loam in an area of Deama-Remunda association, 650 feet west and 190 feet north of the northwest corner marker of sec. 18, T. 17 S., R. 16 E.:

A11—0 to 3 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) when moist; weak fine granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet, many fine roots; common very fine tubular pores; neutral; abrupt smooth boundary.

A12—3 to 6 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate fine granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common very fine tubular pores; neutral; abrupt smooth boundary.

B1—6 to 15 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate fine subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; many fine roots; common very fine tubular pores; neutral; clear smooth boundary.

B21t—15 to 25 inches; reddish brown (5YR 4/4) heavy clay loam, dark reddish brown (5YR 3/4) when moist; moderate fine angular blocky structure; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; few patchy clay films on peds; neutral; clear smooth boundary.

B22t—25 to 34 inches; reddish brown (5YR 5/4) heavy clay loam, reddish brown (5YR 4/4) when moist; weak fine prismatic structure parting to moderate medium subangular blocks; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; few patchy clay films on peds; neutral; clear wavy boundary.

C1—34 to 45 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; massive; hard, very friable when moist, slightly sticky and plastic when wet; few very fine roots; common very fine tubular pores; neutral; clear wavy boundary.

C2—45 to 60 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 4/4) when moist; massive; hard, very friable when moist, slightly sticky and plastic when wet; few very fine tubular pores; neutral.

The color of the A horizon has hue of 7.5YR or 10YR when dry and moist, value of 3 or 4 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The Bt horizon has hue of 5YR or 7.5YR and chroma of 3 or 4 when dry and moist. It is silty clay loam or clay loam. The C horizon has hue of 5YR or

7.5YR, value of 4 or 5 when moist, and chroma of 3 through 5 when dry and moist. It is sandy clay loam, silty clay loam or clay loam.

RM—Remunda-Penasco association. This association occurs in narrow limestone valleys in the southwestern part of the survey area. Slopes are 1 to 15 percent. Mapped areas are 1 to 4 miles long, narrow and elongated in shape, and about 80 to 400 acres in size.

This association consists of about 55 percent Remunda loam, 20 percent Penasco cobbly loam, and 25 percent less extensive soils.

Included with these soils in mapping are scattered areas of Pena, Gabaldon, Deama, Dev, Ancho, and Cuevoland soils and areas of soils that are similar to Remunda soils except that they have bedrock at depths of 20 to 40 inches. Pena and Deama soils are on ridges. Gabaldon and Dev soils are on flood plains. Ancho and Cuevoland soils are in depressions in association with Remunda soils.

The nearly level to moderately sloping Remunda soil is in depressions. It has a profile that is similar to the one described as representative of the series, but it has a clay loam substratum. The gently undulating to rolling Penasco soil is on ridges.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Gullies are few to common in areas of Remunda soils.

This association is used for grazing, watershed, and wildlife habitat. Remunda soil in nonirrigated capability subclass VIe, Loamy CP–4 range site; Penasco soil in nonirrigated capability subclass VIIs, Shallow CP–4 range site.

Rock Outcrop

This miscellaneous area consists of exposed bedrock. It occurs on ridges, hills, and escarpments. Slopes are mostly 0 to 50 percent, but vertical cliffs are common.

Rock outcrop consists mostly of limestone that weathers slowly. Interbedded siltstone and shale also are included. Rock outcrop is mapped only in complex with the Deama and Ector soils in this survey area.

This miscellaneous area is used for watershed.

Roswell Series

The Roswell series consists of deep, excessively drained soils. These soils formed in aeolian and alluvial sediments on uplands. Slopes are 1 to 15 percent. Elevation is 3,500 to 4,100 feet. Vegetation is mainly sand dropseed, little bluestem, sand bluestem, threeawn, sandbur, shinnery oak, sand sagebrush, and yucca. The mean annual precipitation is 12 to 13 inches, and the mean annual soil temperature is 59° to 61° F. The frost-free season is 190 to 205 days.

In a representative profile the surface layer is light brown fine sand about 13 inches thick. The underlying material is pink fine sand to a depth of 88 inches or more. The soil profile is noncalcareous and neutral.

Permeability is rapid, and available water capacity is 3 to 4 inches. Effective rooting depth is 60 inches or more.

This soil is used for grazing and wildlife habitat.

Representative profile of Roswell fine sand in an area of Roswell-Jalmar complex, 174 feet south and 180 feet west of oil well standpipe located in SE¼SE¼ of sec. 6, T. 13 S., R. 31 E.:

A11—0 to 5 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grained; loose dry and moist; many very fine roots; many very fine interstitial pores; neutral; abrupt smooth boundary.

A12—5 to 13 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine and few coarse roots; many very fine interstitial pores; neutral; gradual smooth boundary.

C—13 to 88 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots and common coarse roots; many interstitial pores; neutral.

The color of the A and C horizons has hue of 7.5YR or 5YR and chroma of 3 or 4 when dry and moist. Texture between depths of 10 and 40 inches is fine sand or loamy fine sand. In places, the C horizon is sandy loam or sandy clay loam below a depth of 40 inches.

Rn—Roswell-Jalmar complex. This complex occurs on deep sand uplands in the eastern part of the survey area west of the High Plains. Slopes are 0 to 15 percent. The mapped area is continuous and elongated in shape.

This complex consists of about 60 percent Roswell fine sand, 25 percent Jalmar fine sand, and 15 percent less extensive soils.

Included with this soil in mapping are scattered areas of Faskin and Malstrom soils and areas of soils that are similar to the Jalmar soils except that they have less than 18 percent clay in the subsoil.

The gently undulating to rolling Roswell soil is in the billowy areas of deep sands. It has the profile that is described as representative of the series.

The level to nearly level Jalmar soil is in the depressions. It has the profile described as representative of the series.

Runoff is very slow. The hazard of water erosion is slight, and the hazard of soil blowing is severe.

This complex is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; Roswell soil in Sandhills CP–2 range site, Jalmar soil in Deep Sand CP–2 range site.

Russler Series

The Russler series consists of saline, well drained soils that are moderately deep to gypsum. These soils formed in alluvium over gypsum beds on uplands (fig. 8). Slopes are 0 to 3 percent. Elevation is 3,300 to 3,700 feet. Vegetation is mainly tobosa, burrograss, black grama, broom snakeweed, and soaptree yucca. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is brown silty clay loam about 2 inches thick. The subsoil is red-

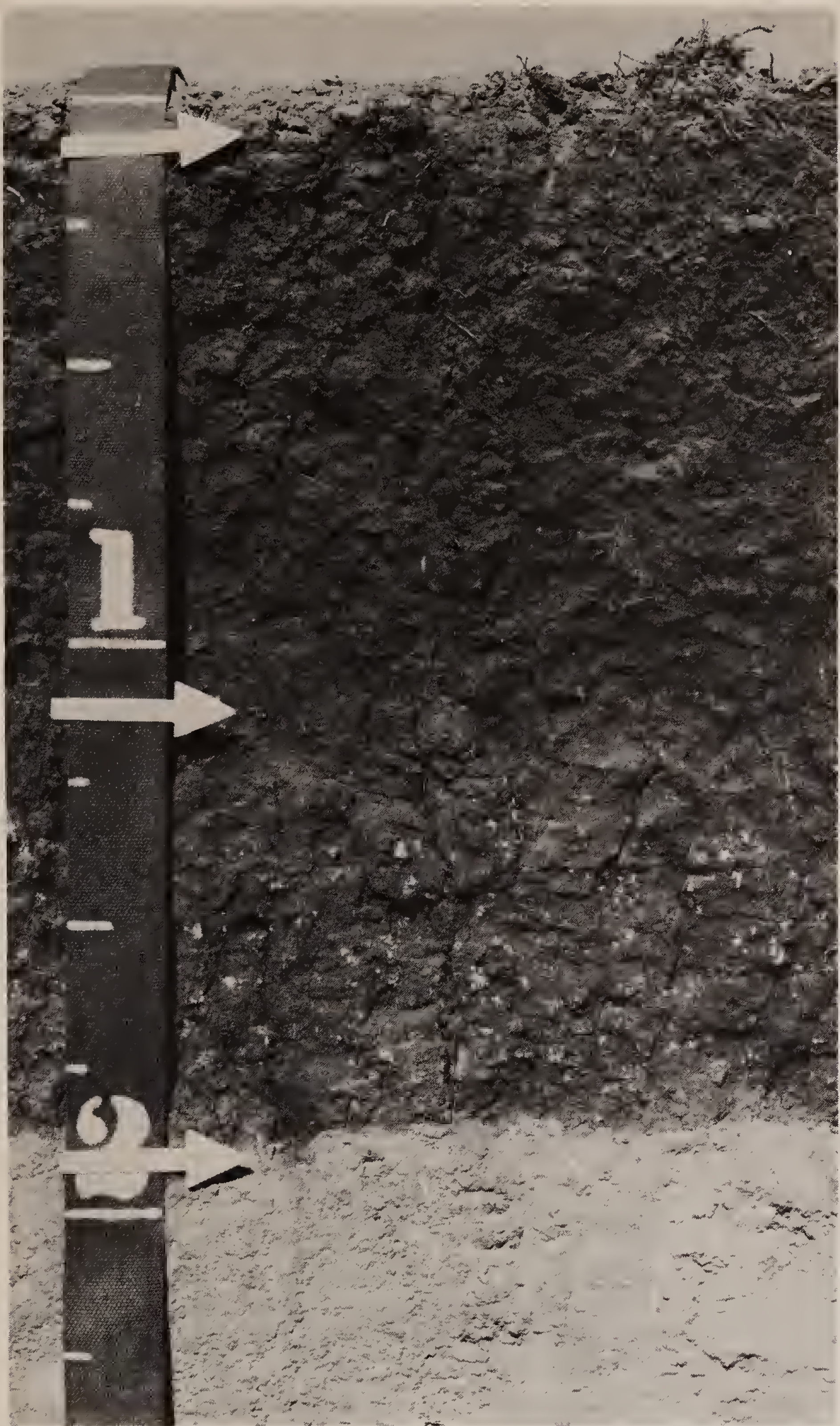

Figure 8.—**Profile of Russler loam. The subsoil has prismatic structure and gypsum material restricts root development.**

dish brown silty clay loam about 20 inches thick. The substratum is reddish and white gypsiferous bedrock to a depth of 36 inches or more. The soil profile is slightly calcareous in the upper part and strongly calcareous in the lower part; it is moderately alkaline.

Permeability is slow, and available water capacity is 2 to 4 inches. Effective rooting depth to gypsum is 20 to 35 inches.

This soil is used for grazing, watershed, and wildlife habitat.

Representative profile of Russler silty clay loam, 435 feet west and 195 feet south of the northeast corner marker of sec. 4, T. 11 S., R. 26 E.:

A1—0 to 2 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) when moist; weak thin platy structure parting to moderate fine granules; slightly hard, very friable when moist, sticky and plastic when wet; many very fine and fine roots; common fine vesicular pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

B21—2 to 7 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) when moist; moderate fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many very fine and fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline; clear smooth boundary.

B22—7 to 13 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) when moist; strong medium subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; many fine and very fine roots; many very fine tubular pores; strongly calcareous; moderately alkaline; clear smooth boundary.

B23ca—13 to 22 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) when moist; strong medium prismatic structure parting to strong medium subangular blocks; very hard, firm when moist, very sticky and very plastic when wet; many very fine roots; many very fine tubular pores; common soft lime masses; strongly calcareous; moderately alkaline; abrupt wavy boundary.

Cr—22 to 36 inches; reddish and white soft crystaline gypsum.

The depth to gypsum is 20 to 40 inches. The A horizon has hue of 5YR or 7.5YR, value of 4 or 5 when dry, and chroma of 3 or 4 when dry and moist. The B horizon has hue of 2.5YR or 5YR, value of 3 or 4 when dry and moist, and chroma of 4 through 5 when dry and moist. The B horizon is silty clay loam or clay loam.

Ru—Russler silty clay loam. This level to nearly level soil occurs on uplands east of the Pecos River. Slopes are 0 to 3 percent. Mapped areas are elongated in shape and about 20 to 2,500 acres in size.

Included with this soil in mapping are scattered areas of Rock outcrop; Gypsum land; and Holloman, Sotim, and Reeves soils that make up 10 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIe; range site Loamy SD–3.

Shanta Series

The Shanta series consists of deep, well drained soils. These soils formed in stratified alluvium on flood plains that are occasionally flooded. Slopes are 1 to 3 percent. Elevation is 5,600 to 5,900 feet. Vegetation is mainly blue grama, giant sacaton, cactus, cottonwood, and native walnut. The mean annual precipitation is 16 to 18 inches, and the mean annual soil temperature is 55° to 58° F. The frost-free season is 170 to 185 days.

In a representative profile the upper part of the surface layer is brown silt loam about 3 inches thick. The lower part of the surface layer is dark brown clay loam about 5 inches thick. The upper 12 inches of the underlying material is dark grayish brown and dark brown clay loam. The lower part of the underlying material is very dark gray silty clay loam to a depth of 60 inches or more. The soil profile is slightly calcareous and moderately alkaline.

Permeability is moderate, and available water capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops, pasture, orchards, grazing, watershed, and wildlife habitat.

Representative profile from an area of Shanta silt loam, 9 feet east of road and 225 feet south of the Rio Penasco crossing in the SW¼ of sec. 3, T. 16 S., R. 17 E.:

A11—0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; weak thin platy structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; common very fine tubular pores; slightly calcareous; moderately alkaline; clear smooth boundary.

A12—3 to 8 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate fine subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; common fine and very fine roots; common fine and very fine tubular pores; slightly calcareous; moderately alkaline; clear smooth boundary.

C1—8 to 15 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate fine subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; common very fine roots; common very fine tubular pores; few worm casts; slightly calcareous; moderately alkaline; clear wavy boundary.

C2—15 to 20 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; weak fine subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; few fine and very fine roots; common very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear smooth boundary.

C3—20 to 22 inches; dark brown (10YR 4/3) silt loam, dark brown (10YR 3/3) when moist; weak thin platy structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few very fine tubular pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

C4—22 to 60 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; moderate medium subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; few very fine roots; common fine and very fine tubular pores; few pebbles; slightly calcareous; moderately alkaline.

The A and C horizons are mildly alkaline or moderately alkaline. The C horizon has value of 3 through 5 when dry and 2 through 4 when moist and chroma of 1 through 3 when dry and moist. The C horizon is stratified loam, clay loam, silt loam, silty clay loam, or fine sandy loam. Some pebbles occur throughout the profile in places.

Sh—Shanta silt loam. This soil occurs on the upper part of the flood plain of the Rio Penasco. Slopes are 1 to 3 percent. The mapped area is continuous, narrow and about 2,000 acres in size. The part of the area used for crops is protected from flooding.

Included with this soil in mapping are scattered areas of Dev, Pena, and Ancho soils; riverwash; and Shanta soils that are similar to this Shanta soil except that they have a surface layer of loam or clay loam, or they are gravelly and cobbly at depths of 20 to 40 inches. Pena and Ancho soils are on the valley terraces and fans. The riverwash is in the stream channel.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is extensively used for irrigated crops, pasture, and orchards. Minor areas are used for grazing, watershed, and wildlife habitat. Protected areas in irrigated capability unit IIe–6, nonirrigated capability subclass VIe, not assigned to a range site; occasionally flooded areas in nonirrigated capability subclass VIw, range site Bottomland CP–4.

Sharvana Series

The Sharvana series consists of well drained soils that are shallow to indurated caliche. These soils formed in aeolian and alluvial sediments on the High Plains. Slopes are 0 to 1 percent. Elevation is 4,300 to 4,400 feet. Vegetation is mainly blue grama, black grama, three-awn, sand dropseed, broom snakeweed, and mesquite. The mean annual precipitation is 14 to 16 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 205 days. Sharvana soils are mapped only in complex with Kimbrough soils in this survey area.

In a representative profile the surface layer is reddish brown fine sandy loam about 6 inches thick. The subsoil is reddish brown sandy clay loam about 6 inches thick. The substratum is reddish brown gravelly sandy clay loam about 4 inches thick. White indurated caliche is at a depth of 16 inches. The soil profile is noncalcareous in the surface layer and subsoil and moderately calcareous in the substratum. It is mildly alkaline throughout.

Permeability is moderate, and available water capacity is 2 or 3 inches. Effective rooting depth to indurated caliche is 8 to 20 inches.

These soils are used for grazing and wildlife habitat.

Representative profile of Sharvana fine sandy loam in an area of Kimbrough-Sharvana complex, 170 feet south and 60 feet west of the northeast corner marker of sec. 4, T. 12 S., R. 31 E.:

A11—0 to 3 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak fine subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; common very fine interstitial pores; mildly alkaline; abrupt smooth boundary.

A12—3 to 6 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak medium subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; common very fine interstitial pores; mildly alkaline; abrupt smooth boundary.

B2t—6 to 12 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; weak coarse prismatic structure parting to weak fine subangular blocks; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common very fine tubular pores; patchy clay films on peds; mildly alkaline; abrupt smooth boundary.

C1ca—12 to 16 inches; reddish brown (5YR 5/4) gravelly sandy clay loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common very fine tubular pores; 45 percent caliche pebbles; moderately calcareous; mildly alkaline; abrupt wavy boundary.

C2cam—16 to 20 inches; white (N 8/0) indurated caliche; few fractures; cementing decreases with depth; several feet thick.

The depth to indurated caliche is from 8 to 20 inches. The A horizon has hue of 7.5YR or 5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The B and C horizons have value of 4 or 5 when dry and 3 or 4 when moist and chroma of 3 or 4 when dry and moist. The B horizon is sandy clay loam or sandy loam. The C1 horizon is gravelly sandy clay loam or gravelly sandy loam. The caliche pebble content in the C1ca horizon ranges from 40 to 70 percent. The C1ca horizon is absent in some profiles.

Simona Series

The Simona series consists of well drained soils that are very shallow to shallow to indurated caliche. These soils formed in aeolian and alluvial sediments on uplands. Slopes are 0 to 5 percent. Elevation is 3,400 to 3,800 feet. Vegetation is mainly black grama, bush muhly, three-awn, sand dropseed, broom snakeweed, mesquite, graythorn, and yucca. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is reddish yellow fine sandy loam about 2 inches thick. The subsoil is reddish brown and light reddish brown fine sandy loam about 8 inches thick. The substratum is yellowish red very gravelly fine sandy loam about 3 inches thick. White indurated caliche is at a depth of 13 inches. The soil profile is noncalcareous and mildly alkaline in the surface layer becoming moderately to strongly calcareous and moderately alkaline in the subsoil and substratum.

Permeability is moderately rapid, and available water capacity is 1 to 2 inches. Effective rooting depth to indurated caliche is 7 to 20 inches.

This soil is used for grazing and wildlife habitat.

Representative profile of Simona fine sandy loam, 165 feet north and 290 feet west of the southeast corner marker of sec. 13, T. 12 S., R. 28 E.:

A1—0 to 2 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 4/6) when moist; single grained; loose when dry and moist; many fine roots; common very fine interstitial pores; mildly alkaline; abrupt smooth boundary

B21—2 to 6 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak fine subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; few very fine tubular pores; slightly calcareous; mildly alkaline; clear smooth boundary.

B22—6 to 10 inches; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak fine subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; few very fine tubular pores; few lime filaments; moderately calcareous; moderately alkaline; clear wavy boundary.

C1ca—10 to 13 inches; yellowish red (5YR 5/6) very gravelly fine sandy loam, yellowish red (5YR 4/6) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; few very fine tubular pores; 50 to 60 percent caliche pebbles and cobblestones; strongly calcareous; moderately alkaline; abrupt wavy boundary.

C2cam—13 inches; white (N 8/0), indurated caliche; thick platy structure in the upper part grading to cemented pebbles and cobblestones in the lower part.

The depth to indurated caliche is 7 to 20 inches. The A, B, and C horizons have hue of 5YR or 7.5YR, value of 4 through 6 when dry and 3 or 4 moist and chroma of 3 through 6 when dry and moist. The B horizon is fine sandy loam or sandy loam with 0 to 5 percent caliche pebbles. The C1 horizon is gravelly or very gravelly fine sandy loam or gravelly sandy loam and is 40 to 55 percent caliche pebbles and cobblestones.

Sm—Simona fine sandy loam. This level to undulating soil occurs on uplands east of the Pecos River. Slopes are 0 to 5 percent. Mapped areas are rounded in shape and about 200 to 2,000 acres in size. A small acreage of this soil, mapped west of the High Plains escarpment, is more moist than is typical of Simona soils.

Included with this soil in mapping are scattered areas of Tencee, Berino, Sotim, and Pecos soils and areas of a soil that is similar to the Simona soil except that it is deeper than 20 inches to the indurated caliche. Pecos soils are in the small round depressions.

Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is severe. Moderate soil blowing is common.

This soil is used for grazing and wildlife habitat. Nonirrigated capability subclass VIIe; range site Shallow Sand SD–3.

Slaughter Series

The Slaughter series consists of well drained soils that are shallow to indurated caliche. These soils formed in alluvium on the High Plains. Slopes are 0 to 1 percent. Elevation is 4,300 to 4,400 feet. Vegetation is mainly tobosa, blue grama, broom snakeweed, mesquite, and cholla cactus. The mean annual precipitation is 14 to 16 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 205 days. Slaughter soils are mapped only in complex with Kimbrough and Stegall soils in this survey area.

In a representative profile the surface layer is brown loam about 3 inches thick. The subsoil is dark brown and reddish brown clay loam about 11 inches thick. White indurated caliche is at a depth of 14 inches. The soil profile is noncalcareous in the surface layer and becomes slightly calcareous in the lower part of the subsoil. It is mildly alkaline throughout.

Permeability is moderately slow, and available water capacity is 2 to 3 inches. Effective rooting depth to indurated caliche is 10 to 20 inches.

This soil is used for grazing and wildlife habitat.

Representative profile of Slaughter loam in an area of Kimbrough-Stegall-Slaughter complex, 0.15 mile east and 280 feet south of the southwest corner marker of sec. 14, T. 13 S., R. 31 E.:

A1—0 to 3 inches; brown (7.5YR 5/2) loam, very dark brown (10YR 2/2) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common very fine tubular pores; mildly alkaline; abrupt smooth boundary

B1—3 to 6 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many very fine roots; common very fine tubular pores; mildly alkaline; abrupt smooth boundary.

B21t—6 to 11 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; strong fine angular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; many very fine roots; few very fine tubular pores; continuous clay films on peds; mildly alkaline; abrupt smooth boundary.

B22t—11 to 14 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; strong fine angular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; common very fine roots; few very fine tubular pores; continuous clay films on peds; few lime filaments; slightly calcareous; mildly alkaline; abrupt wavy boundary.

Ccam—14 to 24 inches; white (N 8/0) indurated caliche with few fractures; cementation decreases with depth.

The depth to indurated caliche is 10 to 20 inches. The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry and moist. The B horizon is clay loam or light clay.

Sotim Series

The Sotim series consists of deep, well drained soils. These soils formed in alluvium on uplands. Slopes are 0 to 5 percent. Elevation is 3,400 to 3,900 feet. Vegetation is mainly burrograss, tobosa, three-awn, black grama, blue grama, broom snakeweed, mesquite, and soaptree yucca. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is reddish brown fine sandy loam about 7 inches thick. The subsoil is reddish brown and reddish yellow light clay loam about 10 inches thick. The substratum is light red light clay loam to a depth of 70 inches or more. The soil profile is moderately calcareous in the surface layer and upper part of the subsoil and strongly calcareous below. It is moderately alkaline throughout.

Permeability is moderately slow, and available water capacity is 9 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazing, watershed, and wildlife habitat.

Representative profile of Sotim fine sandy loam, 240 feet west of the east ¼ corner marker of sec. 36, T. 15 S., R. 26 E.:

A11—0 to 2 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak thin platy structure; slightly hard, very friable when moist; many very fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

A12—2 to 7 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

B21—7 to 12 inches; reddish brown (5YR 5/4) light clay loam, yellowish red (5YR 4/6) when moist; moderate fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many very fine roots; common very fine tubular pores; common worm casts; few lime filaments; moderately calcareous; moderately alkaline; clear smooth boundary.

B22—12 to 17 inches; reddish yellow (5YR 6/6) light clay loam, yellowish red (5YR 4/6) when moist; weak fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many very fine roots; common very fine tubular pores; few worm casts; common lime filaments; strongly calcareous; moderately alkaline; clear smooth boundary.

C1ca—17 to 26 inches; light red (2.5YR 6/6) light clay loam, red (2.5YR 4/6) when moist; massive; hard, friable when moist, sticky and plastic when wet; common very fine roots; common very fine tubular pores; common soft masses and filaments of lime; strongly calcareous; moderately alkaline; clear smooth boundary.

C2ca—26 to 70 inches; light red (2.5YR 6/6) light clay loam, red (2.5YR 4/6) when moist; massive; hard, friable when moist, sticky and plastic when wet; few very fine roots in upper part; common very fine tubular pores; common soft masses of lime; strongly calcareous; moderately alkaline.

The A horizon has hue of 5YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The B horizon has value of 4 or 5 when moist. It is clay loam or heavy loam, and has fine or medium subangular blocky structure. The C horizon has hue of 5YR or 2.5YR, value of 5 through 8 when dry and 4 through 7 when moist, and chroma of 4 through 8 when dry and moist. It is clay loam or heavy loam. Weathered silt and sandstone fragments and small amounts of gypsum are below a depth of 40 inches in places.

So—Sotim fine sandy loam. This level to nearly level soil occurs on uplands east of the Pecos River. Slopes are 0 to 3 percent. Mapped areas are rounded and elongated in shape and about 50 to 640 acres in size.

Included with this soil in mapping are scattered areas of Russler, Reeves, Tencee, and Sotim loams; Rock outcrop; Gypsum land; and small areas of a soil that is similar to Sotim soils except that it has a subsoil and substratum of light sandy clay loam. These included soils make up about 15 percent of the mapped areas.

Runoff is medium. The hazards of water erosion and soil blowing are moderate.

This soil is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIe; range site Loamy SD–3.

Stegall Series

The Stegall series consists of well drained soils that are moderately deep to indurated caliche. These soils formed in alluvium on the High Plains. Slopes are 0 to 1 percent. Elevation is 4,300 to 4,400 feet. Vegetation is mainly tobosa, blue grama, broom snakeweed, mesquite, and cholla cactus. The mean annual precipitation is 14 to 16 inches, and the mean annual soil temperature is 59° to 62° F. The frost-free season is 190 to 205 days. Stegall soils are mapped only in complex with Kimbrough and Slaughter soils in this survey area.

In a representative profile the surface layer is brown loam about 3 inches thick. The subsoil is dark brown and brown clay loam, heavy clay loam, and gravelly clay loam about 32 inches thick. White indurated caliche is at a depth of 35 inches. The soil profile is noncalcareous and mildly alkaline in the surface layer and upper part of the subsoil, and becomes slightly calcareous and moderately alkaline in the lower part of the subsoil.

Permeability is moderately slow, and available water capacity is 5 to 6.5 inches. Effective rooting depth to indurated caliche is 20 to 40 inches.

This soil is used for grazing and wildlife habitat.

Representative profile of Stegall loam in an area of Kimbrough-Stegall-Slaughter complex, 390 feet east and 90 feet north of the cattleguard at the northeast section corner of sec. 10, T. 13 S., R. 31 E.:

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak thin platy structure parting to weak fine granules; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; many very fine tubular pores; mildly alkaline; abrupt smooth boundary.

B1—3 to 10 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) when moist; moderate fine subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; many very fine roots; many fine and very fine tubular pores; mildly alkaline; abrupt smooth boundary.

B21t—10 to 18 inches; brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 3/4) when moist; moderate medium prismatic structure parting to strong fine angular blocks; hard, firm when moist, sticky and plastic when wet; many very fine roots; many very fine tubular pores; patchy clay films on peds; few cracks a quarter inch wide; mildly alkaline; abrupt smooth boundary.

B22t—18 to 30 inches; brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 3/4) when moist; strong fine angular blocky structure; hard, firm when moist, sticky and plastic when wet; common very fine roots; many very fine tubular pores; patchy and continuous clay films on peds; moderately alkaline; abrupt smooth boundary.

B3—30 to 35 inches; brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) when moist; weak medium subangular blocky structure; hard, firm when moist, sticky and plastic when wet; few very fine roots; many very fine tubular pores; few lime filaments; 45 percent caliche pebbles and cobblestones; slightly calcareous; moderately alkaline; abrupt wavy boundary.

C1cam—35 to 38 inches; white (N 8/0) continuous indurated caliche; laminar in the upper part; cementation decreases with depth.

The depth to indurated caliche is 20 to 40 inches. The A and B1 horizons have value of 2 or 3 when moist, and chroma of 2 or 3 when dry and moist. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 through 4 when dry and moist. The Bt horizon is heavy clay loam or light clay and is 35 to 45 percent clay. The B3 horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. It is a clay loam or sandy clay loam and is 5 to 50 percent caliche pebbles and cobblestones.

Tencee Series

The Tencee series consists of well drained soils that are very shallow and shallow to indurated caliche. These soils formed in gravelly and cobbly alluvium on uplands. Slopes are 1 to 30 percent. Elevation is 3,400 to 4,200 feet. Vegetation is mainly black grama, bush muhly, three-awn, fluffgrass, graythorn, creosotebush, mesquite, and broom snakeweed. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is yellowish brown gravelly loam about 2 inches thick. The subsoil is brown loam about 3 inches thick. The substratum is brown very gravelly loam about 4 inches thick. White indurated caliche is at a depth of 9 inches and extends to a depth of 31 inches. Below this is weakly cemented caliche and pebbles and cobblestones to a depth of 51 inches or more. The soil profile is strongly calcareous and moderately alkaline throughout.

Permeability is moderate, and available water capacity is 1 to 2 inches. Effective rooting depth to indurated caliche is 6 to 20 inches.

These soils are used for grazing, watershed, wildlife habitat, and community development and as a source of crushed caliche.

Representative profile of Tencee gravelly loam in an area of Reakor-Tencee association, 135 feet south and 21 feet west of the Southwestern Public Service Company substation in the NE$\frac{1}{4}$NE$\frac{1}{4}$NE$\frac{1}{4}$ of sec. 4, T. 14 S., R. 25 E.:

A1—0 to 2 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) when moist; weak fine subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; common very fine tubular pores; 15 percent limestone and caliche pebbles; strongly calcareous; moderately alkaline; abrupt smooth boundary.

B2—2 to 5 inches; brown (10YR 5/3) loam, brown (10YR 4/3) when moist; moderate fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; 10 percent limestone and caliche pebbles; few lime filaments; strongly calcareous; moderately alkaline; clear wavy boundary.

C1ca—5 to 9 inches; brown (10YR 5/3) very gravelly loam, brown (10YR 4/3) when moist; weak fine subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few very fine roots; common very fine tubular pores; 65 percent limestone and caliche pebbles and cobblestones; few lime filaments; pebbles and cobblestones coated with lime; strongly calcareous; moderately alkaline; abrupt wavy boundary.

C2cam—9 to 31 inches; white (N 8/0) indurated caliche; grading to strongly cemented in the lower part.

C3—31 to 51 inches; white (N 8/0) weakly cemented to noncemented caliche and limestone pebbles and cobblestones.

The depth to indurated caliche is 6 to 20 inches. The A and B horizons have hue of 10YR or 7.5YR, value of 4 through 6 when dry and 3 through 5 when moist, and chroma of 2 through 6 when dry and moist. The A horizon is 5 to 30 percent caliche and limestone pebbles. The B horizon is loam, clay loam, or fine sandy loam that is 5 to 20 percent caliche and limestone pebbles; very shallow profiles generally do not have a B horizon. The C1ca horizon has hue of 10YR or 7.5YR, value of 4 through 7 when dry and 3 through 5 when moist, and chroma of 3 through 6 when dry and moist. It is loam, light clay loam, or fine sandy loam that is 35 to 80 percent caliche and limestone pebbles and cobblestones. The C2cam horizon is nearly continuous but contains lenses and pockets of medium textured soil materials that are not cemented or are only weakly cemented.

Te—Tencee gravelly sandy loam. This nearly level to gently rolling soil occurs on uplands east of the Pecos River. Slopes are 1 to 9 percent. Mapped areas are rounded in shape and about 320 to 2,000 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer and a subsoil of gravelly sandy loam.

Included with this soil in mapping are scattered areas of Sotim, Berino, Simona, Pajarito, and Pecos soils that make up about 10 percent of the mapped areas. These soils are in depressions.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for grazing, watershed, and wildlife habitat and as a source of crushed caliche. Nonirrigated capability subclass VIIe; range site Gravelly SD–3.

TfD—Tencee cobbly loam, 5 to 30 percent slopes. This gently rolling to hilly soil occurs on hills in the northwestern part of the survey area. Mapped areas are rounded in shape and about 100 to 1,000 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer of dark brown cobbly loam.

Included with this soil in mapping are Tencee gravelly loam; Upton, Pecos, Atoka, and Reakor soils; and Rock outcrop that make up about 25 percent of the mapped areas. Rock outcrop and Upton soils are scattered throughout the mapped areas. Atoka and Reakor soils are in depressions. Pecos soils are on flood plains.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIe; range site Hills CP–4.

Tg—Tencee-Upton complex. This mapping unit is nearly level to gently rolling soils on upland ridges west of the Pecos River. Slopes are 0 to 9 percent. Mapped areas are elongated and rounded in shape and about 5 to 12,500 acres in size.

This complex consists of 55 percent Tencee gravelly loam, 35 percent Upton gravelly loam, and 10 percent less extensive soils.

Included in mapping are Atoka, Reakor, and Pecos soils, and Reakor loam, gravelly subsoil variant. Except for the Pecos soils, these soils are in depressions and are intermingled with the Tencee and Upton soils. The Pecos soils are on flood plains.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This complex is used for grazing, wildlife habitat, and watershed and as a source of crushed caliche. Nonirrigated capability subclass VIIe; range site Gravelly SD–3.

TS—Tencee-Sotim association. This association occurs on uplands east of the Pecos River. Slopes are 0 to 9 percent. Mapped areas are rounded in shape and about 60 to 1,300 acres in size.

This association consists of 50 percent Tencee gravelly fine sandy loam, 30 percent Sotim fine sandy loam, and 20 percent less extensive soils.

Included with these soils in mapping are Pecos, Berino, Simona, Reeves, Holloman, and Sotim soils; Tencee loams; Rock outcrop; and Gypsum land. Also included are small areas of a soil that is similar to the Sotim soil except that it has a subsoil and substratum of light sandy clay loam. Except for the Rock outcrop, these inclusions are in scattered depressions. The Rock outcrop is on ridges.

The gently undulating to gently rolling Tencee soil is on ridges. It has a profile that is similar to the one described as representative of the series, but it has a surface layer and a subsoil of gravelly fine sandy loam.

The level to gently sloping Sotim soil is in depressions. It has a profile that is similar to the one described as representative of the series, but it has a subsoil and a substratum of clay loam.

Runoff is medium. For Tencee soils the hazard of water erosion is moderate, and the hazard of soil blowing is slight. For Sotim soils the hazards of water erosion and soil blowing are moderate.

This association is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIe; Tencee soil in Gravelly SD–3 range site, Sotim soil in Loamy SD–3 range site.

Torriorthents, Very Steep

TOF—Torriorthents, very steep. This mapping unit occurs in the east-central part of this survey area and along the High Plains escarpments. Slopes are 30 to more than 80 percent. Mapped areas are narrow and elongated in shape and about 80 to 2,500 acres in size.

These soils are mainly steep and very steep, calcareous, gravelly, and cobbly. They have medium to coarse texture and are commonly stratified.

Included in mapping are sandstone, red shale, and indurated caliche that make up about 10 percent of the mapped areas, and Ima soils that make up about 10 percent. The soils and Rock outcrop are intermixed. Rock outcrop dominantly occurs on the upper part of the escarpment.

The sparse vegetation consists of black grama, blue grama, side-oats grama, bush muhly, three-awn, sand dropseed, yucca, mesquite, and littleleaf sumac.

Runoff is very rapid. The hazard of water erosion is severe, and the hazard of soil blowing is moderate. Gullies are common.

This unit is used for watershed, wildlife habitat, and grazing. Use is limited because slopes are very steep. Nonirrigated capability subclass VIIe; range site Breaks HP–3.

Upton Series

The Upton series consists of well drained soils that are very shallow and shallow to indurated caliche (fig. 9). These soils formed in gravelly and cobbly alluvium on uplands. Slopes are 0 to 5 percent. Elevation is 3,300 to 4,200 feet. Vegetation is mainly three-awn, fluffgrass, blue grama, tridens, black grama, side-oats grama, broom snakeweed, and creosotebush. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is a brown gravelly loam about 4 inches thick. The subsoil is a brown gravelly loam about 9 inches thick. White indurated gravelly and cobbly caliche is at a depth of 13 inches. The soil profile is strongly calcareous and moderately alkaline throughout.

Permeability is moderate, and available water capacity is 1 to 2 inches. Effective rooting depth to indurated caliche is 6 to 20 inches.

Figure 9.—**Profile of Upton gravelly loam. The soil is a thin layer that has very low available water capacity; indurated caliche restricts root development.**

This soil is used for grazing, watershed, wildlife habitat, community development and as a source for crushed caliche.

Representative profile of Upton gravelly loam in an area of Upton-Atoka association, 0.1 mile south of the 1/4 corner marker of sections 9 and 10, T. 13 S., R. 23 E.:

A1—0 to 4 inches; brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/4) when moist; weak medium granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common medium and fine roots; common fine tubular pores; 25 percent caliche pebbles and cobblestones on the surface; strongly calcareous; moderately alkaline; clear smooth boundary.

B2—4 to 13 inches; brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/4) when moist; weak medium subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common very fine tubular pores; few worm casts; 30 percent caliche pebbles and cobblestones; strongly calcareous; moderately alkaline; clear wavy boundary.

Ccam—13 to 22 inches; white (N 8/0) indurated gravelly and cobbly caliche; laminar in the upper part; degree of cementation decreases with depth; lower part weakly cemented gravel and cobblestones.

The depth to indurated caliche is 6 to 20 inches. The A and B horizons have hue of 10YR or 7.5YR, value of 4 through 6 when dry and 4 or 5 when moist, and chroma of 2 through 4 when dry and moist. The B horizon is loam or clay loam and is 20 to 30 percent caliche pebbles and cobblestones. It is absent in the very shallow profiles.

UA—Upton-Atoka association. This association occurs on uplands west of the Pecos River. Slopes are 0 to 5 percent. Mapped areas are rounded and elongated in shape and about 100 to 3,000 acres in size.

This association consists of about 50 percent Upton gravelly loam, 30 percent Atoka loam, and 20 percent less extensive soils.

Included with these soils in mapping are Bigetty, Pecos, Upton and Reakor soils; Reakor gravelly subsoil variant; and some areas of soils that are similar to Upton and Atoka soils except that they have a dark brown surface layer. Reakor soils are intermixed with Atoka soils. Bigetty and Pecos soils are on flood plains.

The nearly level to undulating Upton soil is on ridges. It has the profile described as representative of the series. The level to nearly level Atoka soil is in depressions between areas of Upton soil.

Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This association is used for grazing, watershed, and wildlife habitat. Nonirrigated capability subclass VIIs; Upton soils in Gravelly SD–3 range site, Atoka soil in Loamy SD–3 range site.

Vinton Series

The Vinton series consists of deep, well drained soils. These soils formed in stratified alluvium on flood plains. They are occasionally flooded. Slopes are 0 to 1 percent. Elevation is 3,300 to 3,500 feet. Vegetation is mainly alkali sacaton, sand dropseed, and saltcedar. The mean annual precipitation is 10 to 12 inches, and the mean annual soil temperature is 62° to 65° F. The frost-free season is 200 to 215 days.

In a representative profile the surface layer is brown loamy fine sand about 8 inches thick. The underlying material to a depth of 72 inches is 7 inches of reddish yellow fine sand, 9 inches of brown fine sandy loam, 33 inches of light brown and brown loamy fine sand, and 15 inches of reddish yellow fine sand. The soil profile is slightly calcareous and mildly alkaline throughout.

Permeability is moderately rapid, and available water capacity is 3.5 to 7 inches. Effective rooting depth is 72 inches or more. This soil is used for watershed, wildlife habitat, and grazing.

Representative profile from an area of Vinton loamy fine sand in an area of Vinton-Glendale association, 100 feet south and 30 feet east of the eighth bridge support from the west end of the Pecos River bridge on U.S. 380 in the SW¼ of sec. 34, T. 10 S., R. 25 E.:

A—0 to 8 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; many fine interstitial pores; slightly calcareous; mildly alkaline; abrupt wavy boundary.

C1—8 to 15 inches; reddish yellow (7.5YR 6/6) fine sand, strong brown (7.5YR 5/6) when moist; single grained; loose when dry and moist; many very fine roots; many very fine interstitial pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C2—15 to 24 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; few very fine tubular pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C3—24 to 34 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; few very fine tubular pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C4—34 to 42 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; few very fine tubular pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C5—42 to 57 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; many very fine interstitial pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C6—57 to 72 inches; reddish yellow (7.5YR 6/6) fine sand, strong brown (7.5YR 5/6) when moist; single grained; loose when dry and moist; few very fine roots; many very fine interstitial pores; slightly calcareous; mildly alkaline.

The A horizon has value of 5 through 7 when dry and 4 through 6 when moist, and chroma of 4 through 6 when dry and moist. The C horizon has value of 5 through 7 when dry and 4 through 6 when moist. The soil profile is erratically stratified, ranging in texture from sands to loam, but dominantly is loamy fine sand.

VG—Vinton-Glendale association. This association occurs on the Pecos River flood plains. Slopes are 0 to 1 percent. The soils are subject to occasional flooding. Mapped areas are elongated in shape and about 20 to 2,000 acres in size.

This association consists of about 70 percent Vinton loamy fine sand, 20 percent Glendale fine sandy loam, and 10 percent less extensive soils.

Included with these soils in mapping are Pecos soils and some areas of a soil that is similar to the Vinton soil except that it is fine sand throughout.

The level Vinton soil is mostly adjacent to the river channel. It has the profile that is described as representative of the series. The level Glendale soil is generally on the outer parts of the mapped areas. Both soils are subject to occasional flooding.

Runoff is slow. The hazard of water erosion is moderate. For Vinton soil the hazard of soil blowing is severe, and for the Glendale soil the hazard of soil blowing is moderate.

This association is used for watershed, wildlife habitat, and grazing. Nonirrigated capability subclass VIIe; range site Bottomland SD–3.

Use and Management of the Soils

This section discusses the use and management of the soils for irrigated crops, nonirrigated land, grazing, wildlife, engineering, building site development, and recreation. It includes an explanation of capability classification of soils, discussions of management of irrigated and nonirrigated soils by capability units and subclasses, and estimated yields of irrigated crops under a high level of management. Much information significant to wildlife, engineering, building site development, and recreation is presented in tables.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are 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 engineering.

In the capability system, irrigated soils in Chaves

County, Southern Part, are grouped at three levels: the capability class, the subclass, and the unit. The nonirrigated soils are grouped at two levels; the capability class and the subclass. 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.

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. (There are no Class V soils in this survey area.)

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 is 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 or units, 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 designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Chaves County, Southern Part, are described and suggestions for the use and management of the soils are given.

The names of soil series represented in a capability unit are named in the description of the capability unit, but this does not mean that all the soils of a given series appear in the unit. To find the name of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

General management practices for irrigated cropland

Irrigation systems.—Irrigation systems must be designed to distribute water evenly over the fields without causing erosion. Water should be applied in amounts that the soil can hold in the root zone of the crop. Such gravity irrigation systems as furrows and borders are the most common irrigation systems in Chaves County, Southern Part. They are used more than sprinkler irrigation systems on loamy soils, such as Reakor loam, because these soils are easy to level. Furrow and border irrigation systems are well suited to such nearly level, more clayey soils as Pecos silty clay loam.

A well designed conservation irrigation system minimizes erosion and limits loss of water. Planning an irrigation system requires knowledge of how fast the soil can absorb water, how much water it can hold, how much water is available to plants, and how much water the plant needs. Pecos silty clay loam, for example, absorbs water more slowly than Glendale fine sandy loam. Technical help in planning a conversation irrigation system is available through the local office of the Soil Conservation Service.

Conservation cropping systems.—Conservation cropping systems are used to improve or maintain tilth, to limit erosion, and to help control weeds, insects, and disease. A cropping system is a sequence of crops in which soil-improving crops balance soil-depleting crops. The frequency of growing soil-improving crops depends on the limitation of the soil. A deep, loamy soil, such as Bigetty loam, 0 to 1 percent slopes, does not need a soil-improving crop in the rotation as often as a moderately deep, loamy soil, such as Reeves loam, 0 to 1 percent slopes. Alfalfa and grasses are soil-improving crops. Small grain, corn, and sorghum can be used as soil-improving crops if large amounts of residue can be returned to the soil, if nitrogen is added to hasten decomposition, and if large amounts of residue are turned under.

Crop residue management.—Leaving crop residue on or near the surface helps control erosion, improve the water intake rate, reduce evaporation of soil moisture, maintain the organic matter content and plant nutrients, and preserve soil structure. Protection is especially needed in fall, winter, and spring when the hazard of soil blowing is most severe. After harvest, the residue is usually left on the soil throughout the winter. When the seedbed is prepared in the spring, the residue is incorporated into the soil.

The amount of residue needed to protect the soil varies according to the texture of the surface layer. Soils having a surface layer with a high content of sand, such as Reakor sandy loam, need more crop residue than do soils with a loamy surface, such as Reakor loam.

Use of manure.—Additions of barnyard manure or green manure crops are needed to improve tilth and soil structure, to increase infiltration, and to increase the availability of the major and minor plant nutrients. Barnyard manure is readily available in the survey area, and the amounts applied to the soil depend upon the amount of organic matter already in the soil. Bigetty loam soils have a higher organic-matter content than Reeves loams, thus they require smaller additions of manure than Reeves loams.

Lining irrigation ditches.—Some irrigation field ditches, canals, or laterals are lined with impervious materials, such as concrete, asphalt, or other durable lining. The principal purposes of lining ditches and canals are to reduce loss of water, prevent waterlogging of the soils, and control erosion. Unlined irrigated field ditches sustain the greatest water loss on Glendale fine sandy loam, and erosion is serious on such soils as Reakor loam, 1 to 3 percent slopes.

Minimum tillage.—Minimum tillage maintains soil structure, reduces soil compaction, and keeps pore space. Tilling the soils when wet, especially such soils as Pecos silty clay loam, causes surface compaction. Surface compaction can be avoided by reducing the number of tillage operations, by not tilling when the soil is wet, and by varying the depth of tillage.

Management of field crops and pastures by capability units

This section gives information about soils placed in irrigated capability units. Irrigated soils can become affected by salt if poor quality irrigation water is applied. In this survey area the irrigation waters have a soluble salt content from 500 to 3,000 parts per million. A high proportion of these soluble salts is gypsum, and this lessens the adverse effects. However, some soils have been affected by salts carried in the irrigation water.

Irrigated soils can be cultivated the year around. They seldom freeze and are wet only a few days. Wind velocities are high in the spring. To minimize soil blowing, farmers plow their fields in spring and leave them rough until time for planting and irrigation.

The irrigated capability units in the survey area are discussed in the following pages.

CAPABILITY CLASS I, IRRIGATED

This class consists of soils of the Gabaldon, Glendale, Reakor, and Bigetty series. These soils are well drained. They have a surface layer of loam or silt loam. Slopes are 0 to 1 percent. The mean annual precipitation is 10 to 18 inches. The frost-free season is 170 to 215 days. Permeability is moderate to moderately slow, and available water capacity is 8 to 13 inches. Runoff is slow to medium, and the hazard of erosion is slight. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and wildlife habitat; the Bigetty soil is also used for community development. These soils can be used for pasture and hay. They are suited to all crops commonly grown in the survey area. The main crops are cotton, alfalfa, sorghum, barley, and corn for silage. Cotton is not grown on the Gabaldon soils.

Effective management includes maintaining soil fertility and using water efficiently. A cropping system that uses either legumes or grasses for at least 3 years or a high residue crop that is returned to the soil once every 4 years helps maintain soil tilth.

These soils are suited to gravity, subsurface, or sprinkler irrigation. A properly designed irrigation system is needed for efficient use of irrigation water.

CAPABILITY UNIT IIe–2, IRRIGATED

This unit consists of soils of the Glendale and Reakor series. These soils are well drained. They have a surface layer of fine sandy loam or sandy loam and the substratum is high in content of lime. Slopes are 0 to 1 percent. The mean annual precipitation is 10 to 12 inches. The frost-free season is 200 to 215 days. Permeability is moderate to moderately slow, and available water capacity is 8 to 12 inches. Runoff is slow, and the hazard of soil blowing is moderate. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and wildlife habitat. They can be used for pasture or hay. They are suited to all crops commonly grown in the survey area. The main crops are cotton, alfalfa, and sorghum.

Effective management practices include controlling soil blowing, maintaining soil fertility, and using water efficiently. Proper tillage practices and a cropping system that either returns a high residue crop into the soil once every 3 years or uses grasses and legumes that can be managed for at least 3 years helps reduce soil blowing.

These soils need land leveling in places. They are suited to gravity, subsurface, or sprinkler irrigation.

CAPABILITY UNIT IIe–6, IRRIGATED

This unit consists of soils of the Shanta, Bigetty, and Reakor series. These soils are well drained. Most have a surface layer of silt loam or loam. Reakor soils are strongly calcareous. Shanta soils are protected from flooding. Slopes are mostly 1 to 3 percent. The mean annual precipitation is 10 to 18 inches. The frost-free season is 170 to 215 days. Permeability is moderate to moderately slow, and available water capacity is 9.5 to 12.5 inches. Runoff is medium, and the hazard of water erosion is moderate. Rooting depth is 60 inches or more.

These soils are used for irrigated crops, wildlife habitat, and community development. They can be used for pasture and hay. They are suited to all crops commonly grown in the survey area. The main crops are cotton, alfalfa, sorghum, and barley.

Effective management practices include maintaining soil fertility, reducing runoff and erosion, and using water efficiently. Proper tillage practices and a cropping system that either returns a high residue crop into the soil once every 3 years or uses legumes and grasses for at least 3 years helps reduce runoff.

Land leveling is required in places for effective irrigation water control. Excessive leveling cuts should be avoided on the Reakor soil to prevent exposure of the high lime concentration in the substratum. Shanta soils are subject to occasional overflow and need diversions to protect them from flooding.

Soils in this capability unit are suited to gravity, subsurface, or sprinkler irrigation.

CAPABILITY UNIT IIs-1, IRRIGATED

The only soil in this unit is Pecos silty clay loam, nonsaline, 0 to 1 percent slopes. It is moderately well drained. It has a surface layer and substratum of silty clay loam. The mean annual precipitation is 10 to 14 inches. The frost-free season is 190 to 215 days. Permeability is very slow, and available water capacity is 6 to 9 inches. Runoff is slow, and the hazard of erosion is slight. Effective rooting depth is 60 inches or more.

This soil is used for irrigated crops, community development, and wildlife habitat. It can be used for pasture and hay. It is suited to all crops commonly grown in the survey area. The main crops are cotton, alfalfa, sorghum, barley, and corn.

Effective management practices include maintaining soil fertility and using water efficiently. A cropping system that either returns a high residue crop into the soil once every 3 years or uses legumes or grasses for at least 3 years helps maintain and improve soil tilth and water intake. Tillage should be minimal and should be avoided when the soil is wet.

This soil is suited to gravity, subsurface, or sprinkler irrigation. It is well suited to gravity irrigation. A properly designed irrigation system should consider the slow rate of water intake and the available water capacity of the soil. Irrigation water should be applied at a slow rate. It can be applied more frequently and irrigation runs can be longer on this soil than on soils with a moderate water intake rate.

CAPABILITY UNIT IIs-4, IRRIGATED

The only soil in this unit is Reakor loam, gravelly subsoil variant. It is well drained. Slopes are 0 to 3 percent. The mean annual precipitation is 10 to 12 inches. The frost-free season is 200 to 215 days. Permeability is moderate, and available water capacity is 6.5 to 7.5 inches. Runoff is medium to slow, and the hazard of erosion is slight. Effective rooting depth is 60 inches or more.

The soil is used for irrigated crops and wildlife habitat. It is suited to all crops commonly grown in the survey area. The main crops are cotton, alfalfa, and sorghum.

Effective management practices include maintaining soil fertility and tilth, reducing runoff and erosion, and using water efficiently. Rough tillage and a cropping system that either returns a high residue crop into the soil once every 3 years or uses grasses or legumes for at least 3 years helps maintain soil tilth, improve water intake, and reduce runoff and erosion.

Land leveling is required in places for irrigation water control. Excessive leveling cuts should be avoided to prevent exposure of the very gravelly substratum.

This soil is suited to gravity or sprinkler irrigation. A properly designed irrigation system should consider the moderate available water capacity of the soil. Irrigation water should be applied in moderate amounts and more frequently on this soil than on soils that have a higher available water capacity.

CAPABILITY UNIT IIIe-12, IRRIGATED

This unit consists of Reeves and Atoka soils. These soils are well drained. They have a surface layer of loam and are underlain by indurated caliche or material that has a high content of gypsum at depths of 20 to 40 inches. The mean annual precipitation is 10 to 12 inches. The frost-free season is 200 to 215 days. Permeability is moderate, and available water capacity is 4 to 5 inches. Runoff is medium, and the hazard of water erosion is moderate. Effective rooting depth is 20 to 40 inches.

These soils are used for irrigated crops, wildlife habitat, and community development. They can be used for pasture and hay. They are suited to most crops commonly grown in the survey area. The main crops are cotton, alfalfa, and sorghum.

Effective management practices include maintaining soil fertility, reducing runoff and erosion, and using water efficiently. A cropping system that returns a high residue crop to the soil once every 2 years helps reduce water erosion and runoff. If legumes or grasses are grown in crop rotation, species should be selected that can be maintained on the land for at least 3 years.

Deep land leveling cuts should be avoided because of the moderate depth to the indurated caliche or gypsum.

These soils are suited to gravity or sprinkler irrigation. A properly designed irrigation system should consider the 4- to 5-inch available water capacity and 20- to 40-inch deep rooting zone. Irrigation water should be applied in moderate amounts and at more frequent intervals on these soils than on deeper soils. These soils tend to be droughty and require more frequent irrigation than deeper soils.

CAPABILITY UNIT IIIs-7, IRRIGATED

This unit consists of soils in the Atoka series. These soils are well drained. They have a surface layer of loam and are underlain by indurated caliche at a depth of 20 to 34 inches. Slopes are 0 to 1 percent. The mean annual precipitation is 10 to 12 inches. The frost-free season is 200 to 215 days. Permeability is moderate, and available water capacity is 4 to 5.5 inches. Runoff is medium, and the hazard of erosion is slight. Effective rooting depth is 20 to 34 inches.

These soils are used for irrigated crops, wildlife habitat, and community development. They can be used for pasture and hay. They are suited to most crops grown in the survey area. The main crops are cotton, alfalfa, and grain sorghum.

Effective management practices include maintaining soil fertility and using water efficiently. A cropping system that returns a high residue crop to the soil once every 3 years helps maintain and improve soil tilth. If legumes and grasses are grown in a crop rotation, species should be selected that can be managed and maintained on the land for at least 3 years. Deep leveling cuts should be avoided because of the moderate depth to indurated caliche.

These soils are suited to gravity or sprinkler irrigation. They are droughty and irrigation water should be applied in moderate amounts at moderate intervals. The length of irrigation runs should be adjusted to the water intake rate and available water capacity of the soils.

Erosion is not a serious hazard on these level soils.

CAPABILITY UNIT IIIs–9, IRRIGATED

This unit consists of soils in the Balmorhea, Bigetty, and Reeves series. These moderately saline soils are well drained or are drained phases of more poorly drained soils. They have a surface layer of loam. Most Balmorhea soils have a strongly calcareous underlying layer that has a high content of gypsum. The Reeves soils are underlain by gypsum at a depth of 20 to 40 inches. Slopes are 0 to 1 percent. The mean annual precipitation is 10 to 14 inches. The frost-free season is 190 to 215 days. Permeability is moderate or moderately slow, and available water capacity is 5.0 to 9.5 inches. The water table is below a depth of 5 feet. Runoff is slow, and the hazard of erosion is slight. Effective rooting depth is 20 to 60 inches or more.

These soils are used for irrigated crops and wildlife. They can be used for pasture and hay. The choice of crops is restricted because the soils are saline. The main crops are cotton and alfalfa.

Effective management practices include maintaining soil fertility, leaching salts, and using water efficiently. A cropping system that returns a high residue crop to the soil once every 2 years helps maintain and improve soil tilth and water intake. If legumes or grasses are grown in a cropping sequence, species should be selected that can be managed and maintained on the land for at least 3 years. Deep leveling cuts need to be avoided on the Reeves soils because of the moderate depth to gypsum accumulation.

These soils are suited to gravity irrigation. A properly designed irrigation system is needed to use irrigation water efficiently, to prevent overirrigation and water logging of soils and more serious salt accumulation, and to permit leaching of salts. Diversions are needed in places to protect the soils from flooding. In places a drainage system is needed to prevent a seasonal high water table and to leach salts from the soil.

CAPABILITY UNIT IVs–2, IRRIGATED

This unit consists of Holloman loam, thick solum. This soil is well drained, and it has a surface layer of loam and is underlain by gypsum at a depth of 10 to 20 inches. Slopes are 0 to 3 percent. The mean annual precipitation is 10 to 12 inches. The frost-free season is 200 to 215 days. Permeability is moderate, and available water capacity is 1.5 to 3 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. Effective rooting depth is 10 to 20 inches.

This soil is used for irrigated crops and wildlife. It can be used for pasture and hay. The choice of crops is limited because the soil is shallow to gypsum. The main crops are cotton, alfalfa, and sorghum. Some crops exhibit severe chlorosis.

Effective management practices include maintaining soil fertility, controlling runoff and erosion, and using water efficiently. A cropping system that returns a high residue crop to the soil 2 years in 3 helps maintain and improve the rate of water intake and available water capacity and reduce runoff and erosion. Permanent pasture should be established where practical. Deep plowing or land leveling should be avoided because the soil is shallow to gypsum.

This soil is suited to gravity or sprinkler irrigation. Irrigation water should be applied frequently in small amounts because the available water capacity of this soil is 1.5 to 3 inches.

CAPABILITY UNIT IVs–11, IRRIGATED

The only soil in this unit is Pecos silty clay loam. This moderately saline soil is moderately well drained. It has a surface layer of silty clay loam and silty clay and is underlain by clay and sandy clay loam. Slopes are 0 to 1 percent. The mean annual precipitation is 10 to 14 inches. The frost-free season is 190 to 215 days. Permeability is very slow, and available water capacity is 6 to 9 inches. Runoff is slow, and the hazard of erosion is slight. Effective rooting depth is 60 inches or more.

This soil is used for irrigated crops and wildlife. It can be used for pasture and hay. The choice of crops is restricted because of salinity. The soil is best suited to salt-tolerant plants and crops. The main crops are alfalfa (fig. 10) and cotton.

Effective management practices include maintaining soil fertility and water intake rates, leaching, and using water efficiently. A cropping system that returns a high residue crop to the soil 2 years in 3 helps maintain and improve soil tilth and water intake. If salt-tolerant legumes or grasses are grown in the crop rotation, they should be maintained on the land for at least 4 years. Rough tillage, minimum tillage, and management of crop residue also help maintain and improve soil tilth and water intake and help reduce puddling and crusting of the surface soil.

This soil is best suited to gravity irrigation. A properly designed irrigation system is needed for efficient use of irrigation water. Small amounts of water should be applied frequently. Length of irrigation runs should

Figure 10.—This area of Pecos silty clay loam is in capability unit IVs–11, irrigated. This field of alfalfa hay produced 2 tons per acre for the first cutting.

be adjusted to the water intake rate and available water capacity. Diversions or dikes are needed in places to protect the soil from flooding. In places a drainage system is needed to prevent a seasonal high water table and to leach excess salts from the soil.

CAPABILITY UNIT IVw-3, IRRIGATED

The only soil in this unit is Balmorhea loam. This soil is somewhat poorly drained and moderately saline. It commonly has a strongly calcareous underlying layer that has a high content of gypsum. Slopes are 0 to 1 percent. The mean annual precipitation is 10 to 12 inches. The frost-free season is 200 to 215 days. Permeability is moderately slow, and available water capacity is 6.0 to 7.5 inches. Runoff is slow and erosion hazard is slight. Effective rooting depth is 60 inches or more.

This soil is used for irrigated crops. The main crops are cotton and alfalfa. However, the soil is best suited to pasture and hay.

Effective management practices include maintaining soil fertility, installing a drainage system, leaching excess soluble salts, and using water efficiently. A cropping system that returns a high residue crop to the soil 2 years in 3 or uses salt-tolerant legumes or grasses for at least 4 years helps maintain and improve available water capacity and water intake.

A drainage system should be installed to lower the water table and provide an outlet for salt removal. Excess salts should be removed by leaching.

These soils are suited to gravity irrigation. A properly designed irrigation system is needed to help prevent overirrigation, water logging, and additional accumulation of salts.

Management and predicted yields on irrigated soils

The predicted yields given in table 2 are averages that can be expected over a period of years. These predictions are based on results of research and on information obtained in interviews with agricultural and other producers.

The yields given are for a high level of management, and the following is assumed:

1. Conservation cropping systems are practiced which include crops that produce a large amount of residue to maintain and improve soil fertility, water intake rate, and soil tilth, and to reduce runoff, water erosion, and soil blowing.
2. Suitable crop varieties are selected, and seed is planted at the proper time and correct rate.
3. Needed fertilizer is applied at the proper time and according to the most recent and proven recommendations.
4. The soils are tilled carefully at the right time with the right kinds of implements so that crop residue is utilized and excessive compaction is avoided.
5. Insect pests, weeds, and plant diseases are controlled by chemicals and proper management.
6. Length and slope of irrigation runs are suitable, or properly designed sprinklers are used.
7. Irrigation water is applied according to crop needs and at the proper times.
8. Crops are harvested at the proper time.

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 to the county. Yields higher than those predicted are not uncommon in small fields or in experimental plots.

Nonirrigated capability classification

In this survey area the soils are grouped at two levels of nonirrigated capability classification: the capability class and the subclass. The nonirrigated capability subclass to which the soils have been assigned is shown at the end of each soil description.

The nonirrigated subclasses used in the Chaves County, Southern Part, survey area are as follows:

Subclass VIc soils are generally unsuited to cultivation or are severely limited, chiefly because of the dry climate.

Subclass VIe soils are generally unsuited to cultivation or are severely limited, chiefly because of risk of erosion if protective cover is not maintained.

Subclass VIs soils are generally unsuited to cultivation or are severely limited, chiefly because of the shallowness, stones, alkali, or other soil features.

Subclass VIw soils are generally unsuited to cultivation or are severely limited, chiefly because of risk of flooding or a high water table.

Subclass VIIc soils are unsuited to cultivation or are very severely limited, chiefly because of the dry climate.

Subclass VIIe soils are unsuited to cultivation or are very severely limited, chiefly because of risk of erosion if protective cover is not maintained or is seriously damaged.

Subclass VIIs soils are unsuited to cultivation or are very severely limited, chiefly because of shallowness, stones, alkali, or other soil features.

Subclass VIIIe miscellaneous areas have little potential for vegetation, chiefly because of the risk of erosion.

Range Management [2]

Range makes up about 94 percent of the Chaves County, Southern Part, soil survey area, or about 1,900,000 acres. This range is used mostly for domestic livestock grazing. The soils are relatively high producing sources of forage for cattle and sheep.

Ewe lamb and wether sheep operations producing wool, lamb, and mutton predominate in the western and southwestern parts of the area. The central and eastern parts of the area are used mainly for cow-calf and yearling cattle enterprises.

Climatically, the area is suited to grazing during all seasons of the year. Range is improved through grazing systems which provide for periodic rest during the

[2] By NOEL MARSH, range conservationist, Soil Conservation Service.

TABLE 2.—*Yields per acre of irrigated crops and pasture*

[All yields were estimated for a high level of management in 1973. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Cotton lint	Alfalfa hay	Grain sorghum	Sorghum silage	Corn silage	Barley	Pasture
	Lb	*Ton*	*Bu*	*Ton*	*Ton*	*Bu*	*AUM* [1]
Atoka:							
AtA	850	6	95	20	16	70	15
AtB	800	5	93	19	15	65	14
Balmorhea:							
Ba	----	5	----	12	----	60	14
Bd	875	5	71	13	11	60	14
Bigetty:							
[2] BgA	1,250	8	134	30	22	80	20
BgB	1,000	7	116	25	20	80	18
[2] Bh	875	5	63	15	10	55	14
[3] BP:							
Bigetty part	1,250	8	134	30	22	80	20
Pecos part	1,250	8.0	130	30	22	80	20
Gabaldon:							
[3] GD:							
Gabaldon part	----	7	125	25	20	80	18
Dev part	----	----	----	----	----	----	----
Glendale:							
[2] Ge, [2] Gf	1,350	7	115	22	20	70	18
Holloman:							
Ho	625	4	45	10	10	60	11
Pecos:							
Pe	875	5	60	13	11	60	14
PfA, PGB	1,250	8.0	130	30	22	80	20
[3] PH:							
Pecos part	1,250	8.0	130	30	22	80	20
Dev part	----	----	----	----	----	----	----
Penasco:							
[3] PN:							
Penasco part	----	----	----	----	----	----	----
Gabaldon part	----	7	125	25	20	80	18
Reakor:							
Ra, ReB, RF	1,000	7	115	25	20	70	18
ReA	1,250	8	135	30	22	100	20
Reakor gravelly subsoil variant:							
Rg	850	6	95	20	16	70	15
Reeves:							
RkA	875	6	95	20	16	70	15
RkB	800	5	90	19	15	65	14
Shanta:							
Sh	----	7	110	25	20	80	18

[1] Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.
[2] Yields are for areas protected from flooding.
[3] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

growing season and which alter the season of grazing during successive years.

In addition to grazing, associated uses of the range include watershed, recreation, wildlife, fuel and energy extraction, transportation, and production of noncommercial wood products such as fenceposts.

The range in the survey area is in parts of four land resource areas (*3*) and sub-areas which are based on climate, topography, and soils. These are Southern Desertic Basins, Plains, and Mountains (SD–3); Pecos-Canadian Plains and Valleys (CP–4 and CP–2); and Southern High Plains (HP–3).

Land resource areas and sub-areas for range site classification

Chaves County, Southern Part, is divided into four land resource areas and sub-areas for the purpose of classifying range sites (fig. 11).

A land resource area is a geographic area that is characterized by a particular combination or pattern of soils, elevation, climate, and topography. Variations in these features result in different kinds of rangeland. The average annual precipitation ranges from 11 inches along the Pecos River to 14 inches along the eastern boundary of the survey area and to 18 inches in the higher elevations in the west-central part. Elevation ranges from about 3,200 feet in the central part to 4,400 feet along the eastern edge, and to 6,600 feet in the southwest part.

Land Resource sub-area CP–4 is in the western part of the survey area. It consists of an area that is mostly controlled by limestone bedrock. Land Resource sub-area SD–3 is the central part of the survey area. It consists mainly of the Pecos River Valley. Land Resource sub-area CP–2 is in the eastern part of the survey area. It consists mainly of sandy soils below the High Plains escarpment. Land Resource sub-area HP–3 is along the extreme eastern edge of the survey area. It consists of a relatively level mesa.

Green sprangletop, deer grass, Metcalf muhly, one-seed juniper, and pinyon pine grow only in Land Resource sub-area CP–4 in this survey area. Creosotebush and catclaw mimosa grow only in Land Resource sub-area SD–3. Yellow indiangrass grows only in Land Resource sub-area CP–2. None of the plant species that

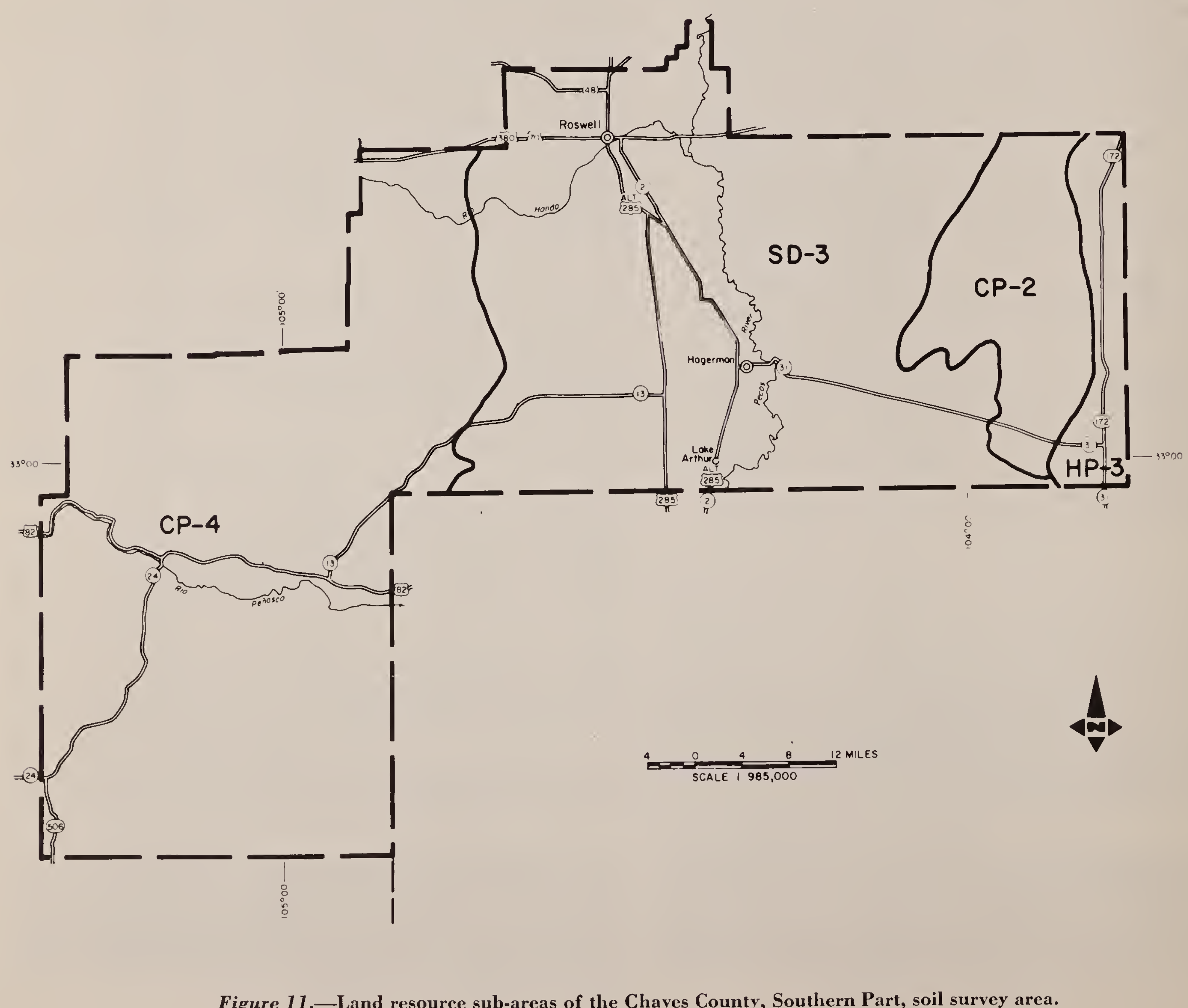

Figure 11.—Land resource sub-areas of the Chaves County, Southern Part, soil survey area.

are within this survey area are unique to Land Resource sub-area HP–3.

Limestone-controlled land resource sub-area CP–4 consists mainly of large ranches that are operated as sheep ranches or as cow-calf ranches. Land Resource subareas SD–3 and CP–2 consist of ranches that are mainly cattle ranches with cow-calf operations. Land Resource sub-area HP–3 consists mainly of cattle ranches with yearling operations.

Range sites and conditions

Soils that have the capacity to produce similar kinds, amounts, and proportions of range plants are grouped into range sites. A range site is an expression of all the environmental factors contributing to its development: geology, topography, climate, soils, and plant and animal life.

The plant community found on a range site that has not undergone abnormal, introduced disturbance or physical deterioration is termed the "natural potential" or "climax" plant community for that site. Since climax plant communities are natural phenomena they are not precise or fixed. Their composition varies slightly from year to year and from place to place.

Abnormal disturbance of the climax community such as excessive livestock use, burning, or plowing results in regression or, in severe cases, destruction of the plant cover. Following disturbance, if range site deterioration by erosion is not irreversible, secondary plant succession proceeds toward the climax vegetation for the site.

Range conservationists and soil scientists work together in describing the potential vegetation for each mapping unit and in grouping soils into range sites.

Range condition is an expression of the present vegetation on a range site in relation to the potential vegetation for the site by comparison or departure. Knowing the present range condition provides an index of the changes that have taken place in the plant cover and a basis for predicting the results of management and treatment.

By comparing the plant composition in the present condition to that of the climax plant community one can see how some species have increased while others decreased. How a plant community reacts to grazing depends on the kinds and classes of grazing animal, the season of use, and the degree of plant tissue removal.

The composition of plant communities both in climax and present condition, together with other range site information provides the interpretive basis for selecting management objectives, designing grazing systems, managing for wildlife, determining recreation potential, and evaluating watershed conditions.

Management objectives generally relate to restoring range to as near to its potential as is reasonably feasible. Sometimes managers seek to create or maintain a plant community somewhat removed from potential to fit specific needs in the grazing program, to provide for wildlife habitat, or for other benefits.

Any management objective must be compatible with conservation objectives, providing for plant communities which will protect and improve soil and water resources while meeting the desires and needs of the operator.

Descriptions of range sites

On the following pages, the range sites of Chaves County, Southern Part, are described. The percentage composition of the principal plants in the potential plant community is approximated, and an estimate of the potential annual air-dry production for each site when it is in excellent condition is given. The feasibility and practicability of applying certain range improvement practices are discussed where they are significant and soil related. The soils in each range site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

The soil textures given in the following descriptions refer to the surface layer unless otherwise noted. The common and scientific names of the native plants of this section are listed in a soil conservation publication (*16*).

BOTTOMLAND (CP–4) RANGE SITE

The soils of this range site are gravelly loams, cobbly loams, and silt loams. They are deep and have moderate and moderately rapid permeability. Available water capacity is low to high. Slopes are 0 to 3 percent. Mean annual precipitation is 10 to 18 inches. Runoff is slow to medium. Elevation is 3,300 to 5,900 feet. The soils are flooded frequently or occasionally.

The vegetation on this site is mostly grasses and scattered shrubs and only occasional forbs.

The approximate composition of the climax (potential) plant community, by weight, is 25 percent tobosa; 15 percent side-oats grama; 10 percent each of cane bluestem and alkali sacaton; and 5 percent each of vine-mesquite, creeping muhly, Apache-plume, brickellbush, littleleaf sumac, blue grama, and annual and perennial forbs. Brickellbush is generally not browsed by cattle or sheep.

Associated species include giant sacaton, yucca, mesquite, catclaw mimosa, bush muhly, three-awn, plains bristlegrass, black grama, silver bluestem, cacti, native walnut, desert-willow, cottonwood, wolftail, and broom snakeweed.

Under continuous livestock grazing, side-oats grama, cane bluestem, vine-mesquite, and bush muhly decrease while tobosa, three-awn, creeping muhly, and Apache-plume increase. Under prolonged heavy grazing the vegetation is dominated by tobosa, creeping muhly, mesquite, catclaw mimosa, and other brush species, which greatly reduces the volume of forage available.

Most range management practices, including prescribed burning and spot fertilization, are feasible when needed on this site.

When this site is in excellent condition, the total annual air-dry vegetative yield is 2,500 pounds per acre in favorable years and 750 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle or sheep.

BOTTOMLAND (SD–3) RANGE SITE

The soils of this range site are loams, fine sandy loams, silty clay loams, and loamy fine sands. They are deep and have very slow to moderately rapid permeability. Available water capacity is low to high. Slopes are 0 to 3 percent. Mean annual precipitation is 10 to

14 inches. Runoff is slow to medium. Elevation is 3,300 to 5,000 feet. These soils are rarely to occasionally flooded.

The vegetation on this site is about 75 to 85 percent grasses, 5 percent shrubs, and 10 to 15 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 25 percent tobosa; 12 percent alkali sacaton; 10 percent each of side-oats grama, giant sacaton and cane bluestem; 5 percent each of brickellbush, littleleaf sumac, Apache-plume, and other perennial forbs; and 3 percent each of white tridens and American tarbush. Brickellbush and American tarbush are not generally browsed by cattle or sheep.

Associated species include bush muhly, sand dropseed, burrograss, buffalograss, blue grama, saltcedar, fourwing saltbush, winterfat, mesquite, catclaw mimosa, creeping muhly, Arizona cottontop, yucca, and cholla cactus.

Under continuous livestock grazing, side-oats grama, white tridens, cane bluestem, and vine-mesquite decrease while tobosa, burrograss, and brush species increase. With prolonged heavy grazing, the plant community is dominated by tobosa, burrograss, mesquite, catclaw mimosa, American tarbush, and tesajo cactus, which greatly reduces the volume of forage available.

Because the soils of this site are rarely to occasionally flooded, water-spreading systems will help to reduce erosion and increase production.

When this site is in excellent condition, the total annual air-dry vegetative yield is 2,000 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. About 85 percent of this production is from plants which furnish forage for cattle or sheep.

BREAKS (HP-3) RANGE SITE

The soils of this range site are steep to very steep, gravelly, stony, and cobbly Torriorthents. Also included is steep to very steep Rock outcrop. Runoff is rapid. The hazard of water erosion is severe. Elevation is 3,400 to 4,300 feet.

The vegetation on this site is about 85 to 95 percent grasses and 5 to 10 percent shrubs, and an occasional forb. The approximate composition of the climax (potential) plant community, by weight, is 25 percent black grama; 20 percent side-oats grama; 10 percent hairy grama; and 5 percent each of blue grama, bush muhly, plains bristlegrass, wolftail, winterfat, fourwing saltbush, three-awn, sand dropseed, and slim tridens.

Associated species include minor amounts of little bluestem, Metcalfe muhly, silver bluestem, yucca, creosotebush, buckwheat, plains lovegrass, littleleaf sumac, annuals, and perennial forbs.

Under continuous livestock grazing, side-oats grama, black grama, and blue grama decrease while sand dropseed, three-awn, tridens, yucca, and cactus increase. With prolonged heavy grazing, the vegetation is dominated by three-awn, fluffgrass, wooly groundsel, mesquite, creosotebush, and cholla cactus, which greatly reduces the quantity of forage available.

Range seeding is impractical on this site because the soils are shallow, stony, and very steep.

When this site is in excellent condition, the total annual air-dry vegetative yield is 800 pounds per acre in favorable years and 450 pounds per acre in unfavorable years. About 95 percent of this production is from plants which furnish forage for cattle or sheep.

CLAYEY (HP-3) RANGE SITE

The soils of this site have a thin surface layer of loam and a subsoil of clay loam. They are shallow to moderately deep over indurated caliche and have moderately slow permeability. Available water capacity is very low to moderate. Slopes are 0 to 1 percent. Mean annual precipitation is 14 to 16 inches. Runoff is slow. Elevation is 4,300 to 4,400 feet.

The vegetation on this site is essentially pure grassland. Only an occasional cholla cactus, small shrub, or forb occurs. The approximate composition of the climax (potential) plant community, by weight, is 45 percent tobosa; 10 percent each of blue grama and side-oats grama; and 5 percent each of Arizona cottontop, vine-mesquite, buffalograss, sand dropseed, three-awn, cholla cactus, and plains bristlegrass. Cholla cactus is not generally used by cattle or sheep.

Associated species include mat muhly, broom snakeweed, alkali sacaton, mesquite, and annual and perennial forbs.

Under continuous livestock grazing, side-oats grama, Arizona cottontop, vine-mesquite, blue gama, and plains bristlegrass decrease while tobosa and buffalograss increase. With prolonged heavy grazing, the vegetation is dominated by tobosa, buffalograss, mat muhly, broom snakeweed, and silverleaf nightshade, and mesquite also invades; this reduces the quality and quantity of forage available.

Brush management and range seeding can be carried out when needed.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,500 pounds per acre in favorable years, and 800 pounds per acre in unfavorable years. About 95 percent of this production is from plants which furnish forage for cattle or sheep.

DEEP SAND (CP-2) RANGE SITE

The soils of this range site are loamy fine sands and fine sands (fig. 12). They are deep and have moderately rapid or moderate permeability. Available water capacity is moderate to high. These soils are productive under limited rainfall since a high percentage of the precipitation is absorbed and is available for plant growth. Slopes are 0 to 3 percent. Mean annual precipitation is 12 to 13 inches. Runoff is slow to very slow. Elevation is 3,500 to 4,100 feet.

The vegetation on this site is about 75 to 80 percent grasses, 20 to 25 percent shrubs, and 5 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 20 percent sand bluestem; 17 percent shinnery oak; 10 percent each of little bluestem and side-oats grama; 5 percent each of yellow indiangrass, Halls panicum, hairy grama, plains bristlegrass, and sand dropseed; 3 percent yucca; and 10 percent annual grasses and forbs.

Associated species include giant dropseed, giant sandreed, three-awn, sand sagebrush, queensdelight, sand paspalum, bush muhly, sandbur, fall witchgrass, spike dropseed, mesquite, red lovegrass, black grama and blue grama.

Under continuous livestock grazing, sand bluestem,

Figure 12.—This area of Roswell-Jalmar complex is in Sandhills and Deep Sand (CP–2) range sites in good condition. Vegetation is sand bluestem, little bluestem, giant dropseed, yucca, and shinnery oak.

little bluestem, yellow indiangrass, side-oats grama, and plains bristlegrass decrease while shinnery oak, sand sagebrush, yucca, three-awn, and dropseeds increase. With prolonged severe grazing, dunes develop and the vegetation is dominated by shinnery oak, yucca, sand sagebush, three-awn, and low-value annuals, which greatly reduces the volume of forage available.

This site is suited to and responds rapidly to all types of vegetative management practices. Practices that disturb the vegetation should be followed by reestablishing vegetation to reduce wind erosion. Such practices should be done only during the less windy periods of the year.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle.

DEEP SAND (SD–3) RANGE SITE

The soils of this range site are loamy fine sands. They are deep and have rapid permeability. Available water capacity is low to moderate. Runoff is very slow and a large percentage of the precipitation is available for vegetation. Slopes are 3 to 15 percent. Mean annual precipitation is 10 to 12 inches. Elevation is 3,400 to 3,800 feet.

The vegetation on this site is about 75 to 85 percent grasses, 15 to 25 percent shrubs, and few forbs. The approximate composition of the climax (potential) plant community, by weight, is 20 percent shinnery oak; 15 percent little bluestem; 10 percent each of sand bluestem, giant dropseed, and black grama; 5 percent each of Havard panicum, three-awn, mesa dropseed, Halls panicum, sand sagebrush, plains bristlegrass, and annual grasses and forbs. Sand sagebrush is not generally browsed by cattle or sheep.

Associated species include sand paspalum, yucca, bush muhly, blue grama, hairy grama, side-oats grama, croton, mesquite, catclaw mimosa, fourwing saltbush, sand dropseed, and broom snakeweed.

Under continuous livestock grazing little bluestem, sand bluestem, Havard panicum, and black grama decrease while three-awn, dropseeds, sand sagebrush, yucca, and shinnery oak increase. With prolonged heavy grazing, the vegetation is dominated by shinnery oak, sand sagebrush, three-awn, mesquite, yucca, and low value annual weeds, which greatly reduces the volume of forage available and causes sand to blow up into dunes and hummocks.

This range site responds well to brush management, deferred grazing, and other management practices. Range seeding is difficult because precipitation is low and there is a high hazard of soil blowing. Livestock waterings should be located in stable areas to prevent blowouts.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,500 pounds per acre in favorable years and 750 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle.

GRAVELLY (SD–3) RANGE SITE

The soils of this range site are gravelly loams, cobbly loams, and gravelly sandy loams (fig. 13). They are shallow and have gravel and cobblestones throughout the profile. They are underlain by indurated caliche or bedrock at depths of 6 to 20 inches, which reduces the available water capacity and root growth. These soils have moderate permeability. Available water capacity is very low. Slopes are 0 to 9 percent. Mean annual precipitation is 10 to 12 inches. Runoff is medium. Elevation is 3,300 to 4,200 feet.

The vegetation on this site is about 75 to 85 percent

Figure 13.—This area of Lozier-Tencee complex is in Gravelly (SD–3) range site in good condition. Slopes are 1 to 9 percent. Vegetation is three-awn, black grama, cholla cactus, and sacahuista.

grasses, 15 to 20 percent shrubs, and 5 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 20 percent black grama; 15 percent side-oats grama; 10 percent each of blue grama, three-awn, and tridens; 5 percent each of bush muhly, creosotebush, winterfat, catclaw mimosa, and soaptree yucca; and 10 percent annual grasses and forbs. Creosotebush and catclaw mimosa are not generally browsed by cattle or sheep.

Associated species include range ratany, hairy grama, broom snakeweed, mesquite, cholla cactus, fluffgrass, sand dropseed, burrograss, javelinabush, sacahuista, ocotillo, and graythorn.

Under continuous livestock grazing, such plants as side-oats grama, black grama, bush muhly, and winterfat decrease while tridens, blue grama, three-awn, and sand dropseed increase. With prolonged heavy grazing, the vegetation is dominated by creosotebush, fluffgrass, three-awn, broom snakeweed, and cholla cactus.

Range seeding is difficult and seldom attempted on this site because of the shallow depth to indurated caliche or bedrock, very low available water capacity and low precipitation. Vegetation can be maintained and improved through grazing systems and limited brush management where needed.

When this site is in excellent condition, the total annual air-dry vegetative yield is 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. About 80 percent of this production is from plants which furnish forage for cattle or sheep.

GYP (SD–3) RANGE SITE

The soils of this range site are loams. They are shallow to gypsum. They have moderate permeability. Available water capacity is very low. Runoff is rapid. Slopes are 0 to 9 percent. Mean annual precipitation is 10 to 12 inches. Elevation is 3,300 to 3,600 feet. Depth to gypsum is 8 to 20 inches.

The vegetation on this site is about 60 percent grasses, 30 percent shrubs, and 10 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 30 percent gyp grama; 20 percent coldenia; 10 percent each of gyp dropseed and alkali sacaton; 5 percent each of black grama, three-awn, fourwing saltbush, and tobosa; 3 percent winterfat; 2 percent Mormon-tea; 3 percent perennial forbs; and 2 percent annual forbs.

Associated species which also occur in minor amounts include ear muhly, fluffgrass, plains bristlegrass, blue grama, sand dropseed, javelinabush, yucca, mesquite, cacti, croton, allthorn, butterfly bush, littleleaf sumac, bush muhly, burrograss, and gyp muhly.

Under continuous livestock grazing, black grama and gyp grama decrease while coldenia and gyp dropseed increase and mesquite and broom snakeweed invade. With prolonged heavy grazing the vegetation is dominated by low value grasses and spiny shrubs, with seasonal annuals established in the more favorable soil pockets. When the vegetation is in this condition soil erosion occurs, barren gypsum land appears to become more abundant, and the volume of usable forage is greatly reduced.

Range seeding on this site is very difficult because the soil is shallow, available water capacity and precipitation are low, and there is a hazard of erosion. Vegetation improvement is very slow. Livestock should be carefully managed and grazing systems should be installed.

When this site is in excellent condition, the total annual air-dry vegetative yield is 500 pounds per acre in favorable years and 200 pounds per acre in unfavorable years. About 80 percent of this production is from plants which furnish forage for cattle or sheep.

HILLS (CP–4) RANGE SITE

The soils of this range site are gravelly or cobbly loams; 25 to 35 percent of the surface is covered by limestone gravel and cobblestones. These soils are shallow to deep and have moderate permeability. Available water capacity is very low to moderate. Slopes are 1 to 30 percent. Mean annual precipitation is 10 to 18 inches. Runoff is medium. Elevation is 3,400 to 6,000 feet.

The vegetation on this site is about 75 percent grasses, 25 percent shrubs, and a few scattered forbs. The approximate composition of the climax (potential) plant community, by weight, is 20 percent side-oats grama; 15 percent black grama; 10 percent each of blue grama, plains lovegrass, and three-awn; 5 percent each of green sprangletop, rough tridens, Apacheplume, algerita, oak, agave, and one-seed juniper. Algerita and agave are not generally browsed by cattle or sheep.

Associated species include mountainmahogany, cholla cactus, pinyon pine, Metcalfe muhly, littleleaf sumac, vine-mesquite, mullein, catclaw mimosa, sand dropseed, creeping muhly, mat muhly, deer grass, tobosa, sotol, bush muhly, burrograss, graythorn, creosotebush, and broom snakeweed.

Under continuous livestock grazing, side-oats grama, plains lovegrass, green sprangletop, and black grama decrease while blue grama, tridens, three-awn, and woody plants increase. With prolonged heavy grazing, the vegetation is dominated by tridens, three-awn, creeping muhly, catclaw mimosa, cholla cactus, oak brush, and other woody plants, which greatly reduces the volume of forage available.

Vegetation can be improved through grazing systems. Range seeding and brush management are applicable where needed.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. About 80 percent of this production is from plants which furnish forage for cattle or sheep.

LIMESTONE HILLS (CP–4) RANGE SITE

The soils of this range site are calcareous cobbly loams and cobbly clay loams underlain by limestone (fig. 14). Rock outcrop is included. These soils are very shallow (4 to 18 inches deep) and have moderate permeability. Available water capacity is very low. Slopes are 0 to 50 percent. Mean annual precipitation is 12 to 18 inches. Runoff is medium to rapid. Elevation is 4,000 to 6,800 feet.

The vegetation on this site is about 70 percent grasses, 25 percent shrubs, and 5 percent scattered forbs. The approximate composition of the climax (potential) plant community, by weight, is 25 percent side-oats grama; 15 percent black grama; 10 percent

Figure 14.—**In the background is an area of Deama-Rock outcrop complex in Limestone Hills (CP–4) range site. Slopes are 1 to 50 percent. In the foreground is an area of Penasco soils in Shallow (CP–4) range site. Juniper and cholla cactus are increasing on these sites.**

each of Metcalfe muhly and blue grama; 7 percent mariola; 5 percent each of plains lovegrass, green sprangletop, algerita, ocotillo, agave, and yucca; and 3 percent cacti. Algerita, ocotillo, and cacti are not generally browsed by cattle or sheep.

The associated species include cane bluestem, rough tridens, wolftail, mountain muhly, one-seed juniper, pinyon pine, Spanish-dagger, mat muhly, little bluestem, bullgrass, three-awn, feather peabush, littleleaf sumac, skunkbush sumac, sacahuista, catclaw mimosa, sotol, and green needlegrass.

Under continuous livestock grazing, side-oats grama, plains lovegrass, black grama, and green sprangletop decrease while blue grama, three-awn, rough tridens, catclaw mimosa, and cholla cactus increase. With prolonged heavy grazing the vegetation is dominated by rough tridens, three-awn, broom snakeweed, fluffgrass, cacti, and various woody species, which greatly reduces the volume of forage available.

Rock outcrop, shallow depth to bedrock, very low available water capacity, and stony and cobbly surface soils make this site unsuitable for range seeding. Vegetation can be improved slowly through grazing systems. Some brush management may be applicable in local areas.

When this site is in excellent condition, the total annual air-dry vegetative yield per acre is 1,200 pounds in favorable years and 500 pounds per acre in unfavorable years. About 80 percent of this production is from plants which furnish forage for cattle or sheep.

LIMY (SD–3) RANGE SITE

The soils of this range site are moderately to strongly calcareous fine sandy loams. They are deep and have moderate permeability. Available water capacity is very low. Slopes are 0 to 3 percent. Mean annual precipitation is 10 to 12 inches. Runoff is slow. Elevation is 3,500 to 3,800 feet.

Vegetation on this site is about 75 percent grasses, 25 percent shrubs, and an occasional forb. The approximate composition of the climax (potential) plant community, by weight, is 20 percent black and blue grama; 10 percent each of alkali sacaton, tobosa, side-oats grama, burrograss, and yucca; 5 percent each of vine-mesquite, bush muhly, Mormon-tea, fourwing saltbush, winterfat, and three-awn.

Associated species which sometimes occur in minor amounts include ear muhly, sand dropseed, desertholly, hairy grama, plains bristlegrass, mesquite, and creosotebush.

Under continuous livestock grazing, black grama, side-oats grama, alkali sacaton, Mormon-tea, and winterfat decrease while burrograss, tobosa, yucca, and three-awn increase. With prolonged heavy grazing, the vegetation is dominated by creosotebush, American tarbush, fluffgrass, yucca, and three-awn, which greatly reduces the volume of forage available.

This site responds to grazing systems, deferred grazing, and brush management where needed. Range seeding is hazardous because of the low precipitation and very low available water capacity of the soils.

When this site is in excellent condition, the total annual air-dry vegetative yield per acre is 1,000 pounds in favorable years and 475 pounds in unfavorable years. About 95 percent of this production is from plants which furnish forage for cattle or sheep.

LOAMY (CP-4) RANGE SITE

The soils of this range site are loams, silty clay loams, and silt loams, and are noncalcareous or calcareous. They are deep and have moderate, moderately slow, and slow permeability. Available water capacity is high. Slopes are 0 to 9 percent. Mean annual precipitation is 16 to 18 inches. Runoff is medium. Elevation is 5,600 to 6,600 feet.

The vegetation on this site is essentially 100 percent grasses. The approximate composition of the climax (potential) plant community, by weight, is 25 percent side-oats grama; 15 percent each of blue grama and tobosa; 10 percent black grama; 5 percent each of Halls panicum, three-awn, winterfat, littleleaf sumac, plains lovegrass, and sand dropseed; and 5 percent annual grasses and forbs.

Associated species include cholla cactus, hairy grama, tridens, giant sacaton, yucca, creeping muhly, mat muhly, broom snakeweed, silver bluestem, pinyon pine, one-seed juniper, algerita, vine-mesquite, green sprangletop, hairy grama, wolftail, bush muhly, mesquite, and pricklypear cactus. These plants are in the climax plant community in varying amounts of less than 5 percent.

Under continuous livestock grazing, side-oats grama, plains lovegrass, black grama, and winterfat decrease while blue grama, tobosa, three-awn, and sand dropseed increase. With prolonged heavy grazing, brush, cactus, annual grasses, and weeds make up a substantial part of the vegetation, which greatly reduces the total amount of forage available.

Range seeding when needed is feasible on this site. Range mechanical treatments reduce runoff and increase water infiltration. Brush management is applicable where needed.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,000 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. About 95 percent of this production is from plants which furnish forage for cattle or sheep.

LOAMY (SD-3) RANGE SITE

The soils of this range site are loams, silty clay loams, and fine sandy loams. They are shallow to deep and have moderate, moderately slow, to slow permeability. Available water capacity is very low to high. Slopes are 0 to 5 percent. Mean annual precipitation is 10 to 14 inches. Runoff is slow to medium. Elevation is 3,300 to 4,500 feet.

The vegetation on this site is about 80 percent grasses, 15 percent shrubs, and 5 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 20 percent burrograss; 15 percent each of blue grama and tobosa; 13 percent side-oats grama; 7 percent black grama; 5 percent each of alkali sacaton, broom snakeweed, sand dropseed, and soaptree yucca; 3 percent winterfat; and 7 percent annual grasses and forbs.

Small amounts of littleleaf sumac, gyp grama, bush muhly, gyp muhly, coldenia, Mormon-tea, fourwing saltbush, ring muhly, mesquite, giant sacaton, pricklypear cactus, desertholly, vine-mesquite, cholla cactus, and three-awn are found in the climax plant community in places.

Under continuous livestock grazing, such plants as side-oats grama, black grama, Mormon-tea, winterfat, and bush muhly decrease, while burrograss, tobosa, blue grama, and broom snakeweed increase. With prolonged heavy grazing the vegetation is dominated by burrograss, broom snakeweed, ring muhly, various brush species, and annual grasses and weeds, which greatly reduces the volume of forage available.

Burning generally results in losses of black grama and side-oats grama with corresponding increases in tobosa. Range seeding is hazardous on this site because the probability of precipitation is low and soil surface temperatures are high. Brush management where needed improves vegetation under favorable climatic conditions. Soils of this site, except for the Atoka, Holloman, and Reeves soils, are suitable for earthen structures.

When this site is in excellent condition, the total annual air-dry vegetative yield is 950 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. About 80 percent of this production is from plants which furnish forage for cattle or sheep.

SALT FLATS (SD-3) RANGE SITE

The soils of this range site are loams. They are moderately saline and are rarely flooded. They are deep, and have moderately slow permeability. Available water capacity is high. Slopes are 0 to 3 percent. Mean annual precipitation is 10 to 14 inches. Runoff is slow to medium. Elevation is 3,300 to 4,500 feet.

The vegetation on this site is about 90 percent grasses and 10 percent shrubs and forbs. The approximate composition of the climax (potential) plant community, by weight, is 70 percent alkali sacaton; 10 percent inland saltgrass; 5 percent vine-mesquite; and 3 percent each of fourwing saltbush, burrograss, goldenrod, seepwillow, and seepweed. Goldenrod, seepwillow, and seepweed are generally not used by cattle or sheep.

Associated species include sedges, rushes, saltcedar, tobosa, three-awn, black grama, mesquite, cholla cactus, giant sacaton, annuals, and perennial forbs.

Continuous moderate livestock grazing has little effect on the plant community, which remains dominantly alkali sacaton. With prolonged heavy grazing, the stand of alkali sacaton is thinner, and mesquite, saltcedar, and weeds invade, which reduces the volume of forage available.

Range seeding is essentially impractical because of the saline soils, hot climate and low probability of precipitation.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle or sheep.

SALT MEADOW (SD-3) RANGE SITE

The soils of this site are loams. They are deep, somewhat poorly drained, and saline, and the water table is at a depth of 2 to 4 feet. These soils have moderately slow permeability. Available water capacity is moderate. Slopes are 0 to 1 percent. Mean annual precipitation is 10 to 12 inches. Runoff is slow. Elevation is 3,300 to 3,700 feet.

The vegetation on this site is about 60 to 70 percent grasses, 20 to 25 percent shrubs, and 10 to 20 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 40 percent alkali sacaton; 15 percent giant sacaton; 10 percent fourwing saltbush; 5 percent vine-mesquite; 4 percent each of sedges, seepweed, saltgrass, mesquite, iodinebush, and wolfberry; and 3 percent each of cattail and arrowweed. Seepweed, iodinebush, cattail, arrowweed and wolfberry are not generally used by cattle or sheep.

Associated species include seepwillow, giant reedgrass, rushes, and cottonwood.

Under continuous livestock grazing alkali sacaton decreases and inland saltgrass increases. With prolonged heavy grazing, the vegetation is dominated by almost pure stands of inland saltgrass, with minor amounts of burrobrush, mesquite, saltcedar, iodinebush, seepweed, and salt sedges, which greatly reduces the volume of forage available.

Range seeding is essentially impractical because of the saline soils, hot climate, and low probability of precipitation.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,800 pounds per acre in favorable years, and 1,400 pounds per acre in unfavorable years. About 75 percent of this production is from plants which furnish forage for cattle or sheep.

SALTY BOTTOMLAND (SD-3) RANGE SITE

The soils of this range site are loams and silty clay loams. They are deep and are rarely flooded. They are saline, having sufficient salt content to limit the vegetation to salt-tolerant species. They have very slow or moderately slow permeability. Available water capacity is moderate to high. Slopes are 0 to 1 percent. Mean annual precipitation is 10 to 14 inches. Runoff is slow to medium. Elevation is 3,300 to 5,000 feet.

The vegetation on this site is about 75 to 80 percent grasses, 15 percent shrubs, and 5 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 35 percent alkali sacaton; 27 percent giant sacaton; 10 percent inland saltgrass; 5 percent each of fourwing saltbush, iodinebush, burrograss, tobosa, and sedges. Iodinebush is not generally used by cattle or sheep.

Minor amounts of two-flower trichloris, rushes, cholla cactus, giant reed grass, bitterweed, pepperweed, purslane, yucca, mesquite, saltcedar, dock, catclaw mimosa, and wolfberry are also found in the climax plant community in places.

Under continuous livestock grazing, tobosa and vine-mesquite decrease while alkali sacaton and burrograss increase. Fourwing saltbush is replaced by mesquite, catclaw mimosa, wolfberry, and iodinebush. With prolonged heavy grazing, the vegetation is dominantly a thin stand of alkali sacaton with lesser amounts of inland saltgrass, sedges, seepweed, iodinebush, saltcedar, and other low value plants, which greatly reduces the volume of forage available.

Range seeding is essentially impractical because of the saline soils, hot climate, and low probability of precipitation.

When this site is in excellent condition, the total annual air-dry vegetative yield is 2,000 pounds per acre in favorable years and 750 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle or sheep.

SANDHILLS (CP-2) RANGE SITE

The soils of this range site are hummocky fine sands. They are deep and have rapid permeability. Available water capacity is very low to low. Slopes are 1 to 15 percent. Mean annual precipitation is 12 to 13 inches. Runoff is very slow. Elevation is 3,500 to 4,100 feet.

The vegetation on this site is about 70 to 80 percent grasses, 15 to 20 percent shrubs, and 5 to 10 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 20 percent sand bluestem; 15 percent shinnery oak; 10 percent each of giant dropseed and sand sagebrush; 5 percent each of Havard panicum, three-awn, yucca, hairy grama, fall witchgrass, plains bristlegrass, and little bluestem; and 10 percent annual forbs. Sand sagebrush is not generally used by cattle or sheep.

Associated species include minor amounts of black grama, red lovegrass, big bluestem, sand dropseed, sandbur, and yellow indiangrass.

Under continuous grazing, sand bluestem, little bluestem, plains bristlegrass, and Havard panicum decrease while three-awn, yucca, sand sagebrush, and shinnery oak increase. With prolonged heavy grazing, mesquite invades, and the vegetation is dominated by brush and low value grasses, which reduces the volume of forage available.

Vegetation on this site responds to brush management when needed. Vegetation disturbance should be kept to a minimum to prevent soil blowing.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,600 pounds per acre in favorable years and 1,100 pounds per acre in unfavorable years. About 85 percent of this production is from plants which furnish forage for cattle.

SANDY (CP-2) RANGE SITE

The soils of this range site are fine sands, loamy fine sands, and fine sandy loams. They are deep and have moderate to moderately rapid permeability. Available water capacity is moderate to high. Slopes are 0 to 5 percent. Mean annual precipitation is 12 to 13 inches. Runoff is medium or slow. Elevation is 3,500 to 4,100 feet.

The vegetation on this site is 80 percent grasses, 20 percent shrubs, and only an occasional forb. The approximate composition of the climax (potential) plant community, by weight, is 20 percent side-oats grama; 15 percent each of little bluestem and blue and hairy gramas; 10 percent black grama, and 5 percent each of plains bristlegrass, sand dropseed, buffalograss, three-awn, yucca, winterfat, sand sagebrush, and four-wing saltbush.

Associated species which sometimes occur in minor amounts include New Mexico feathergrass, sand bluestem, red lovegrass, bush muhly, broom snakeweed, mesquite, sandbur, shinnery oak, and annual and perennial forbs.

Under continuous livestock grazing, side-oats grama, little bluestem, and plains bristlegrass decrease while blue grama, hairy grama, buffalograss, sand dropseed, and three-awn increase. With prolonged heavy grazing, mesquite invades, and the vegetation is dominated by mesquite, yucca, three-awn, broom snakeweed, and sand dropseed, which greatly reduces the volume of forage available.

Vegetation improvement through management practices such as deferred grazing and grazing systems is good. Brush management, when needed, improves vegetation. Range seeding is hazardous because of the hazard of soil blowing and the low probability of precipitation.

When the site is in excellent condition, the total annual air-dry vegetative yield is 1,400 pounds per acre in favorable years and 650 pounds per acre in unfavorable years. About 95 percent of this production is from plants which furnish forage for cattle and sheep.

SANDY (SD-3) RANGE SITE

The soils of this range site are sandy loams, loamy fine sands, and fine sandy loams (fig. 15). They are moderately deep to deep and have moderately rapid or moderate permeability. Available water capacity is very low to high. Slopes are 0 to 5 percent. Mean annual precipitation is 10 to 12 inches. Runoff is very slow to medium. Elevation is 3,300 to 3,900 feet.

Figure 15.—This area of Berino fine sandy loam is in Sandy (SD-3) range site in fair condition. Vegetation is dominantly sand dropseed, three-awn, and yucca.

The vegetation on this site is 80 percent grasses, 10 to 15 percent shrubs, and 5 to 10 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 40 percent black grama; 10 percent each of blue and hairy grama and dropseeds; 7 percent javelinabush; 5 percent each of bush muhly, plains bristlegrass, side-oats grama, and yucca; 3 percent three-awn; 2 percent winterfat; 3 percent annual forbs; and 3 percent perennial forbs. Javelinabush is not generally browsed by cattle or sheep.

Associated species which sometimes occur in minor amounts include catclaw mimosa, Mormon-tea, mesquite, shinnery oak, burrograss, alkali sacaton, tobosa, broom snakeweed, and vine-mesquite.

Under continuous livestock grazing, side-oats grama, bush muhly, plains bristlegrass, and winterfat decrease while sand dropseed, three-awn, hairy grama, and yucca increase. With prolonged heavy grazing, the vegetation is composed of mesquite, wooly groundsel, yucca, three-awn, annual forbs, and woody species, which greatly reduces the volume of forage available.

This site is suited to vegetation improvement through such management practices as deferred grazing and grazing systems. Brush management, where needed, improves vegetation. Range seeding is unreliable because of the hot soil surface temperature and low probability of precipitation.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,100 pounds per acre in favorable years and 450 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle and sheep.

SHALLOW (CP-4) RANGE SITE

The soils of this range site are cobbly loams and gravelly loams underlain by indurated caliche or limestone. They are shallow to very shallow and have moderate permeability. Available water capacity is very low. Slopes are 0 to 15 percent. Mean annual precipitation is 12 to 18 inches. Runoff is medium to rapid. Elevation is 4,000 to 6,800 feet.

The vegetation on this site is about 80 percent grasses, 15 percent shrubs, and 5 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 25 percent black grama; 20 percent side-oats grama; 10 percent each of blue grama and rough tridens; 5 percent each of bush muhly, hairy grama, sotol, catclaw mimosa, three-awn, and littleleaf sumac; and 5 percent annual grasses and forbs. Sotol and catclaw mimosa are not generally browsed by cattle or sheep.

Associated species include minor amounts of algerita, sand dropseed, wolftail, Halls panicum, agave, soaptree yucca, sacahuista, broom snakeweed, little bluestem, green sprangletop, hairy tridens, cholla cactus, slim tridens, mat muhly, one-seed juniper, Spanish-dagger, mountain muhly, and pinyon pine.

Under continuous livestock grazing, side-oats grama, black grama, and bush muhly decrease while rough tridens, three-awn, cholla cactus, and catclaw mimosa increase. Prolonged heavy grazing may result in a vegetation dominated by broom snakeweed, fluffgrass, cacti, brush species and annual weeds, which greatly reduces the volume of forage available.

Vegetation can be improved through grazing systems and deferment. Brush management, when needed, improves vegetation. Range seeding is hazardous, except in local areas of deeper soils, because of soil depth and low available water capacity.

When this site is in excellent condition, the total annual air-dry vegetative yield is 850 pounds in favorable years and 350 pounds in unfavorable years. About 85 percent of this production is from plants which furnish forage for cattle or sheep.

SHALLOW (HP-3) RANGE SITE

The soils of this range site are gravelly fine sandy loams (fig. 16), gravelly loams, and fine sandy loams underlain by indurated caliche. They are very shallow and shallow and have moderate permeability. Available water capacity is very low. Slopes are 0 to 3 percent. Mean annual precipitation is 14 to 16 inches. Runoff is medium. Elevation is 4,300 to 4,400 feet.

The vegetation on this site is about 60 to 65 percent grasses, 5 to 10 percent shrubs, and 20 to 30 percent forbs. The approximate composition of the climax (potential) plant community, by weight, is 20 percent each of black grama and side-oats grama; 11 percent blue grama; 5 percent each of little bluestem, New Mexico feathergrass, sand dropseed, and buckwheat; 3 percent each of winterfat, Mormon-tea, and woolly goundsel; 15 percent perennial forbs; and 5 percent annual grasses and forbs. Wooly goundsel is not generally used by cattle or sheep.

Associated species include minor amounts of yucca,

Figure 16.—**This area of Kimbrough gravelly loam is in Shallow (HP-3) range site in good condition. Slopes are 0 to 3 percent. Vegetation is side-oats grama, black grama, and blue grama.**

hoarhound, desert daisy, broom snakeweed, wolftail, tobosa, three-awn, mesquite, and cholla cactus.

Under continuous livestock grazing such plants as little bluestem, side-oats grama, and black grama decrease while blue grama, sand dropseed, wolftail, and three-awn increase. With prolonged heavy grazing the plant community is dominated by three-awn, broom snakeweed, cholla cactus, mesquite, and wooly groundsel, which greatly reduces the volume of forage available.

Vegetation improvement is good to rapid in favorable climatic conditions through grazing systems and deferred grazing. When needed brush management results in rapid vegetation improvement under these same conditions. Range seeding is hazardous, except in local areas of deeper soils, because of the shallow depth to caliche and low available water capacity.

When this site is in excellent condition, the total annual air-dry vegetative yield is 1,000 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle or sheep.

SHALLOW SAND (SD-3) RANGE SITE

The soils of this range site are fine sandy loams. They are shallow (7 to 20 inches deep to indurated caliche) and have moderately rapid permeability. Available water capacity is very low. Slopes are 0 to 5 percent. Mean annual precipitation is 10 to 12 inches. Runoff is slow. Elevation is 3,400 to 3,800 feet.

The vegetation on this site is about 90 to 95 percent grasses and 5 to 10 percent shrubs and forbs. The approximate composition of the climax (potential) plant community, by weight, is 70 percent black grama; 3 percent each of plains bristlegrass and sand dropseed; 2 percent each of bush muhly, bristle panicum, three-awn, fall witchgrass, javalinabush, range ratany, and catclaw mimosa; 7 percent perennial forbs; and 3 percent annual forbs. Javalinabush and catclaw mimosa are not generally used by cattle or sheep.

Associated species include minor amounts of spike dropseed, slim tridens, broom snakeweed, feather dalea, fourwing saltbush, wolfberry, yucca, tesajillo, bush muhly, mesquite, gray thorn, yucca, Mormon-tea, desert zinnia, croton, paperflower, senna, bladderpod, deerstongue, woolly indianwheat, and plains blackfoot.

Under continuous grazing, black grama, bush muhly, plains bristlegrass, and perennial forbs decrease while three-awn, dropseeds, and catclaw mimosa increase and mesquite and creosotebush invade. With prolonged heavy grazing, the vegetation is dominated by low value grasses and brush species such as mesquite, creosotebush, catclaw mimosa, and javalinabush, which greatly reduces the volume of forage available.

Range vegetation is readily improved through grazing systems, deferred grazing and brush management when it is needed. Range seeding is hazardous because of the shallow depth to indurated caliche and low available water capacity.

When this site is in excellent condition the total annual air-dry vegetative yield is 1,150 pounds per acre in favorable years and 675 pounds per acre in unfavorable years. About 90 percent of this production is from plants which furnish forage for cattle or sheep.

Engineering[3]

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, water management, and recreation. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the section "Soil Properties." The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock and hardness of bedrock within a depth of 5 or 6 feet, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to select potential residential, commercial, industrial, and recreational areas; make preliminary estimates pertinent to construction in a particular area; evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; plan detailed onsite investigations of soils and geology; find sources of gravel, sand, clay, and topsoil; plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 3 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 4 for sanitary facilities; and table 6, for water management. Table 5 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; the Glossary defines many of these terms.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 3. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, generally difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 3 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation do not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-

[3] CHARLES CARUSO, area engineer, Soil Conservation Service, helped prepare this section.

TABLE 3.—*Building site development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Alama:					
Aa	Moderate: floods.	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, low strength, shrink-swell.
Ancho:					
[1] AN:					
Ancho part	Moderate: too clayey.	Moderate: shrink-swell, frost action, low strength.	Moderate: shrink-swell, low strength.	Moderate: frost action, shrink-swell, low strength.	Moderate: shrink-swell, low strength, frost action.
Penasco part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Atoka:					
AtA, AtB	Moderate: cemented pan.	Moderate: shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: shrink-swell.	Moderate: cemented pan, low strength, shrink-swell.
Balmorhea:					
Ba	Moderate: floods, too clayey, wetness.	Severe: floods	Severe: floods	Severe: corrosive, floods.	Severe: low strength.
Bd	Moderate: floods, too clayey.	Severe: floods	Severe: floods	Severe: corrosive, floods.	Severe: low strength.
Berino:					
[1] BE:					
Berino part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
Cacique part	Severe: cemented pan.	Moderate: cemented pan, shrink-swell.	Severe: cemented pan.	Moderate: cemented pan, shrink-swell.	Moderate: cemented pan, shrink-swell, low strength.
[1] Bf:					
Berino part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
Pintura part	Severe: cutbanks cave.	Moderate: slope	Moderate: slope.	Severe: slope	Moderate: slope.
Bigetty:					
BgA, Bh	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
BgB	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
[1] BP:					
Bigetty part	Moderate: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, shrink-swell.
Pecos part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: shrink-swell, floods.
Cuevoland:					
[1] CA:					
Cuevoland part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, frost action.

TABLE 3.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Cuevoland:					
[1] CA:					
Ancho part	Moderate: too clayey.	Moderate: shrink-swell, frost action, low strength.	Moderate: shrink-swell, low strength.	Moderate: frost action, shrink-swell, low strength.	Moderate: shrink-swell, low strength, frost action.
Pena part	Moderate: small stones.	Slight	Slight	Moderate: slope.	Slight.
Deama:					
[1] De:					
Deama part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Rock outcrop part.					
[1] DR:					
Deama part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Remunda part	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Dune land:					
Du.					
Ector:					
[1] EcC:					
Ector part	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop part.					
[1] EcD:					
Ector part	Severe: slope, depth to rock, small stones.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Rock outcrop part.					
Faskin:					
Fa	Slight	Slight	Slight	Slight	Moderate: low strength.
[1] FM:					
Faskin part	Slight	Slight	Slight	Slight	Moderate: low strength.
Malstrom part	Slight	Slight	Slight	Slight	Slight.
[1] Fr:					
Faskin part	Slight	Slight	Slight	Slight	Moderate: low strength.
Roswell part	Severe: cutbanks cave.	Moderate: slope	Moderate: slope.	Severe: slope	Moderate: slope.
Gabaldon:					
[1] GD:					
Gabaldon part	Moderate: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: low strength, floods, shrink-swell.
Dev part	Severe: floods, small stones.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Glendale:					
Ge	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength.

TABLE 3.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Glendale:					
Gf	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
Holloman:					
Ho	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: depth to rock.	Severe: corrosive.	Moderate: depth to rock, low strength.
[1] Hp:					
Holloman part	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: depth to rock.	Severe: corrosive.	Moderate: depth to rock, low strength.
Gypsum land part.					
Holloman thick solum part.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: depth to rock.	Severe: corrosive.	Moderate: depth to rock, low strength.
[1] HrC:					
Holloman part	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: depth to rock.	Severe: corrosive.	Moderate: depth to rock, low strength.
Gypsum land part.					
Holloman thick solum part.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: depth to rock.	Severe: corrosive.	Moderate: depth to rock, low strength.
[1] HSE:					
Holloman part	Moderate: depth to rock, slope.	Moderate: depth to rock, low strength, slope.	Severe: depth to rock.	Severe: slope, corrosive.	Moderate: depth to rock, low strength, slope.
Gypsum land part.					
Ima:					
Im	Slight	Slight	Slight	Slight	Slight.
Jal:					
Ja	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Kimbrough:					
Km	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
[1] Ks:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Sharvana part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
[1] Kt:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Stegall part	Severe: cemented pan.	Moderate: cemented pan, low strength.	Severe: cemented pan.	Moderate: cemented pan, low strength.	Severe: low strength.
Slaughter part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, low strength.
Lozier:					
[1] Lr:					
Lozier part	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.

TABLE 3.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Lozier:					
[1] Lr:					
Reakor part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, corrosive.	Severe: cemented pan.
[1] Lt:					
Lozier part	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, corrosive.	Severe: cemented pan.
Pajarito:					
Pa	Slight	Slight	Slight	Slight	Slight.
[1] Pb:					
Pajarito part	Slight	Slight	Slight	Slight	Slight.
Pintura part	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope	Moderate: slope.
Pecos:					
Pe	Severe: floods	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: shrink-swell, floods.
PfA, PGB	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: shrink-swell, floods.
[1] PH:					
Pecos part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: shrink-swell, floods.
Dev part	Severe: floods, small stones.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Pena:					
[1] PK:					
Pena part	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope	Moderate: slope, frost action.
Penasco part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.
Penasco:					
[1] PL:					
Penasco part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.
Ancho part	Moderate: too clayey.	Moderate: shrink-swell, frost action, low strength.	Moderate: shrink-swell, low strength.	Moderate: frost action, shrink-swell, low strength.	Moderate: shrink-swell, low strength, frost action.
[1] PN:					
Penasco part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Gabaldon part	Moderate: floods.	Severe: floods	Severe: floods	Severe: floods	Moderate: low strength, floods, shrink-swell.
Reakor:					
Ra, ReA, ReB, RF	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength. shrink-swell.

TABLE 3.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Reakor gravelly subsoil variant: Rg	Moderate: small stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
Reakor: [1] RH: Reakor part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Pecos part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: shrink-swell, floods.
[1] Rl: Reakor part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, corrosive.	Severe: cemented pan.
Reeves: RkA, RkB	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, corrosive.	Moderate: shrink-swell, low strength.
[1] RL: Reeves part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, corrosive.	Moderate: shrink-swell, low strength.
Holloman part	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: depth to rock.	Severe: corrosive.	Moderate: depth to rock, low strength.
Holloman thick solum part.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: depth to rock.	Severe: corrosive.	Moderate: depth to rock, low strength.
Remunda: [1] RM: Remunda part	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Penasco part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.
Roswell: [1] Rn: Roswell part	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope	Moderate: slope.
Jalmar part	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Russler: Ru	Moderate: depth to rock.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, depth to rock.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.
Shanta: Sh	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods, low strength.
Simona: Sm	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.

TABLE 3.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Sotim:					
So	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.
Tencee:					
Te	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, corrosive.	Severe: cemented pan.
TfD	Severe: cemented pan, slope.	Severe: cemented pan, slope.	Severe: cemented pan, slope.	Severe: cemented pan, corrosive, slope.	Severe: cemented pan, slope.
[1] Tg:					
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, corrosive.	Severe: cemented pan.
Upton part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.
[1] TS:					
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, corrosive.	Severe: cemented pan.
Sotim part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.
Torriorthents:					
TOF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Upton:					
[1] UA:					
Upton part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.
Atoka part	Moderate: cemented pan.	Moderate: shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: shrink-swell.	Moderate: cemented pan, low strength, shrink-swell.
Vinton:					
[1] VG:					
Vinton part	Severe: cutbanks cave.	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, low strength.
Glendale part	Moderate: floods, too clayey.	Severe: floods	Severe: floods	Severe: floods	Moderate: low strength.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

swell potential of the soil (fig. 17). Soil texture, plasticity, and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 3 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity that were used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones, all of which affect stability and ease of excavation, were also considered.

TABLE 4.—*Sanitary facilities*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe" and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Alama:					
Aa	Severe: percs slowly.	Severe: floods	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Ancho:					
[1] AN:					
Ancho part	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Fair: too clayey.
Penasco part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Atoka:					
AtA, AtB	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: thin layer, area reclaim.
Balmorhea:					
Ba	Severe: percs slowly, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: too clayey.
Bd	Severe: percs slowly.	Severe: floods	Moderate: floods.	Moderate: floods.	Fair: too clayey.
Berino:					
[1] BE:					
Berino part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Cacique part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: area reclaim, thin layer.
[1] Bf:					
Berino part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Pintura part	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: slope, too sandy.
Bigetty:					
BgA, Bh	Severe: percs slowly.	Slight	Slight	Slight	Fair: too clayey.
BgB	Severe: percs slowly.	Slight	Slight	Slight	Fair: too clayey.
[1] BP:					
Bigetty part	Severe: percs slowly.	Severe: floods	Moderate: floods.	Moderate: floods.	Fair: too clayey.
Pecos part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Poor: too clayey.
Cuevoland:					
[1] CA:					
Cuevoland part	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Good.
Ancho part	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Fair: too clayey.
Pena part	Slight	Moderate: seepage, slope, small stones.	Moderate: small stones.	Slight	Poor: small stones.

TABLE 4.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Deama:					
[1] De:					
Deama part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, large stones, small stones.
Rock outcrop part.					
[1] DR:					
Deama part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, large stones, small stones.
Remunda part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Dune land:					
Du.					
Ector:					
[1] EcC:					
Ector part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones.
Rock outcrop part.					
[1] EcD:					
Ector part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope	Poor: thin layer, small stones.
Rock outcrop part.					
Faskin:					
Fa	Slight	Moderate: seepage.	Slight	Slight	Good.
[1] FM:					
Faskin part	Slight	Moderate: seepage.	Slight	Slight	Good.
Malstrom part	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy, area reclaim.
[1] Fr:					
Faskin part	Slight	Moderate: seepage.	Slight	Slight	Good.
Roswell part	Moderate: slope.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, area reclaim.
Gabaldon:					
[1] GD:					
Gabaldon part	Moderate: percs slowly, floods.	Severe: floods	Moderate: floods.	Moderate: floods.	Good.
Dev part	Severe: floods	Severe: floods, seepage, small stones.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: small stones.
Glendale:					
Ge, Gf	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Good.
Holloman:					
Ho	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.
[1] Hp:					
Holloman part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.

TABLE 4.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Holloman:					
[1] Hp:					
Gypsum land part.					
Holloman thick solum part.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.
[1] HrC:					
Holloman part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.
Gypsum land part.					
Holloman thick solum part.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.
[1] HSE:					
Holloman part	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: area reclaim, thin layer.
Gypsum land part.					
Ima:					
Im	Slight	Severe: seepage.	Moderate: seepage.	Moderate: seepage.	Good.
Jal:					
Ja	Slight	Moderate: seepage.	Slight	Slight	Good.
Kimbrough:					
Km	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
[1] Ks:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Sharvana part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer.
[1] Kt:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Stegall part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: thin layer, too clayey.
Slaughter part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer.
Lozier:					
[1] Lr:					
Lozier part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones, area reclaim.
Reakor part	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: area reclaim, small stones, thin layer.
[1] Lt:					
Lozier part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones, area reclaim.

TABLE 4.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lozier:					
[1] Lt:					
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: area reclaim, small stones, thin layer.
Pajarito:					
Pa	Slight	Severe: seepage.	Moderate: seepage.	Moderate: seepage.	Good.
[1] Pb:					
Pajarito part	Slight	Severe: seepage.	Moderate: seepage.	Moderate: seepage.	Good.
Pintura part	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: slope, too sandy.
Pecos:					
Pe	Severe: floods, percs slowly.	Severe: floods	Severe: floods	Severe: floods	Poor: too clayey.
PfA, PGB	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Poor: too clayey.
[1] PH:					
Pecos part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Poor: too clayey.
Dev part	Severe: floods	Severe: floods, seepage, small stones.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: small stones.
Pena:					
[1] PK:					
Pena part	Moderate: slope.	Severe: slope	Moderate: small stones.	Moderate: slope.	Poor: small stones.
Penasco part	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.	Moderate: slope.	Poor: thin layer, area reclaim, small stones.
Penasco:					
[1] PL:					
Penasco part	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.	Moderate: slope.	Poor: thin layer, area reclaim, small stones.
Ancho part	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Fair: too clayey.
[1] PN:					
Penasco part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim, small stones.
Gabaldon part	Moderate: percs slowly, floods.	Severe: floods	Moderate: floods.	Moderate: floods.	Good.
Reakor:					
Ra, ReA, RF	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
ReB	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Reakor gravelly subsoil variant:					
Rg	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey, small stones.	Slight	Fair: too clayey, area reclaim.
Reakor:					
[1] RH:					
Reakor part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.

TABLE 4.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Reakor:					
[1] RH:					
Pecos part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Poor: too clayey.
[1] RI:					
Reakor part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: area reclaim, small stones, thin layer.
Reeves:					
RkA	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: area reclaim.
RkB	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: area reclaim.
[1] RL:					
Reeves part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: area reclaim.
Holloman part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.
Holloman thick solum part.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.
Remunda:					
[1] RM:					
Remunda part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Penasco part	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.	Moderate: slope.	Poor: thin layer, area reclaim, small stones.
Roswell:					
[1] Rn:					
Roswell part	Moderate: slope.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, area reclaim.
Jalmar part	Slight	Moderate: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
Russler:					
Ru	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer, too clayey, area reclaim.
Shanta:					
Sh	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Fair: too clayey.
Simona:					
Sm	Severe: cemented pan.	Severe: cemented pan, seepage.	Severe: cemented pan.	Moderate: seepage.	Poor: thin layer, area reclaim.
Sotim:					
So	Severe: percs slowly.	Slight	Severe: seepage.	Slight	Good.
Tencee:					
Te	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: area reclaim, small stones, thin layer.

TABLE 4.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Tencee: TfD	Severe: cemented pan, slope.	Severe: cemented pan, slope.	Severe: cemented pan.	Severe: slope	Poor: slope, small stones, thin layer.
[1] Tg: Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: area reclaim, small stones, thin layer.
Upton part	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer, small stones.
[1] TS: Tencee part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: area reclaim, small stones, thin layer.
Sotim part	Severe: percs slowly.	Moderate: slope.	Severe: seepage.	Slight	Good.
Torriorthents: TOF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Upton: [1] UA: Upton part	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer, small stones.
Atoka part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: thin layer, area reclaim.
Vinton: [1] VG: Vinton part	Severe: floods	Severe: seepage, floods.	Moderate: too sandy, floods.	Moderate: floods.	Fair: too sandy.
Glendale part	Severe: percs slowly.	Severe: floods	Moderate: too clayey, floods.	Moderate: floods.	Good.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 4 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight,* soils are favorable for the specified use and limitations are minor and easily overcome; if *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe,* soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required. The terms *good, fair,* and *poor,* respectively, mean the same as the terms *slight, moderate,* and *severe.*

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between a depth of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that effect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

TABLE 5.—*Construction materials*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair" and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Alama:				
Aa	Fair: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Ancho:				
[1] AN:				
Ancho part	Fair: low strength, shrink-swell, frost action.	Unsuited	Unsuited	Fair: too clayey.
Penasco part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: thin layer, small stones, area reclaim.
Atoka:				
AtA, AtB	Poor: low strength, shrink-swell, thin layer.	Unsuited	Unsuited	Fair: thin layer.
Balmorhea:				
Ba, Bd	Poor: low strength	Unsuited	Unsuited	Fair: excess salt.
Berino:				
[1] BE:				
Berino part	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer.
Cacique part	Poor: thin layer	Unsuited	Unsuited	Poor: too sandy.
[1] Bf:				
Berino part	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
Pintura part	Good	Poor	Unsuited	Poor: too sandy.
Bigetty:				
BgA, BgB	Fair: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Bh	Fair: shrink-swell, low strength.	Unsuited	Unsuited	Poor: excess salt.
[1] BP:				
Bigetty part	Fair: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Pecos part	Poor: shrink-swell	Unsuited	Unsuited	Poor: too clayey.
Cuevoland:				
[1] CA:				
Cuevoland part	Fair: low strength, shrink-swell, frost action.	Unsuited	Unsuited	Good.
Ancho part	Fair: low strength, shrink-swell, frost action.	Unsuited	Unsuited	Fair: too clayey.
Pena part	Fair: frost action	Poor: excess fines	Poor: excess fines	Poor: small stones.
Deama:				
[1] De:				
Deama part	Severe: slope, area reclaim, thin layer.	Unsuited	Unsuited	Poor: slope, large stones, small stones.
Rock outcrop part.				
[1] DR:				
Deama part	Severe: area reclaim, thin layer.	Unsuited	Unsuited	Poor: large stones, small stones, excess lime.
Remunda part	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer.

TABLE 5.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Dune land: Du.				
Ector: [1]EcC: Ector part	Poor: thin layer	Unsuited: thin layer	Unsuited: thin layer	Poor: thin layer, small stones.
Rock outcrop part.				
[1]EcD: Ector part	Poor: thin layer	Unsuited: thin layer	Unsuited: thin layer	Poor: thin layer, small stones.
Rock outcrop part.				
Faskin: Fa	Fair: low strength	Unsuited	Unsuited	Fair: too sandy.
[1]FM: Faskin part	Fair: low strength	Unsuited	Unsuited	Fair: too sandy.
Malstrom part	Good	Unsuited	Unsuited	Poor: too sandy.
[1]Fr: Faskin part	Fair: low strength	Unsuited	Unsuited	Good.
Roswell part	Good	Fair: excess fines	Unsuited	Poor: too sandy, area reclaim.
Gabaldon: [1]GD: Gabaldon part	Fair: low strength, frost action, shrink-swell.	Unsuited	Unsuited	Good.
Dev part	Good	Unsuited	Poor: excess fines	Poor: small stones.
Glendale: Ge, Gf	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Good.
Holloman: Ho	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
[1]Hp: Holloman part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
Gypsum land part.				
Holloman thick solum part.	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
[1]HrC: Holloman part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
Gypsum land part.				
Holloman thick solum part.	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
[1]HSE: Holloman part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
Gypsum land part.				

TABLE 5.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ima:				
Im	Good	Poor: excess fines	Unsuited	Good.
Jal:				
Ja	Fair: low strength	Unsuited	Unsuited	Poor: excess lime.
Kimbrough:				
Km	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess lime, small stones.
[1]Ks:				
Kimbrough part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess lime, small stones.
Sharvana part	Poor: thin layer	Unsuited	Unsuited	Fair: thin layer.
[1]Kt:				
Kimbrough part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess lime, small stones.
Stegall part	Poor: thin layer	Unsuited	Unsuited	Fair: thin layer, too clayey.
Slaughter part	Poor: thin layer, low strength.	Unsuited	Unsuited	Fair: thin layer, too clayey.
Lozier:				
[1]Lr:				
Lozier part	Poor: thin layer	Unsuited: thin layer	Unsuited: thin layer	Poor: thin layer, small stones.
Reakor part	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Good.
Tencee part	Poor: area reclaim, thin layer.	Unsuited	Unsuited: thin layer	Poor: area reclaim, small stones, thin layer.
[1]Lt:				
Lozier part	Poor: thin layer	Unsuited: thin layer	Unsuited: thin layer	Poor: thin layer, small stones.
Tencee part	Poor: area reclaim, thin layer.	Unsuited	Unsuited: thin layer	Poor: area reclaim, small stones, thin layer.
Pajarito:				
Pa	Good	Poor: excess fines	Unsuited	Fair: too sandy.
[1]Pb:				
Pajarito part	Good	Poor: excess fines	Unsuited	Good.
Pintura part	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Pecos:				
Pe	Poor: shrink-swell	Unsuited	Unsuited	Poor: too clayey, excess salt.
PfA, PGB	Poor: shrink-swell	Unsuited	Unsuited	Poor: too clayey.
[1]PH:				
Pecos part	Poor: shrink-swell	Unsuited	Unsuited	Poor: too clayey.
Dev part	Good	Unsuited	Poor: excess fines	Poor: small stones.
Pena:				
[1]PK:				
Pena part	Fair: frost action	Poor: excess fines	Poor: excess fines	Poor: small stones.

TABLE 5.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pena:				
[1] PK:				
Penasco part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: thin layer, small stones, area reclaim.
Penasco:				
[1] PL:				
Penasco part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: thin layer, small stones, area reclaim.
Ancho part	Fair: low strength, shrink-swell, frost action.	Unsuited	Unsuited	Fair: too clayey.
[1] PN:				
Penasco part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: thin layer, small stones, area reclaim.
Gabaldon part	Fair: low strength, frost action, shrink-swell.	Unsuited	Unsuited	Good.
Reakor:				
Ra, ReA, ReB, RF	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Good.
Reakor gravelly subsoil variant:				
Rg	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: area reclaim, excess lime.
Reakor:				
[1] RH:				
Reakor part	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Good.
Pecos part	Poor: shrink-swell	Unsuited	Unsuited	Poor: too clayey.
[1] RI:				
Reakor part	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Good.
Tencee part	Poor: area reclaim, thin layer.	Unsuited	Unsuited: thin layer	Poor: area reclaim, small stones, thin layer.
Reeves:				
RkA, RkB	Fair: shrink-swell, low strength, area reclaim.	Unsuited	Unsuited	Fair: area reclaim, excess salt.
[1] RL:				
Reeves part	Fair: shrink-swell, low strength, area reclaim.	Unsuited	Unsuited	Fair: area reclaim, excess salt.
Holloman part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
Holloman thick solum part.	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess salt.
Remunda:				
[1] RM:				
Remunda part	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
Penasco part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: thin layer, small stones, area reclaim.
Roswell:				
[1] Rn:				
Roswell part	Good	Fair: excess fines	Unsuited	Poor: too sandy, area reclaim.

TABLE 5.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Roswell:				
[1] Rn:				
Jalmar part	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Russler:				
Ru	Fair: shrink-swell, low strength, area reclaim.	Unsuited	Unsuited	Poor: excess salt, area reclaim.
Shanta:				
Sh	Poor: low strength	Unsuited	Unsuited	Fair: too clayey.
Simona:				
Sm	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, thin layer.
Sotim:				
So	Fair: low strength, shrink-swell.	Poor: excess fines	Unsuited	Fair: excess lime.
Tencee:				
Te	Poor: area reclaim, thin layer.	Unsuited	Unsuited: thin layer	Poor: area reclaim, small stones, thin layer.
TfD	Poor: area reclaim, thin layer.	Unsuited	Unsuited: thin layer	Poor: slope, small stones, thin layer.
[1] Tg:				
Tencee part	Poor: area reclaim, thin layer.	Unsuited	Unsuited: thin layer	Poor: area reclaim, small stones, thin layer.
Upton part	Poor: thin layer	Unsuited	Unsuited: thin layer	Poor: thin layer, small stones.
[1] TS:				
Tencee part	Poor: area reclaim, thin layer.	Unsuited	Unsuited: thin layer	Poor: area reclaim, small stones, thin layer.
Sotim part	Fair: low strength, shrink-swell.	Poor: excess fines	Unsuited	Fair: excess lime.
Torriorthents:				
TOF	Severe: slope	Unsuited	Unsuited	Poor: slope.
Upton:				
[1] UA:				
Upton part	Poor: thin layer	Unsuited	Unsuited: thin layer	Poor: thin layer, small stones.
Atoka part	Poor: low strength, shrink-swell, thin layer.	Unsuited	Unsuited	Fair: thin layer.
Vinton:				
[1] VG:				
Vinton part	Fair: low strength	Poor: excess fines	Unsuited	Poor: too sandy.
Glendale part	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Good.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 6.—*Water management*

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Alama:					
Aa	Favorable	Compressible, low strength, piping.	Percs slowly	Favorable	Erodes easily, percs slowly, piping.
Ancho:					
[1] AN:					
Ancho part	Slope	Low strength, compressible.	Percs slowly	Erodes easily, percs slowly, slope.	Erodes easily, piping, percs slowly.
Penasco part	Cemented pan, slope.	Thin layer	Cemented pan	Droughty, rooting depth, excess lime.	Cemented pan, rooting depth.
Atoka:					
AtA	Cemented pan	Thin layer, hard to pack, piping.	Cemented pan	Droughty, rooting depth.	Cemented pan, rooting depth.
AtB	Slope, cemented pan.	Thin layer, hard to pack, piping.	Cemented pan	Droughty, rooting depth, slope.	Cemented pan, rooting depth, slope.
Balmorhea:					
Ba	Favorable	Compressible, low strength.	Excess salt, wetness, floods.	Excess salt, wetness, floods.	Wetness, floods.
Bd	Favorable	Low strength, compressible.	Excess salt, floods	Excess salt, floods	Floods, erodes easily.
Berino:					
[1] BE:					
Berino part	Seepage	Low strength, compressible, piping.	Favorable	Soil blowing	Erodes easily, piping.
Cacique part	Cemented pan	Thin layer	Cemented pan	Rooting depth, soil blowing.	Cemented pan, complex slope.
[1] Bf:					
Berino part	Seepage	Low strength, compressible, piping.	Favorable	Erodes easily	Erodes easily, piping.
Pintura part	Seepage, slope	Piping, seepage	Cutbanks cave, slope.	Droughty, slope	Too sandy, slope, piping.
Bigetty:					
BgA	Favorable	Shrink-swell, low strength, piping.	Percs slowly	Favorable	Favorable.
BgB	Favorable	Shrink-swell, low strength, piping.	Percs slowly	Slope, erodes easily	Favorable.
Bh	Favorable	Shrink-swell, low strength, piping.	Excess salt, percs slowly.	Excess salt	Favorable.
[1] BP:					
Bigetty part	Favorable	Shrink-swell, low strength, piping.	Floods, percs slowly	Favorable	Favorable.
Pecos part	Favorable	Compressible, low strength.	Percs slowly	Slow intake	Favorable.
Cuevoland:					
[1] CA:					
Cuevoland part	Favorable	Low strength, compressible, piping.	Poor outlets	Erodes easily, excess lime.	Erodes easily, piping.
Ancho part	Slope	Low strength, compressible.	Percs slowly	Erodes easily, percs slowly, slope.	Erodes easily, piping, percs slowly.

TABLE 6.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Cuevoland:					
[1]CA:					
Pena part	Seepage, slope, small stones.	Favorable	Slope	Droughty, excess lime, slope.	Slope.
Deama:					
[1]De:					
Deama part	Slope, depth to rock.	Thin layer, piping	Depth to rock, slope.	Droughty, rooting depth, slope.	Depth to rock, rooting depth, slope.
Rock outcrop part.					
[1]DR:					
Deama part	Depth to rock	Thin layer, piping	Depth to rock	Droughty, rooting depth, slope.	Depth to rock, rooting depth, slope.
Remunda part	Slope	Low strength, compressible, hard to pack.	Percs slowly	Erodes easily, percs slowly, slope.	Percs slowly.
Dune land:					
Du.					
Ector:					
[1]EcC:					
Ector part	Depth to rock	Thin layer	Depth to rock	Rooting depth	Depth to rock.
Rock outcrop part.					
[1]EcD:					
Ector part	Depth to rock	Thin layer	Depth to rock	Rooting depth	Depth to rock.
Rock outcrop part.					
Faskin:					
Fa	Seepage	Seepage, piping	Favorable	Fast intake, soil blowing.	Erodes easily, piping.
[1]FM:					
Faskin part	Seepage	Seepage, piping	Favorable	Fast intake, soil blowing.	Erodes easily, piping.
Malstrom part	Seepage	Erodes easily, piping.	Favorable	Fast intake, soil blowing.	Erodes easily, piping.
[1]Fr:					
Faskin part	Seepage	Seepage, piping	Favorable	Fast intake, soil blowing.	Erodes easily, piping.
Roswell part	Seepage, slope	Seepage, erodes easily.	Favorable	Fast intake, soil blowing.	Complex slope, erodes easily.
Gabaldon:					
[1]GD:					
Gabaldon part	Seepage	Low strength, compressible, piping.	Floods	Floods	Erodes easily, piping.
Dev part	Seepage	Seepage	Floods	Floods, seepage, droughty.	Piping, floods.
Glendale:					
Ge, Gf	Favorable	Low strength, piping, shrink-swell.	Favorable	Favorable	Piping.
Holloman:					
Ho	Depth to rock, seepage.	Low strength, piping, thin layer.	Depth to rock, excess salt, complex slope.	Droughty, excess salt, rooting depth.	Depth to rock, rooting depth, complex slope.
[1]Hp:					
Holloman part	Depth to rock, seepage.	Low strength, piping, thin layer.	Depth to rock, excess salt, complex slope.	Droughty, excess salt. rooting depth.	Depth to rock, rooting depth, complex slope.

TABLE 6.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Holloman:					
[1] Hp:					
Gypsum land part.					
Holloman thick solum part.	Depth to rock, seepage.	Low strength, piping, thin layer.	Depth to rock, excess salt, complex slope.	Droughty, excess salt, rooting depth.	Depth to rock, rooting depth, complex slope.
[1] HrC:					
Holloman part	Depth to rock, seepage, slope.	Low strength, piping, thin layer.	Depth to rock, excess salt, complex slope.	Droughty, excess salt, rooting depth.	Depth to rock, rooting depth, complex slope.
Gypsum land part.					
Holloman thick solum part.	Depth to rock, seepage, slope.	Low strength, piping, thin layer.	Depth to rock, excess salt, complex slope.	Droughty, excess salt, rooting depth.	Depth to rock, rooting depth, complex slope.
[1] HSE:					
Holloman part	Depth to rock, seepage, slope.	Low strength, piping, thin layer.	Slope, depth to rock, excess salt.	Excess salt, rooting depth, slope.	Depth to rock, erodes easily, slope.
Gysum land part.					
Ima:					
Im	Seepage	Piping, seepage	Favorable	Erodes easily, seepage.	Erodes easily.
Jal:					
Ja	Seepage	Low strength, piping, compressible.	Poor outlets	Droughty, excess lime.	Piping.
Kimbrough:					
Km	Cemented pan	Thin layer	Cemented pan	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.
[1] Ks:					
Kimbrough part	Cemented pan	Thin layer	Cemented pan	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.
Sharvana part	Cemented pan	Thin layer	Cemented pan	Rooting depth, droughty.	Cemented pan, rooting depth.
[1] Kt:					
Kimbrough part	Cemented pan	Thin layer	Cemented pan	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.
Stegall part	Thin layer	Thin layer	Cemented pan	Rooting depth, slow intake.	Cemented pan, rooting depth.
Slaughter part	Cemented pan	Thin layer	Cemented pan	Rooting depth, droughty, slow intake.	Cemented pan, rooting depth.
Lozier:					
[1] Lr:					
Lozier part	Depth to rock	Thin layer	Depth to rock	Rooting depth	Depth to rock.
Reakor part	Seepage, slope	Low strength, compressible, piping.	Slope	Slope, erodes easily	Favorable.
Tencee part	Cemented pan, slope	Piping, thin layer	Cemented pan, complex slope.	Droughty, rooting depth, slope.	Cemented pan, complex slope, rooting depth.

TABLE 6.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Lozier:					
[1] Lt:					
Lozier part	Depth to rock	Thin layer	Depth to rock	Rooting depth	Depth to rock.
Tencee part	Cemented pan, slope.	Piping, thin layer	Cemented pan, complex slope.	Droughty, rooting depth, slope.	Cemented pan, complex slope, rooting depth.
Pajarito:					
Pa	Seepage	Seepage, piping	Favorable	Erodes easily, complex slope.	Erodes easily, poor outlets.
[1] Pb:					
Pajarito part	Seepage	Seepage, piping	Favorable	Erodes easily, complex slope.	Erodes easily, poor outlets.
Pintura part	Seepage, slope	Piping, seepage	Cutbanks cave, slope.	Droughty, slope	Too sandy, slope, piping.
Pecos:					
Pe	Favorable	Compressible, low strength.	Percs slowly	Excess salt, slow intake.	Favorable.
PfA, PGB	Favorable	Compressible, low strength.	Percs slowly	Slow intake	Favorable.
[1] PH:					
Pecos part	Favorable	Compressible, low strength.	Percs slowly	Slow intake	Favorable.
Dev part	Seepage	Seepage	Floods	Floods, seepage, droughty.	Piping, floods.
Pena:					
[1] PK:					
Pena part	Seepage, slope, small stones.	Favorable	Slope	Droughty, excess lime, slope.	Slope.
Penasco part	Cemented pan, slope	Thin layer	Cemented pan	Droughty, rooting depth, excess lime.	Cemented pan, rooting depth.
Penasco:					
[1] PL:					
Penasco part	Cemented pan, slope	Thin layer	Cemented pan	Droughty, rooting depth, excess lime.	Cemented pan, rooting depth.
Ancho part	Slope	Low strength, compressible.	Percs slowly	Erodes easily, percs slowly, slope.	Erodes easily, piping, percs slowly.
[1] PN:					
Penasco part	Cemented pan, slope	Thin layer	Cemented pan	Droughty, rooting depth, excess lime.	Cemented pan, rooting depth.
Gabaldon part	Seepage	Low strength, compressible, piping.	Floods	Floods	Erodes easily, piping.
Reakor:					
Ra	Seepage	Low strength, compressible, piping.	Favorable	Soil blowing	Favorable.
ReA	Seepage	Low strength, compressible, piping.	Favorable	Favorable	Favorable.
ReB	Seepage, slope	Low strength, compressible, piping.	Slope	Slope, erodes easily.	Favorable.
RF	Seepage	Low strength, compressible, piping.	Favorable	Slope, erodes easily.	Favorable.

TABLE 6.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Reakor gravelly subsoil variant:					
Rg	Seepage	Compressible, low strength, piping.	Favorable	Droughty	Favorable.
Reakor:					
[1] RH:					
Reakor part	Seepage	Low strength, compressible, piping.	Favorable	Favorable	Favorable.
Pecos part	Favorable	Compressible, low strength.	Percs slowly	Slow intake	Favorable.
[1] RI:					
Reakor part	Seepage	Low strength, compressible, piping.	Favorable	Slope, erodes easily.	Favorable.
Tencee part	Cemented pan, slope.	Piping, thin layer	Cemented pan, complex slope.	Droughty, rooting depth, slope.	Cemented pan, complex slope, rooting depth.
Reeves:					
RkA, RkB	Seepage, slope	Thin layer, hard to pack, piping.	Excess salt	Droughty, excess salt.	Slope.
[1] RL:					
Reeves part	Seepage, slope	Thin layer, hard to pack, piping.	Excess salt	Droughty, excess salt.	Slope.
Holloman part	Depth to rock, seepage, slope.	Low strength, piping, thin layer.	Depth to rock, excess salt.	Droughty, excess salt, rooting depth.	Depth to rock, rooting depth.
Holloman thick solum part.	Depth to rock, seepage, slope.	Low strength, piping, thin layer.	Depth to rock, excess salt.	Droughty, excess salt, rooting depth.	Depth to rock, rooting depth.
Remunda:					
[1] RM:					
Remunda part	Slope	Low strength, compressible, hard to pack.	Percs slowly	Erodes easily, percs slowly, slope.	Percs slowly, slope.
Penasco part	Cemented pan, slope.	Thin layer	Cemented pan	Droughty, rooting depth, excess lime.	Cemented pan, rooting depth.
Roswell:					
[1] Rn:					
Roswell part	Seepage, slope	Seepage, erodes easily.	Favorable	Fast intake, soil blowing.	Complex slope, erodes easily.
Jalmar part	Seepage	Seepage, piping	Favorable	Erodes easily, fast intake.	Too sandy.
Russler:					
Ru	Depth to rock	Low strength, hard to pack, piping.	Depth to rock, excess salt, percs slowly.	Excess salt, erodes easily, rooting depth.	Piping, erodes easily, rooting depth.
Shanta:					
Sh	Seepage	Compressible, shrink-swell, piping.	Floods	Floods, erodes easily.	Favorable.
Simona:					
Sm	Cemented pan, seepage.	Thin layer, seepage	Cemented pan	Droughty, erodes easily, rooting depth.	Cemented pan, rooting depth.

TABLE 6.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Sotim:					
So	Favorable	Low strength, compressible, piping.	Percs slowly	Excess lime, soil blowing.	Erodes easily, piping.
Tencee:					
Te, TfD	Cemented pan, slope.	Piping, thin layer	Cemented pan, complex slope.	Droughty, rooting depth, slope.	Cemented pan, complex slope, rooting depth.
[1] Tg:					
Tencee part	Cemented pan, slope.	Piping, thin layer	Cemented pan, complex slope.	Droughty, rooting depth, slope.	Cemented pan, complex slope, rooting depth.
Upton part	Cemented pan, seepage.	Thin layer, seepage	Cemented pan	Rooting depth, droughty.	Cemented pan.
[1] TS:					
Tencee part	Cemented pan, slope.	Piping, thin layer	Cemented pan, complex slope.	Droughty, rooting depth, slope.	Cemented pan, complex slope, rooting depth.
Sotim part	Slope	Low strength, compressible, piping.	Cemented pan, complex slope.	Droughty, rooting depth, slope.	Erodes easily, piping.
Torriorthents:					
TOF	Slope	Erodes easily	Slope	Erodes easily, slope	Slope, erodes easily.
Upton:					
[1] UA:					
Upton part	Cemented pan, seepage.	Thin layer, seepage	Cemented pan	Rooting depth, droughty.	Cemented pan.
Atoka part	Cemented pan	Thin layer, hard to pack, piping.	Cemented pan	Droughty, rooting depth, slope.	Cemented pan, rooting depth, slope.
Vinton:					
[1] VG:					
Vinton part	Seepage	Piping, low strength, seepage.	Favorable	Droughty, soil blowing.	Too sandy, soil blowing, piping.
Glendale part	Favorable	Low strength, piping, shrink-swell.	Cutbanks cave	Favorable	Piping.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible either to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in content of organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its

Figure 17.—Foundation cracking caused by the high shrink-swell potential of Pecos silty clay loam, nonsaline, 0 to 1 percent slopes.

capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste in excavated trenches or on the surface of the soil. The waste is spread, compacted in layers, and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 4 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for sanitary landfills should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, organic-matter content, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, saving material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of road fill, sand, gravel, and topsoil is indicated in table 5 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet, and described as the survey is made.

Road fill is soil material used in embankments for roads. The ratings reflect the east of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 9 provide more specific information about the nature of each horizon that can help determine its suitability for road fill.

According to the Unified soil classification system, soils rated *good* have low shrink-swell potential, low potential frost action, and few cobblestones and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, high potential frost action, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*, regardless of the quality of the suitable material.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 5 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand

and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 9.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones, are low in content of gravel and other coarse fragments, and have gentle slopes. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils; very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 6 the degree of soil limitation or soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

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

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation, and resistance to water erosion, soil blowing, soil slipping, and piping.

Recreation

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewer lines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited for recreational use in varying degree by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 7 the limitations of soils for recreation are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by additional information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 4, and interpretations for dwellings without basements and for local roads and streets, given in table 3.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet nor subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

TABLE 7.—*Recreational development*

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

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ancho:				
Aa	Severe: floods	Moderate: dusty, floods.	Moderate: floods, percs slowly.	Moderate: dusty.
Ancho:				
[1] AN:				
Ancho part	Moderate: percs slowly, dusty.	Moderate: dusty	Moderate: dusty, percs slowly, slope.	Moderate: dusty.
Penasco part	Severe: small stones	Severe: small stones	Severe: slope, small stones.	Severe: small stones.
Atoka:				
AtA	Slight	Slight	Slight	Slight.
AtB	Slight	Slight	Moderate: slope	Slight.
Balmorhea:				
Ba	Severe: floods	Moderate: dusty, floods, wetness.	Moderate: dusty, percs slowly, wetness.	Moderate: dusty, wetness.
Bd	Severe: floods	Moderate: dusty, floods.	Moderate: dusty, percs slowly.	Moderate: dusty.
Berino:				
[1] BE:				
Berino part	Slight	Slight	Slight	Slight.
Cacique part	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.
[1] Bf:				
Berino part	Slight	Slight	Slight	Slight.
Pintura part	Severe: too sandy	Severe: too sandy	Severe: slope, too sandy.	Severe: too sandy.
Biggety:				
BgA, Bh	Moderate: dusty	Moderate: dusty	Moderate: dusty, percs slowly.	Moderate: dusty.
BgB	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty, percs slowly.	Moderate: dusty.
[1] BP:				
Bigetty part	Severe: floods	Moderate: floods, dusty.	Moderate: floods, dusty.	Moderate: dusty.
Pecos part	Severe: floods	Moderate: floods, too clayey.	Moderate: floods, too clayey.	Moderate: floods, too clayey.
Cuevoland:				
[1] CA:				
Cuevoland part	Slight	Slight	Moderate: slope	Slight.
Ancho part	Moderate: percs slowly, dusty.	Moderate: dusty	Moderate: dusty, percs slowly, slope.	Moderate: dusty.
Pena part	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
Deama:				
[1] De:				
Deama part	Severe: slope	Severe: slope	Severe: slope, large stones, small stones.	Severe: slope.
Rock outcrop part.				

TABLE 7.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Deama:				
[1] DR:				
Deama part	Moderate: large stones, small stones.	Moderate: large stones, small stones.	Severe: depth to rock, large stones, small stones.	Moderate: large stones, small stones.
Remunda part	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
Dune land:				
Du	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing, slope.	Severe: too sandy, soil blowing.
Ector:				
[1] EcC:				
Ector part	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, small stones.	Moderate: slope, small stones.
Rock outcrop part.				
[1] EcD:				
Ector part	Severe: slope	Severe: slope	Severe: slope, depth to rock, small stones.	Moderate: slope, small stones.
Rock outcrop part.				
Faskin:				
Fa	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.
[1] FM:				
Faskin part	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.
Malstrom part	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.
[1] Fr:				
Faskin part	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.
Roswell part	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing, slope.	Severe: too sandy, soil blowing.
Gabaldon:				
[1] GD:				
Gabaldon part	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Dev part	Severe: floods, small stones.	Severe: small stones	Severe: floods, small stones.	Severe: small stones.
Glendale:				
Ge	Slight	Slight	Slight	Slight.
Gf	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Holloman:				
Ho	Moderate: dusty	Moderate: dusty	Moderate: depth to rock, dusty.	Moderate: dusty.
[1] Hp:				
Holloman part	Moderate: dusty	Moderate: dusty	Moderate: depth to rock, dusty.	Moderate: dusty.
Gypsum land part.				
Holloman thick solum part.	Moderate: dusty	Moderate: dusty	Moderate: depth to rock, dusty.	Moderate: dusty.
[1] HrC:				
Holloman part	Moderate: dusty	Moderate: dusty	Moderate: depth to rock, dusty, slope.	Moderate: dusty.
Gypsum land part.				

TABLE 7.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Holloman:				
[1] HrC:				
Holloman thick solum part.	Moderate: dusty	Moderate: dusty	Moderate: depth to rock, dusty, slope.	Moderate: dusty.
[1] HSE:				
Holloman part	Moderate: dusty, slope.	Moderate: dusty, slope.	Severe: slope	Moderate: dusty.
Gypsum land part.				
Ima:				
Im	Slight	Slight	Moderate: slope	Slight.
Jal:				
Ja	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Kimbrough:				
Km	Moderate: small stones.	Moderate: small stones.	Severe: small stones, cemented pan.	Moderate: small stones.
[1] Ks:				
Kimbrough part	Moderate: small stones.	Moderate: small stones.	Severe: small stones, cemented pan.	Moderate: small stones.
Sharvana part	Slight	Slight	Severe: cemented pan.	Slight.
[1] Kt:				
Kimbrough part	Moderate: small stones.	Moderate: small stones.	Severe: small stones, cemented pan.	Moderate: small stones.
Stegall part	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Slaughter part	Moderate: percs slowly.	Slight	Severe: cemented pan.	Slight.
Lozier:				
[1] Lr:				
Lozier part	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, small stones.	Moderate: slope, small stones.
Reakor part	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
Tencee part	Moderate: small stones.	Moderate: small stones.	Severe: cemented pan, small stones.	Moderate: small stones.
[1] Lt:				
Lozier part	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, small stones.	Moderate: slope, small stones.
Tencee part	Moderate: small stones.	Moderate: small stones.	Severe: cemented pan, small stones.	Moderate: small stones.
Pajarito:				
Pa	Moderate: too sandy	Moderate: too sandy	Moderate: slope, too sandy.	Moderate: too sandy.
[1] Pb:				
Pajarito part	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
Pintura part	Severe: too sandy	Severe: too sandy	Severe: slope, too sandy.	Severe: too sandy.
Pecos:				
Pe, PfA, PGB	Severe: floods	Moderate: floods, too clayey.	Moderate: floods, too clayey.	Moderate: floods, too clayey.
[1] PH:				
Pecos part	Severe: floods	Moderate: floods, too clayey.	Moderate: floods, too clayey.	Moderate: floods, too clayey.

TABLE 7.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Pecos:				
[1] PH:				
Dev part	Severe: floods, small stones.	Severe: small stones	Severe: floods, small stones.	Severe: small stones.
Pena:				
[1] PK:				
Pena part	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
Penasco part	Severe: small stones	Severe: small stones	Severe: slope, small stones.	Severe: small stones.
Penasco:				
[1] PL:				
Penasco part	Severe: small stones	Severe: small stones	Severe: slope, small stones.	Severe: small stones.
Ancho part	Moderate: percs slowly, dusty.	Moderate: dusty	Moderate: dusty, percs slowly, slope.	Moderate: dusty.
[1] PN:				
Penasco part	Severe: small stones	Severe: small stones	Severe: small stones	Severe: small stones.
Gabaldon part	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Reakor:				
Ra, ReA, RF	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
ReB	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
Reakor gravelly subsoil variant:				
Rg	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Reakor:				
[1] RH:				
Reakor part	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Pecos part	Severe: floods	Moderate: floods, too clayey.	Moderate: floods, too clayey.	Moderate: floods, too clayey.
[1] RI:				
Reakor part	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Tencee part	Moderate: small stones.	Moderate: small stones.	Severe: cemented pan, small stones.	Moderate: small stones.
Reeves:				
RkA	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
RkB	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
[1] RL:				
Reeves part	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Holloman part	Moderate: dusty	Moderate: dusty	Moderate: depth to rock, dusty, slope.	Moderate: dusty.
Holloman thick solum part.	Moderate: dusty	Moderate: dusty	Moderate: depth to rock, dusty, slope.	Moderate: dusty.
Remunda:				
[1] RM:				
Remunda part	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
Penasco part	Severe: small stones	Severe: small stones	Severe: slope, small stones.	Severe: small stones.

TABLE 7.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Roswell:				
[1] Rn:				
Roswell part	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing, slope.	Severe: too sandy, soil blowing.
Jalmar part	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Russler: Ru	Moderate: too clayey	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Shanta: Sh	Severe: floods	Moderate: floods	Severe: floods	Slight.
Simona: Sm	Slight	Slight	Moderate: slope	Slight.
Sotim: So	Moderate: dusty	Moderate: dusty	Moderate: percs slowly, dusty.	Moderate: dusty.
Tencee: Te	Moderate: small stones.	Moderate: small stones.	Severe: cemented pan, small stones.	Moderate: small stones.
TfD	Severe: slope	Severe: slope	Severe: cemented pan, slope, small stones.	Moderate: slope, small stones.
[1] Tg:				
Tencee part	Moderate: small stones.	Moderate: small stones.	Severe: cemented pan, small stones.	Moderate: small stones.
Upton part	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: cemented pan, small stones.	Moderate: dusty, small stones.
[1] TS:				
Tencee part	Moderate: small stones.	Moderate: small stones.	Severe: cemented pan, small stones.	Moderate: small stones.
Sotim part	Moderate: dusty	Moderate: dusty	Moderate: percs slowly, dusty, slope.	Moderate: dusty.
Torriorthents: TOF	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Upton:				
[1] UA:				
Upton part	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: cemented pan, small stones.	Moderate: dusty, small stones.
Atoka part	Slight	Slight	Slight	Slight.
Vinton:				
[1] VG:				
Vinton part	Severe: floods	Moderate: floods, too sandy.	Severe: floods	Moderate: too sandy.
Glendale part	Severe: floods	Moderate: dusty, floods.	Severe: floods	Moderate: dusty.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

The design and layout of *paths and trails* for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife Habitat[4]

Wildlife is an important resource of the Chaves County, Southern Part, survey area.

Soils, history of land uses, and climate influence the diversity, quantity, and quality of wildlife habitats and kinds of wildlife.

In table 8, soils of the survey area are rated as to suitability for the elements of wildlife habitat as well as for the three general types of wildlife. Ratings are for nonirrigated soils, unless otherwise noted. One rating was given for complexes and associations where the ratings were the same for the soils within the association. Only the irrigated ratings are given for those soils that are mainly irrigated.

Areas of woodland habitat are small and of two types: mixed pinyon-juniper type in very localized areas along the southwestern border, and riparian deciduous type along the Rio Hondo, Rio Felix, Rio Penasco, and Pecos River. The mule deer is common to these areas.

Most natural drainageways support only ephemeral streams. However, fishable populations of warm water fish species are in the Pecos River and the lower sections of Spring River, Rio Hondo, and Berrendo Creek. Parts of the Rio Penasco, Rio Felix, Berrendo Creek, and Spring River are seasonally stocked with trout to provide a limited put-and-take fishery.

Small lakes which support sport-fish fisheries are at Bottomless Lakes State Park, Bitter Lakes National Wildlife Refuge, Spring River Park, and Lake Van. There are a large number of irrigation storage reservoirs in the valley cropland area, but relatively few support sport fish populations.

The Bitter Lakes National Wildlife Refuge is adjacent to the Pecos River. This 24,000-acre refuge provides habitat for large numbers of wintering waterfowl and lesser sandhill cranes.

Range habitats characteristically reflect the dry moisture regime and the long history of livestock grazing. Many plant communities are nearly monotypic in nature. The pronghorn antelope is common to rangeland areas.

Croplands are confined to rather large and continuous areas where irrigation water is available. Alfalfa hay and grain crops are important to mourning doves, lesser sandhill cranes, and waterfowl, and are of some local significance to ring-necked pheasant and quail.

Representative species of wildlife which occur in some abundance in parts of the survey area include mule deer, pronghorn antelope, scaled quail, mourning dove, cottontail rabbit, jack rabbit, coyote, bobcat, lesser prairie chicken, ducks, geese, shorebirds, and some snakes and lizards.

The lesser prairie chicken is considered a threatened species of the United States, as reported in the 1973 Edition, "Threatened Wildlife of the United States," Bureau of Sport Fisheries and Wildlife. In New Mexico the bird occurs in sufficient numbers to accomodate controlled public hunting.

The distribution of wildlife species within the survey area can be related to soils which are suitable for certain land uses and production of specific types of vegetation.

The soils of the Chaves County, Southern Part, survey area have been rated as to their suitability for the improvement, maintenance, or development of specific wildlife habitat elements. Ratings reflect conditions with and without supplemental irrigation, as applicable. The wildlife habitat elements for which ratings are made are:

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

Grasses and legumes are perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescues, wheatgrasses, switchgrass, orchardgrass, Bermudagrass, clovers, alfalfa, and vetches.

Wild herbaceous plants are native or established range grasses and forbs that provide food and cover for wildlife. Examples are johnsongrass, grama grasses, panicums, alkali sacaton, tobosa, dropseeds, plains bristlegrass, bluestems, broom snakeweed, crotons, kochia, globemallows, sunflowers, senna, and Russian-thistle.

Shrubs are native or established woody shrubs which produce browse or mast for wildlife food, or that provide cover for wildlife. Examples are fourwing saltbush, mesquite, oak brush, rubber rabbitbush, sand sagebrush, allthorn, littleleaf sumac, skunkbush sumac, Apache-plume, mountainmahogany, cactus, yucca, and agave.

Wetland plants are annual and perennial wild herbaceous plants of moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover for wildlife associated with wetlands. Examples are smartweed, wild millet, rushes, sedges, saltgrass, and cattail.

Shallow water areas are natural or constructed areas of shallow water with average depths of less than five feet. Examples are marshes, flooded cropfields, wildlife watering developments, and wildlife ponds.

Considered in rating soils for these wildlife habitat elements are thickness of soil, soil texture, available water capacity, drainage class, surface stoniness, frequency of flooding, slope, salinity, and moisture regime. The ratings are expressed as good, fair, poor, or very poor.

An additional rating was made for the suitability of each soil for producing all the essential habitat elements required for three general types of wildlife. Woodland wildlife habitats, because of their limited occurrence, have not been considered. A method of as-

[4] By Edwin A. Swenson, Jr., biologist, Soil Conservation Service, and Jerry P. Sparks, formerly biologist with the Soil Conservation Service.

TABLE 8.—*Wildlife habitat potentials*

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Alama:									
Aa	Poor	Fair	Fair	Poor	Poor	Very poor	Poor	Very poor	Fair.
Ancho:									
[1] AN:									
Ancho part	Poor	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Fair.
Penasco part	Very poor	Very poor	Fair	Fair			Poor		Fair.
Atoka:									
AtA, AtB	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor.	
Balmorhea:									
Ba	Poor	Fair	Poor	Poor	Fair	Fair	Poor	Fair	Poor.
Bd	Fair	Fair	Poor	Fair	Good	Good	Good	Good	Poor.
[1] BE:									
Berino part	Very poor	Very poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
Cacique part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
[1] BF:									
Berino part	Very poor	Very poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
Pintura part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Bigetty:									
BgA, BgB	Good	Good		Good	Good	Fair	Good	Fair.	
Bh	Fair	Fair		Poor	Good	Fair	Fair	Fair.	
[1] BP:									
Bigetty part	Very poor	Very poor	Poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
Pecos part	Poor	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair.
Cuevoland:									
[1] CA:									
Cuevoland part	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Ancho part	Poor	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
Pena part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Deama:									
[1] DE:									
Deama part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Rock outcrop part.									
[1] DR:									
Deama part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Remunda part	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
Dune land:									
Du.									
Ector:									
[1] EcC:									
Ector part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.

Rock outcrop part.									
Ector:									
[1] EcD:									
Ector part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Rock outcrop part.									
Faskin:									
Fa	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
[1] FM:									
Faskin part	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Malstrom part	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
[1] Fr:									
Faskin part	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Roswell part	Very poor	Very poor	Good	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Gabaldon:									
[1] GD:									
Gabaldon part	Good	Good	Good	Fair	Good	Good	Good	Good	Fair.
Dev part	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
Glendale:									
Ge, Gf	Good	Good	Good	Good	Fair	Poor	Good	Poor	Fair.
Holloman:									
Ho	Poor	Poor	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
[1] Hp:									
Holloman part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Gypsum land part.									
Holloman thick solum part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1] HrC:									
Holloman part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Gypsum land part.									
Holloman thick solum part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1] HSE:									
Holloman part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Gypsum land part.									
Ima:									
Im	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Jal:									
Ja	Very poor	Very poor	Poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
Kimbrough:									
Km	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1] Ks:									
Kimbrough part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Sharvana part	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
[1] Kt:									
Kimbrough part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.

TABLE 8.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Kimbrough:									
[1] Kt:									
Stegall part	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Slaughter part	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Lozier:									
[1] Lr:									
Lozier part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Reakor part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Tencee part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1] Lt:									
Lozier part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Tencee part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Pajarito:									
Pa	Very poor	Very poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
[1] Pb:									
Pajarito part	Very poor	Very poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
Pintura part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Pecos:									
Pe	Poor	Poor	Poor	Poor	Poor	Good	Poor	Fair	Poor.
PfA	Good	Good	Fair	Fair	Good	Good	Good	Good	Fair.
PGB	Good	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
[1] PH:									
Pecos part	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Poor	Fair.
Dev part	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
Pena:									
[1] PK:									
Pena part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Penasco part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Penasco:									
[1] PL:									
Penasco part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Ancho part	Poor	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
[1] PN:									
Penasco part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Gabaldon part	Poor	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
Reakor:									
Ra, ReA, ReB	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
RF	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Reakor gravelly subsoil variant:									
Rg	Good	Good		Good	Poor	Poor	Good	Poor.	
Reakor:									
[1] RH:									
Reakor part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Pecos part	Poor	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair.

[1] RI:									
Reakor part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Tencee part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Reeves:									
RkA, RkB	Fair	Good	Fair	Fair	Fair	Poor	Fair	Poor	Fair.
[1] RL:									
Reeves part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Holloman part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Holloman thick solum part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Remunda:									
[1] RM:									
Remunda part	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
Penasco part	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Roswell:									
[1] Rn:									
Roswell part	Very poor	Very poor	Good	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Jalmar part	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Russler:									
Ru	Very poor	Very poor	Poor	Fair	Poor	Very poor	Poor	Very poor	Poor.
Shanta:									
Sh	Good	Good	Fair	Poor	Good	Good	Good	Good	Fair.
Simona:									
Sm	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Sotim:									
So	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Tencee:									
Te, TfD	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1] Tg:									
Tencee part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Upton part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1] TS:									
Tencee part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Sotim part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Torriorthents:									
TOF	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Upton:									
[1] UA:									
Upton part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Atoka part	Very poor	Very poor	Fair	Poor	Poor	Very poor	Poor	Very poor	Poor.
Vinton:									
[1] VG:									
Vinton part	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Glendale part	Poor	Poor	Fair	Poor	Poor	Very poor	Poor	Very poor	Fair.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

signing a weighted factor to selected habitat elements was utilized to arrive at a suitability rating. The general types of wildlife are:

Openland wildlife includes birds and mammals of croplands, pastures, meadows, and other lands associated with farmlands. Examples include ring-necked pheasant, scaled quail, mourning dove, cottontail rabbit, skunk, blackbird, starling, and Western kingbird. This rating considered grain and seed crops, domestic grasses and legumes, wild herbaceous plants, and shrubs as habitat elements.

Wetland wildlife includes birds and mammals of swamps, marshes, and riparian and open water areas. Examples include ducks, geese, shorebirds, great blue heron, muskrat, beaver, and marsh wren. This rating considered wetland plants and shallow water areas as habitat elements.

Rangeland wildlife includes birds and mammals of natural grasslands, shrublands, tree communities along drainageways, and pinyon-juniper types. Examples include Gambel's quail, burrowing owl, marsh hawk, meadowlark, jackrabbit, coyote, badger, lesser prairie chicken, mule deer, prairie dog, pronghorn antelope, and horned lark, This rating considered wild herbaceous plants and shrubs as habitat elements.

The levels of suitability are expressed by an adjective rating.

Good means habitats are easily improved, maintained, or created. There are few or no soil limitations in habitat management and satisfactory results can be expected. *Fair* means habitats can be improved, maintained, or created on these soils, but moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention may be required to insure satisfactory results.

Poor means habitats can be improved, maintained, or created on these soils, but soil limitations are severe. Habitat management may be difficult and expensive and require intensive efforts. Results are questionable.

Very poor means that under the prevailing soil conditions, it is impractical to attempt to improve, maintain, or create habitats. Unsatisfactory results are probable.

Ratings for the suitability of each soil for wildlife habitat elements, as well as for three general types of wildlife habitats, are based upon its potential and not on the present land use or condition.

Soil Properties

Extensive data about soil properties which were collected during the soil survey are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

While making soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially for properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and ranges in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features and engineering test data are presented.

Engineering properties

Table 9 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have horizons of contrasting properties within the upper 5 or 6 feet. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and range in properties of each horizon is given for each soil series in the section "Description of the Soils."

Texture is described in table 9 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, and appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (USCS) (*2*) and the American Association of State Highway and Transportation Officials (AASHTO) (*1*) Soil Classification System. In table 9 soils in the survey area are classified according to both systems. They are explained in the PCA Soil Primer (*13*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes: eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL–ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A–1 are coarse grained and low in content of fines. At the other extreme, in group A–7, are fine-grained soils. Highly organic soils are classified as A–8 on the basis of visual inspection.

When laboratory data are available, the A–1, A–2, and A–7 groups are further classified as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 12. The estimated classification, without group index numbers, is given in table 9. Also in table 9 the percentage, by weight, of cobblestones or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These indexes are used in both the Unified and the AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

All estimates given in table 9 have been rounded to the nearest 5 percent. Thus, when the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percentage points), the classification in the marginal zone has been omitted.

Physical and chemical properties

Table 10 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the planning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental plants or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is largely affected by the quality of the irrigation water and the irrigation practices. Hence, the salinity of individual fields can differ greatly from the value given in table 10. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 10, is the potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the amount of erosion that will result from specific kinds of land treatment. The soil erodibility factor (K) is a measure

TABLE 9.—*Engineering*

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated. When the estimated the classification in the

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Alama:				
Aa	0–3	Loam	ML, CL–ML	A–4
	3–58	Silty clay loam, clay loam, silt loam	CL	A–6
	58–69	Silt loam, loam, clay loam	CL–ML, CL	A–4, A–6
Ancho:				
[1] AN:				
Ancho part	0–7	Loam	CL–ML, ML	A–4
	7–60	Clay loam, silty clay loam	CL	A–6, A–7
Penasco part	0–12	Cobbly loam	SM–SC, SC	A–4, A–6
	12–17	Indurated		
	17–30	Cemented		
Atoka:				
AtA, AtB	0–12	Loam, silt loam	CL–ML	A–4
	12–28	Clay loam, loam	CL–ML, CL	A–4, A–6
	28	Indurated		
Balmorhea:				
Ba, Bd	0–19	Loam	CL–ML, CL	A–4, A–6
	19–40	Silty clay loam, clay	CL, CH	A–7
	40–60	Clay loam, silty clay loam, silty clay	CL, CH	A–7
Berino:				
[1] BE:				
Berino part	0–6	Fine sandy loam	SM	A–2, A–4
	6–60	Sandy clay loam	SC, SM–SC, CL	A–6, A–4
Cacique part	0–16	Fine sand	SM	A–2
	16–29	Sandy clay loam	SC	A–2, A–6
	29	Indurated		
[1] Bf:				
Berino part	0–6	Sandy clay loam	SC, SM–SC, CL	A–6, A–4
	6–60	Sandy clay loam	SC, SM–SC, CL	A–6, A–4
Pintura part	0–60	Loamy fine sand	SM	A–2
Bigetty:				
BgA, BgB	0–11	Loam	CL–ML	A–4
	11–60	Silty clay loam, clay loam, loam	CL–ML, ML	A–4, A–6
Bh	0–11	Loam	CL–ML	A–4
	11–60	Silty clay loam, clay loam, loam	CL–ML, ML	A–4, A–6
[1] BP:				
Bigetty part	0–11	Loam	CL–ML	A–4
	11–60	Silty clay loam, clay loam, loam	CL–ML, ML	A–4, A–6
Pecos part	0–9	Silty clay loam	CH, CL	A–7, A–6
	9–60	Clay, silty clay, silty clay loam	CL, CH	A–6, A–7
Cuevoland:				
[1] CA:				
Cuevoland part	0–26	Loam	ML	A–4
	26–60	Clay loam	CL, CL–ML	A–6, A–4
Ancho part	0–7	Loam	CL–ML	A–4
	7–60	Clay loam, silty clay loam	CL	A–6, A–7
Pena part	0–18	Cobbly loam	SM, ML	A–4
	18–30	Cobbly sandy clay loam, very gravelly clay loam.	GC, SM–SC, SC	A–2, A–4, A–6
	30–60	Very cobbly loam, very gravelly loam	GM	A–1, A–2, A–4

properties and classifications

ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 to 2 percentage points), marginal zone has been omitted]

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4 (4.7 mm)	10 (2.0 mm)	40 (0.42 mm)	200 (0.074 mm)		
Pct					*Pct*	
0	100	100	95–100	70–80	20–30	NP–10
0	100	100	95–100	75–95	30–40	10–15
0	100	100	85–100	75–90	20–30	5–15
0	100	100	95–100	70–95	25–35	5–10
0	100	100	95–100	80–95	30–45	10–20
25–35	80–90	70–80	60–70	40–50	25–35	5–15
---	---	---	---	---	---	---
---	---	---	---	---	---	---
0	100	100	90–100	60–75	20–30	5–10
0	100	100	90–100	70–80	20–30	5–15
---	---	---	---	---	---	---
0–5	90–100	80–100	70–100	60–85	20–40	5–20
0–5	90–100	80–100	70–100	60–100	40–55	20–30
0–5	90–100	80–100	70–100	60–100	40–60	20–40
0	95–100	95–100	60–95	30–50	---	[2] NP
0	95–100	95–100	65–80	35–55	20–35	5–15
0	100	100	50–80	15–35	---	NP
0	90–100	85–100	65–90	30–50	20–35	10–15
---	---	---	---	---	---	---
0	95–100	95–100	65–80	35–55	20–35	5–15
0	95–100	95–100	65–80	35–55	20–35	5–15
0	100	100	70–95	15–25	---	NP
0	100	100	85–90	60–90	20–30	5–10
0	100	100	85–100	80–95	25–40	5–15
0	100	100	85–90	60–90	20–30	5–10
0	100	100	85–100	80–95	25–40	5–15
0	100	100	85–90	60–90	20–30	5–10
0	100	100	85–100	80–95	25–40	5–15
0	100	95–100	90–100	80–95	30–55	15–35
0	100	95–100	90–100	80–95	35–65	20–40
0	100	100	85–95	60–75	<30	NP–5
0	95–100	95–100	90–100	75–85	25–35	5–15
0	100	100	95–100	70–95	25–35	5–10
0	100	100	95–100	80–95	30–45	10–20
10–40	75–85	70–80	60–70	45–55	<30	NP–5
25–55	55–75	50–70	35–65	30–45	25–35	5–15
35–75	40–75	35–70	30–65	20–50	<30	NP–5

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO
	In			
Deama:				
[1] De:				
Deama part	0–15	Cobbly loam	GM, ML	A–4
	15	Unweathered bedrock	---	---
Rock outcrop part.				
[1] DR:				
Deama part	0–15	Cobbly loam	GM, ML	A–4
	15	Unweathered bedrock	---	---
Remunda part	0–3	Loam	ML, CL–ML	A–4
	3–60	Clay loam, clay	CL, CH	A–7
Dune land:				
Du.				
Ector:				
[1] EcC:				
Ector part	0–14	Cobbly loam	GC, SC	A–2
	14	Unweathered bedrock	---	---
Rock outcrop part.				
[1] EcD:				
Ector part	0–14	Cobbly loam	GC, SC	A–2
	14–30	Unweathered bedrock	---	---
Rock outcrop part.				
Faskin:				
Fa	0–18	Fine sandy, loamy fine sand	SM	A–2
	18–60	Sandy clay loam, clay loam	SC, SM–SC, CL, CL–ML	A–4, A–6
[1] FM:				
Faskin part	0–18	Fine sand, loamy fine sand	SM	A–2
	18–60	Sandy clay loam, clay loam	SC, SM–SC, CL, CL–ML	A–4, A–6
Malstrom part	0–25	Loamy fine sand	SM	A–2
	25–60	Loam, fine sandy loam	SM, SM–SC, ML, CL–ML	A–2, A–4
[1] Fr:				
Faskin part	0–8	Sandy clay loam	SC, SM–SC, CL	A–4, A–6
	8–60	Sandy clay loam, clay loam	SC, SM–SC, CL, CL–ML	A–4, A–6
Roswell part	0–88	Loamy fine sand	SM	A–2
Gabaldon:				
[1] GD:				
Gabaldon part	0–60	Silt loam, silty clay loam	ML	A–4, A–6
Dev part	0–60	Gravelly loam	GC	A–2
Glendale:				
Ge	0–16	Fine sandy loam	SM	A–4
	16–60	Loam, silt loam, clay loam, silty clay loam	CL	A–6
Gf	0–16	Loam	CL	A–6
	16–60	Loam, silt loam, clay loam	CL	A–6
Holloman:				
Ho	0–16	Loam	ML, CL–ML, CL	A–4, A–6
	16	Gypsum	---	---

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4 (4.7 mm)	10 (2.0 mm)	40 (0.42 mm)	200 (0.074 mm)		
Pct					*Pct*	
30–50	60–80	55–75	50–75	40–60	25–40	NP–10
30–50	60–80	55–75	50–75	40–60	25–40	NP–10
0 0	100 100	100 100	85–95 90–100	60–75 75–95	25–35 40–55	5–10 15–25
25–50	45–70	40–65	35–50	20–35	25–35	10–15
25–50	45–70	40–65	35–50	20–35	25–35	10–15
0 0	100 100	100 100	70–900 85–100	25–35 35–70	----- 20–40	NP 5–20
0 0	100 100	100 100	70–90 85–100	25–35 35–70	----- 20–40	NP 5–20
0 0	100 95–100	100 90–100	70–90 65–85	25–35 25–55	----- 20–30	NP NP–10
0 0	100 100	100 100	65–85 85–100	35–55 35–70	20–35 20–40	5–15 5–20
0	100	95–100	70–95	15–30	-----	NP
0	95–100	95–100	90–100	80–90	30–40	5–15
0–10	40–55	35–50	35–45	20–35	30–40	10–20
0 0	95–100 100	95–100 100	75–85 80–95	40–50 75–90	20–30 30–40	NP–5 15–25
0 0	100 100	100 100	80–95 80–95	75–90 75–90	30–40 30–40	15–25 15–25
0	100	100	85–95	55–75	20–35	NP–15

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO
	In			
Holloman:				
[1] Hp:				
Holloman part	0–6	Loam	ML, CL–ML, CL	A-4, A-6
	6	Gypsum		
Gypsum land part.				
Holloman thick solum part	0–9	Loam	ML, CL–ML, CL	A-4, A-6
	9	Gypsum		
[1] HrC:				
Holloman part	0–6	Loam	ML, CL–ML, CL	A-4, A-6
	6	Gypsum		
Gypsum land part.				
Holloman thick solum part	0–9	Loam	ML, CL–ML, CL	A-4, A-6
	9	Gypsum		
[1] HSE:				
Holloman part	0–8	Loam	ML, CL–ML, CL	A-4, A-6
	8	Gypsum		
Gypsum land part.				
Ima:				
Im	0–8	Fine sandy loam	SM	A-2, A-4
	8–60	Fine sandy loam, sandy loam	SM	A-2, A-4
Jal:				
Ja	0–12	Fine sandy loam	SM, ML	A-4
	12–60	Loam, clay loam	ML	A-4, A-6
Kimbrough:				
Km	0–11	Gravelly loam	GM, ML	A-2, A-4
	11	Indurated		
[1] Ks:				
Kimbrough part	0–11	Gravelly fine sandy loam	GM, SM	A-2, A-4, A-1
	11	Indurated		
Sharvana part	0–6	Fine sandy loam	SM, SM–SC	A-2, A-4
	6–16	Sandy clay loam	SC, CL, CL–ML, SM–SC	A-4, A-6
	16–20	Indurated		
[1] Kt:				
Kimbrough part	0–11	Gravelly fine sandy loam	GM, SM	A-2, A-4, A-1
	11	Indurated		
Stegall part	0–3	Loam	CL	A-6
	3–35	Clay loam, clay	CL, CH	A-6, A-7
	35–38	Indurated		
Slaughter part	0–3	Loam	CL	A-6
	3–14	Clay loam, clay	CL	A-6, A-7
	14–24	Indurated		
Lozier:				
[1] Lr:				
Lozier part	0–13	Cobbly loam	GC, SC	A-2
	13	Unweathered bedrock		
Reakor part	0–17	Loam	CL–ML, CL	A-4, A-6
	17–65	Clay loam, loam, silty clay loam	CL–ML, CL	A-4, A-6

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4 (4.7 mm)	10 (2.0 mm)	40 (0.42 mm)	200 (0.074 mm)		
Pct					*Pct*	
0	100	100	85–95	55–75	20–35	NP–15
0	100	100	85–95	55–75	20–35	NP–15
0	100	100	85–95	55–75	20–35	NP–15
0	100	100	85–95	55–75	20–35	NP–15
0	100	100	85–95	55–75	20–35	NP–15
0 0	90–100 90–100	85–100 85–100	75–100 75–100	25–50 25–50	<30 <30	NP–5 NP–5
0 0	100 85–100	100 80–100	75–90 70–95	40–55 50–75	--- 35–45	NP 5–15
0–10	55–80	50–75	40–70	30–55	<30	NP–5
0–10	55–80	50–75	35–65	20–45	<25	NP–5
0 0	100 100	100 100	70–95 70–95	30–50 35–60	15–25 20–35	NP–5 5–20
0–10	55–80	50–75	35–65	20–45	<25	NP–5
0 0	100 100	95–100 95–100	85–100 90–100	55–80 60–90	30–40 35–60	10–20 15–30
0 0	100 95–100	100 95–100	85–100 90–100	55–75 65–90	30–40 35–50	10–20 20–30
25–50	45–70	40–65	35–50	20–35	25–35	10–15
0 0	100 100	100 100	90–100 90–100	60–85 75–90	20–30 25–35	5–15 5–15

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Lozier:				
[1] Lr:				
Tencee part	0–9	Cobbly loam	GM	A–1, A–2, A–4
	9	Indurated	---	---
[1] Lt:				
Lozier part	0–13	Cobbly loam	GC, SC	A–2
	13	Unweathered bedrock	---	---
Tencee part	0–9	Cobbly loam	GM	A–1, A–2, A–4
	9	Indurated	---	---
Pajarito:				
Pa	0–3	Loamy fine sand	SM	A–2
	3–46	Fine sandy loam, sandy loam	SM	A–2, A–4
	46–60	Fine sandy loam, sandy loam	SM, ML	A–4
[1] Pb:				
Pajarito part	0–5	Fine sandy loam	SM	A–2, A–4
	5–46	Fine sandy loam, sandy loam	SM	A–2, A–4
	46–60	Fine sandy loam, sandy loam	SM, ML	A–4
Pintura part	0–60	Loamy fine sand	SM	A–2
Pecos:				
Pe	0–9	Silty clay loam	CH, CL	A–7, A–6
	9–60	Clay, silty clay, silty clay loam	CL, CH	A–6, A–7
PfA, PGB	0–9	Silty clay loam	CH, CL	A–7, A–6
	9–60	Clay, silty clay, silty clay loam	CL, CH	A–6, A–7
[1] PH:				
Pecos part	0–9	Silty clay loam	CH, CL	A–7, A–6
	9–60	Clay, silty clay, silty clay loam	CL, CH	A–6, A–7
Dev part	0–60	Gravelly loam	GC	A–2
Pena:				
[1] PK:				
Pena part	0–9	Gravelly loam	SM, ML	A–4
	9–60	Very cobbly loam, very gravelly loam	GM	A–1, A–2, A–4
Penasco part	0–12	Cobbly loam	SM–SC, SC	A–4, A–6
	12–17	Indurated	---	---
	17–30	Cemented	---	---
Penasco:				
[1] PL:				
Penasco part	0–12	Cobbly loam	SM–SC, SC	A–4, A–6
	12–17	Indurated	---	---
	17–30	Cemented	---	---
Ancho part	0–7	Loam	CL–ML, ML	A–4
	7–60	Clay loam, silty clay loam	CL	A–6, A–7
[1] PN:				
Penasco part	0–12	Cobbly loam	SM–SC, SC	A–4, A–6
	12–17	Indurated	---	---
	17–30	Cemented	---	---
Gabaldon part	0–60	Silt loam, silty clay loam	ML	A–4, A–6
Reakor:				
Ra	0–12	Sandy loam	SM	A–2, A–4
	12–65	Clay loam, loam, silty clay loam	CL–ML, CL	A–4, A–6

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4 (4.7 mm)	10 (2.0 mm)	40 (0.42 mm)	200 (0.074 mm)		
Pct					*Pct*	
25–45	60–75	55–70	35–65	20–50	<30	NP–5
25–50	45–70	40–65	35–50	20–35	25–35	10–15
25–45	60–75	55–70	35–65	20–50	<30	NP–5
0	100	100	85–100	25–35		NP
0	90–100	85–100	60–100	30–45		NP
0	90–100	85–100	60–95	35–55	20–25	NP–5
0	100	100	85–100	30–45		NP
0	90–100	85–100	60–100	30–45		NP
0	90–100	85–100	60–95	35–55	20–25	NP–5
0	100	100	70–95	15–25		NP
0	100	95–100	90–100	80–95	30–55	15–35
0	100	95–100	90–100	80–95	35–65	20–40
0	100	95–100	90–100	80–95	30–55	15–35
0	100	95–100	90–100	80–95	35–65	20–40
0	100	95–100	90–100	80–95	30–55	15–35
0	100	95–100	90–100	80–95	35–65	20–40
0–10	40–55	35–50	35–45	20–35	30–40	10–20
10–40	75–85	70–80	60–70	45–55	<30	NP–5
35–75	40–75	35–70	30–65	20–50	<30	NP–5
25–35	80–90	70–80	60–70	40–50	25–35	5–15
25–35	80–90	70–80	60–70	40–50	25–35	5–15
0	100	100	95–100	70–95	25–35	5–10
0	100	100	95–100	80–95	30–45	10–20
25–35	80–90	70–80	60–70	40–50	25–35	5–15
0	95–100	95–100	90–100	80–90	30–40	5–15
0	100	100	60–80	30–50	15–30	NP–5
0	100	100	90–100	75–90	25–35	5–15

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO
	In			
Reakor:				
ReA, ReB, RF	0–17	Loam	CL–ML, CL	A–4, A–6
	17–65	Clay loam, loam, silty clay loam	CL–ML, CL	A–4, A–6
Reakor gravelly subsoil variant:				
Rg	0–11	Loam	CL–ML	A–4
	11–31	Clay loam, loam	CL, CL–ML	A–4, A–6
	31–60	Gravelly clay loam, very gravelly clay loam.	GM–GC, GC	A–2, A–4, A–6
Reakor:				
[1] RH:				
Reakor part	0–17	Loam	CL–ML, CL	A–4, A–6
	17–65	Clay loam, loam, silty clay loam	CL–ML, CL	A–4, A–6
Pecos part	0–9	Silty clay loam	CH, CL	A–7, A–6
	9–60	Clay, silty clay, silty clay loam	CL, CH	A–6, A–7
[1] RI:				
Reakor part	0–17	Loam	CL–ML, CL	A–4, A–6
	17–65	Clay loam, loam, silty clay loam	CL–ML, CL	A–4, A–6
Tencee part	0–9	Gravelly loam	GM, GM–GC, SM	A–1, A–2
	9	Indurated		
Reeves:				
RkA, RkB	0–7	Loam	CL–ML	A–4
	7–31	Clay loam	CL–ML, CL	A–4, A–6
	31–40	Gypsum		
	40–79	Clay loam	CL, CL–ML	A–6, A–4
[1] RL:				
Reeves part	0–7	Loam	CL–ML	A–4
	7–31	Clay loam	CL–ML, CL	A–4, A–6
	31–40	Gypsum		
	40–79	Clay loam	CL, CL–ML	A–6, A–4
Holloman part	0–6	Loam	ML, CL–ML, CL	A–4, A–6
	6	Gypsum		
Holloman thick solum part	0–16	Loam	ML, CL–ML, CL	A–4, A–6
	16	Gypsum		
Remunda:				
[1] RM:				
Remunda part	0–3	Loam	ML, CL–ML	A–4
	3–60	Clay loam	CL, CH	A–7
Penasco part	0–12	Cobbly loam	SM–SC, SC	A–4, A–6
	12–17	Indurated		
	17–30	Cemented		
Roswell:				
[1] Rn:				
Roswell part	0–88	Fine sand	SM	A–2
Jalmar part	0–32	Fine sand	SM, SP–SM	A–2
	32–64	Sandy clay loam	SC	A–2, A–6
Russler:				
Ru	0–7	Silty clay loam	CL, CL–ML	A–4, A–6
	7–22	Clay loam, silty clay loam	CL	A–4, A–6, A–7
	22	Weathered bedrock		
Shanta:				
Sh	0–3	Silt loam	ML, CL–ML	A–4
	3–60	Clay loam, silty clay loam, silt loam	CL	A–6

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number— 4 (4.7 mm)	10 (2.0 mm)	40 (0.42 mm)	200 (0.074 mm)	Liquid limit	Plasticity index
Pct					*Pct*	
0	100	100	90–100	60–85	20–30	5–15
0	100	100	90–100	75–90	25–35	5–15
0	100	100	90–100	60–75	20–30	5–10
0	100	100	90–100	70–90	25–35	5–15
10–20	15–65	10–65	10–60	5–45	25–35	5–15
0	100	100	90–100	60–85	20–30	5–15
0	100	100	90–100	75–90	25–35	5–15
0	100	95–100	90–100	80–95	30–55	15–35
0	100	95–100	90–100	80–95	35–65	20–40
0	100	100	90–100	60–85	20–30	5–15
0	100	100	90–100	75–90	25–35	5–15
0–25	50–70	45–65	30–55	15–35	<30	NP–5
0	100	100	90–100	60–75	20–30	5–10
0	100	100	85–100	60–80	20–30	5–15
0	100	100	90–100	60–80	25–35	5–15
0	100	100	90–100	60–75	20–30	5–10
0	100	100	85–100	60–80	20–30	5–15
0	100	100	90–100	60–80	25–35	5–15
0	100	100	85–95	55–75	20–35	NP–15
0	100	100	85–95	55–75	20–35	NP–15
0	100	100	85–95	60–75	25–35	5–10
0	100	100	90–100	75–95	40–55	15–25
25–35	80–90	70–80	60–70	40–50	25–35	5–15
0	100	95–100	70–95	10–30		NP
0	100	95–100	95–100	5–25		NP
0	100	95–100	95–100	25–45	20–35	10–20
0	100	100	90–100	65–95	25–35	5–15
0	100	100	95–100	75–85	30–45	10–20
0	100	100	85–100	60–90	25–35	5–10
0	100	100	90–100	70–85	30–40	15–25

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Simona:				
Sm	0–10	Fine sandy loam	SM	A–4
	10–13	Fine sandy loam, sandy loam, gravelly fine sandy loam.	SM	A–2, A–4
	13	Indurated		
Sotim:				
So	0–7	Fine sandy loam	SM	A–4
	7–70	Clay loam, loam	CL–ML, CL	A–4, A–6
Tencee:				
Te	0–9	Gravelly sandy loam	GM, SM	A–1, A–2
	9	Indurated		
TfD	0–9	Cobbly loam	GM, SM	A–1, A–2, A–4
	9	Indurated		
[1] Tg:				
Tencee part	0–9	Gravelly loam	GM, SM	A–1, A–2
	9	Indurated		
Upton part	0–13	Gravelly loam	CL, GC, SC	A–4, A–6
	13–22	Cemented		
[1] TS:				
Tencee part	0–9	Gravelly fine sandy loam	GM, SM	A–1, A–2
	9	Indurated		
Sotim part	0–7	Fine sandy loam	SM	A–4
	7–70	Clay loam, loam	CL–ML, CL	A–4, A–6
Torriorthents:				
TOF	0–60	Variable		
Upton:				
[1] UA:				
Upton part	0–13	Gravelly loam	CL, GC, SC	A–4, A–6
	13–22	Cemented		
Atoka part	0–12	Loam, silt loam	CL–ML	A–4
	12–28	Clay loam, loam	CL–ML, CL	A–4, A–6
	28	Indurated		
Vinton:				
[1] VG:				
Vinton part	0–60	Loamy fine sand	SM	A–2
Glendale part	0–16	Fine sandy loam	SM	A–4
	16–60	Loam, silt loam, clay loam	CL	A–6

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and
[2] Nonplastic.

of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, measured in tons per acre per year, whether from rainfall or wind, that may occur without reducing crop production or environmental quality.

Wind erodibility groups are used to predict the susceptibility of soils to blowing and to predict the amount of soil lost by blowing. The groups consist of soils that have similar properties that affect soil blowing, principally those that determine the stability of aggregates that resist breakdown by tillage and abrasion by wind. Among properties of soils that affect their placement in wind erodibility groups are texture, organic matter content, content of calcium carbonate, soil moisture, mineralogical composition, susceptibilty to frost action, and size and stability of aggregates. The wind erodibility group number indicates the relative susceptibility of soils to soil blowing. Soils that are most subject to

and classifications—Continued

Frag-ments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4 (4.7 mm)	10 (2.0 mm)	40 (0.42 mm)	200 (0.074 mm)		
Pct					*Pct*	
0 0–5	100 70–100	100 65–100	90–100 50–100	35–50 20–50	------ ------	NP NP
0 0	95–100 95–100	95–100 95–100	65–85 80–100	35–50 60–80	<30 20–40	NP–5 5–15
0–25	50–70	45–65	30–55	15–35	<30	NP–5
25–45	60–75	55–70	35–65	20–50	<30	NP–5
0–25	50–70	45–65	30–55	15–35	<30	NP–5
0–2	65–85	60–75	55–70	35–55	25–35	10–15
0–25	50–70	45–65	30–55	15–35	<30	NP–5
0 0	95–100 95–100	95–100 95–100	65–85 80–100	35–50 60–80	<30 20–40	NP–5 5–15
0–2	65–85	60–75	55–70	35–55	25–35	10–15
0 0	100 100	100 100	90–100 90–100	60–75 70–80	20–30 20–30	5–10 5–15
0 0 0	95–100 95–100 100	95–100 95–100 100	70–90 75–85 80–95	15–25 40–50 75–90	------ 20–30 30–40	NP NP–5 15–25

behavior of the whole mapping unit.

soil blowing are in group 1; those progressively less subject to soil blowing are in groups 2 through 7; and soils in group 8 are usually not subject to soil blowing.

Soil and water features

Features that relate to runoff or infiltration of water, to flooding, to grading and excavation, and to subsidence and frost action of each soil are indicated in table 11. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding and a seasonal high water table, by the presence of bedrock or a cemented pan in the upper 5 or 6 feet of the soil, by subsidence, or by frost action.

Hydrologic groups are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil. The

TABLE 10.—*Physical and chemical*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm at 25° C.*
Alama:					
Aa	0–3	0.6–2.0	0.16–0.21	7.4–8.4	<2
	3–58	0.2–0.6	0.19–0.21	7.4–8.4	<2
	58–69	0.2–2.0	0.16–0.21	7.9–8.4	<2
Ancho:					
[1] AN:					
Ancho part	0–7	0.2–0.6	0.19–0.21	7.4–8.4	<2
	7–60	0.2–0.6	0.19–0.21	7.4–8.4	<2
Penasco part	0–12	0.6–2.0	0.13–0.15	7.9–8.4	<2
	12–17	—	—	—	—
	17–30	—	—	—	—
Atoka:					
AtA, AtB	0–12	0.6–2.0	0.16–0.18	7.4–8.4	2–4
	12–28	0.6–2.0	0.19–0.21	7.9–8.4	2–4
	28	—	—	—	—
Balmorhea:					
Ba, Bd	0–19	0.6–2.0	0.05–0.18	7.9–8.4	4–16
	19–40	0.2–0.6	0.05–0.18	6.6–8.4	4–16
	40–60	0.2–0.6	0.04–0.18	7.9–8.4	4–16
Berino:					
[1] BE:					
Berino part	0–6	2.0–6.0	0.10–0.13	6.6–7.8	<2
	6–60	0.6–2.0	0.13–0.17	7.4–8.4	2–4
Cacique part	0–16	6.0–20	0.05–0.08	7.4–7.8	<2
	16–29	0.6–2.0	0.14–0.16	7.4–8.4	<2
	29	—	—	—	—
[1] Bf:					
Berino part	0–6	0.6–2.0	0.13–0.17	7.4–8.4	<2
	6–60	0.6–2.0	0.13–0.17	7.4–8.4	2–4
Pintura part	0–60	6.0–20	0.05–0.08	6.6–7.8	<2
Bigetty:					
BgA, BgB	0–11	0.6–2.0	0.16–0.21	7.9–8.4	2–4
	11–60	0.2–0.6	0.19–0.21	7.9–8.4	2–4
Bh	0–11	0.6–2.0	0.07–0.13	7.9–8.4	4–16
	11–60	0.2–0.6	0.07–0.13	7.9–8.4	4–16
[1] BP:					
Bigetty part	0–11	0.6–2.0	0.16–0.21	7.9–8.4	2–4
	11–60	0.2–0.6	0.19–0.21	7.9–8.4	2–4
Pecos part	0–9	0.06–0.2	0.12–0.20	7.9–8.4	2–4
	9–60	<0.06	0.10–0.18	7.9–8.4	2–4
Cuevoland:					
[1] CA:					
Cuevoland part	0–26	0.6–2.0	0.16–0.18	7.4–8.4	<2
	26–60	0.6–2.0	0.16–0.18	7.9–9.0	<2
Ancho part	0–7	0.2–0.6	0.19–0.21	7.4–8.4	<2
	7–60	0.2–0.6	0.19–0.21	7.4–8.4	<2
Pena part	0–18	0.6–2.0	0.11–0.14	7.4–8.4	<2
	18–30	0.6–2.0	0.05–0.08	7.9–8.4	2–4
	30–60	0.6–2.0	0.03–0.08	7.9–8.4	2–4

properties of soils

erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Moderate	Low	0.37	5	5
Moderate	Moderate	Low	0.37		
Moderate	High	Low	0.43		
Moderate	High	Low	0.32	5	4L
Moderate	High	Low	0.32		
Low	High	Low	0.24	1	—
—	—	—	—		
—	—	—	—		
Low	High	Low	0.49	2	4L
Moderate	High	Low	0.43		
—	—	—	—		
Low	High	Moderate	0.15	5	4L
Moderate	High	Moderate	0.15		
Moderate	High	Moderate	0.15		
Low	Low	Low	0.24	3	3
Moderate	High	Low	0.32		
Low	Low	Low	0.32	2	2
Moderate	Moderate	Low	0.32		
—	—	—	—		
Moderate	Moderate	Low	0.32	3	5
Moderate	High	Low	0.32		
Low	Moderate	Low	0.20	5	2
Low	High	Low	0.37	5	4L
Moderate	High	Low	0.43		
Low	High	Low	0.37	5	4L
Moderate	High	Low	0.43		
Low	High	Low	0.37	5	4L
Moderate	High	Low	0.43		
High	High	Low	0.32	5	—
High	High	Low	0.32		
Low	High	Low	0.37	3	4L
Moderate	High	Low	0.43		
Moderate	High	Low	0.32	5	4L
Moderate	High	Low	0.32		
Low	High	Low	0.28	3	—
Low	High	Low	0.28		
Low	High	Low	0.24		

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm at 25° C.*
Deama:					
[1] De:					
Deama part	0–15	0.6–2.0	0.10–0.12	7.4–8.4	<2
	15				
Rock outcrop part.					
[1] DR:					
Deama part	0–15	0.6–2.0	0.10–0.12	7.4–8.4	<2
	15				
Remunda part	0–3	0.6–2.0	0.16–0.18	6.6–7.8	<2
	3–60	0.06–0.2	0.15–0.17	6.6–7.8	<2
Dune land:					
Du.					
Ector:					
[1] EcC:					
Ector part	0–14	0.6–2.0	0.06–0.12	7.9–8.4	<2
	14				
Rock outcrop part.					
[1] EcD:					
Ector part	0–14	0.6–2.0	0.06–0.12	7.9–8.4	<2
	14				
Rock outcrop part.					
Faskin:					
Fa	0–18	2.0–6.0	0.10–0.15	7.4–7.8	<2
	18–60	0.6–2.0	0.12–0.18	7.4–8.4	<2
[1] FM:					
Faskin part	0–18	2.0–6.0	0.10–0.15	7.4–7.8	<2
	18–60	0.6–2.0	0.12–0.18	7.4–8.4	<2
Malstrom part	0–25	6.0–20	0.08–0.10	7.4–8.4	<2
	25–60	2.0–6.0	0.10–0.14	8.5–9.0	2–4
[1] Fr:					
Faskin part	0–8	0.6–2.0	0.14–0.16	7.4–7.8	<2
	8–60	0.6–2.0	0.12–0.18	7.4–8.4	<2
Roswell part	0–88	6.0–20	0.05–0.07	6.6–7.3	<2
Gabaldon:					
[1] GD:					
Gabaldon part	0–60	0.6–2.0	0.16–0.20	7.4–8.4	<2
Dev part	0–60	2.0–6.0	0.03–0.10	7.9–8.4	<2
Glendale:					
Ge	0–16	0.6–2.0	0.13–0.15	7.9–8.4	2–4
	16–60	0.2–0.6	0.16–0.21	7.9–8.4	2–4
Gf	0–16	0.2–0.6	0.16–0.21	7.9–8.4	2–4
	16–60	0.2–0.6	0.16–0.21	7.9–8.4	2–4
Holloman:					
Ho	0–16	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	16				
[1] Hp:					
Holloman part	0–6	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	6				
Gypsum land part.					

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Moderate	Low	0.28	1	8
Low	Moderate	Low	0.28	1	8
Low High	Low High	Low Low	0.37 0.37	5	6
Very low	High	Low	0.28	1	
Very low	High	Low	0.28	1	
Low Low	Low Moderate	Low Low	0.24 0.32	5	3
Low Low	Low Moderate	Low Low	0.24 0.32	5	3
Low Low	High High	Low Low	0.20 0.28	3	2
Low Low	Low Moderate	Low Low	0.24 0.32	5	3
Low	Low	Low	0.20	5	1
Moderate	Moderate	Low	0.37	5	4L
Very low	Moderate	Low			
Low Moderate	High High	Low Low			
Moderate Moderate	High High	Low Low			
Low	High	High	0.49	1	4L
Low	High	Hign	0.49	1	4L

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm at 25° C.*
Holloman:					
[1] Hp:					
Holloman thick solum part	0–9	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	9				
[1] HrC:					
Holloman part	0–6	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	6				
Gypsum land part.					
Holloman thick solum part	0–9	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	9				
[1] HSE:					
Holloman part	0–8	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	8				
Gypsum land part.					
Iına:					
Im	0–8	2.0–6.0	0.11–0.15	7.4–8.4	<2
	8–60	2.0–6.0	0.11–0.15	7.4–8.4	<2
Jal:					
Ja	0–9	0.6–6.0	0.13–0.15	7.9–8.4	<2
	9–60	0.6–2.0	0.10–0.14	8.5–9.0	2–4
Kimbrough:					
Km	0–11	0.6–2.0	0.14–0.20	7.4–8.4	<2
	11				
[1] Ks:					
Kimbrough part	0–11	0.6–2.0	0.13–0.18	7.4–8.4	<2
	11				
Sharvana part	0–6	2.0–6.0	0.11–0.15	7.4–8.4	<2
	6–16	0.6–2.0	0.12–0.17	7.4–8.4	<2
	16–20				
[1] Kt:					
Kimbrough part	0–11	0.6–2.0	0.13–0.18	7.4–8.4	<2
	11				
Stegall part	0–3	0.6–2.0	0.15–0.20	7.4–8.4	<2
	3–35	0.2–0.6	0.14–0.19	7.4–8.4	<2
	35–38				
Slaughter part	0–3	0.6–2.0	0.15–0.20	7.4–8.4	<2
	3–14	0.2–0.6	0.13–0.19	7.4–8.4	<2
	14–24				
Lozier:					
[1] Lr:					
Lozier part	0–13	0.6–2.0	0.11–0.16	7.9–8.4	<2
	13				
Reakor part	0–17	0.6–2.0	0.16–0.20	7.4–8.4	2–4
	17–65	0.6–2.0	0.16–0.21	7.9–8.4	2–4
Tencee part	0–9	0.6–2.0	0.08–0.12	7.9–8.4	<2
	9				
[1] Lt:					
Lozier part	0–13	0.6–2.0	0.06–0.12	7.9–8.4	<2
	13				
Tencee part	0–9	0.6–2.0	0.08–0.12	7.9–8.4	<2
	9				

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	High	High	0.49	1	4L
Low	High	High	0.49	1	4L
Low	High	High	0.49	1	4L
Low	High	High	0.49	1	4L
Low Low	Moderate Moderate	Low Low	0.37 0.43	5	3
Low Low	High High	Low Low	0.43 0.37	2	3
Low	Moderate	Low	0.28	1	5
Low	Moderate	Low	0.28	1	4
Low Low	Low Moderate	Low Low	0.24 0.32	1	3
Low	Moderate	Low	0.28	1	4
Moderate Moderate	Moderate Moderate	Low Low	0.32 0.32	2	5
Moderate Moderate	Moderate Moderate	Low Low	0.32 0.37	1	1
Very low	High	Low	0.28	1	
Low Moderate	High High	Low Low	0.49 0.43	5	4L
Low	High	Low	0.20	1	
Very low	High	Low	0.28	1	
Low	High	Low	0.20	1	

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm at 25° C.*
Pajarito:					
Pa	0–3	2.0–6.0	0.09–0.11	7.4–8.4	<2
	3–46	2.0–6.0	0.13–0.15	7.9–8.4	<2
	46–60	2.0–6.0	0.13–0.15	7.9–8.4	<2
[1] Pb:					
Pajarito part	0–5	2.0–6.0	0.13–0.15	7.4–8.4	<2
	5–46	2.0–6.0	0.13–0.15	7.9–8.4	<2
	46–60	2.0–6.0	0.13–0.15	7.9–8.4	<2
Pintura part	0–60	6.0–20	0.07–0.10	7.4–7.8	<2
Pecos:					
Pe	0–9	0.06–0.2	0.10–0.15	7.9–8.4	4–16
	9–60	<0.06	0.10–0.15	7.9–9.0	4–16
PfA, PGB	0–9	0.06–0.2	0.12–0.20	7.9–8.4	2–4
	9–60	<0.06	0.10–0.18	7.9–8.4	2–4
[1] PH:					
Pecos part	0–9	0.06–0.2	0.12–0.20	7.9–8.4	2–4
	9–60	<0.06	0.10–0.18	7.9–8.4	2–4
Dev part	0–60	2.0–6.0	0.03–0.10	7.9–8.4	<2
Pena:					
[1] PK:					
Pena part	0–9	0.6–2.0	0.11–0.14	7.9–8.4	<2
	9–60	0.6–2.0	0.03–0.08	7.9–8.4	2–4
Penasco part	0–12	0.6–2.0	0.13–0.15	7.9–8.4	<2
	12–17	----	----	----	----
	17–30	----	----	----	----
Penasco:					
[1] PL:					
Penasco part	0–12	0.6–2.0	0.13–0.15	7.9–8.4	<2
	12–17	----	----	----	----
	17–30	----	----	----	----
Ancho part	0–7	0.2–0.6	0.19–0.21	7.4–8.4	<2
	7–60	0.2–0.6	0.19–0.21	7.4–8.4	<2
[1] PN:					
Penasco part	0–12	0.6–2.0	0.13–0.15	7.9–8.4	<2
	12–17	----	----	----	----
	17–30	----	----	----	----
Gabaldon part	0–60	0.6–2.0	0.16–0.20	7.4–8.4	<2
Reakor:					
Ra	0–12	2.0–6.0	0.11–0.15	7.4–8.4	2–4
	12–65	0.6–2.0	0.16–0.21	7.9–8.4	2–4
ReA, ReB, RF	0–17	0.6–2.0	0.16–0.20	7.4–8.4	2–4
	17–65	0.6–2.0	0.16–0.21	7.9–8.4	2–4
Reakor gravelly subsoil variant:					
Rg	0–11	0.6–2.0	0.16–0.18	7.9–8.4	2–4
	11–31	0.6–2.0	0.16–0.18	7.9–8.4	2–4
	31–60	0.6–2.0	0.06–0.08	7.9–8.4	2–4
Reakor:					
[1] RH:					
Reakor part	0–17	0.6–2.0	0.16–0.20	7.4–8.4	2–4
	17–65	0.6–2.0	0.16–0.21	7.9–8.4	2–4

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	High	Low	0.17	5	2
Low	High	Low	0.24		
Low	High	Low	0.24		
Low	High	Low	0.24	5	3
Low	High	Low	0.24		
Low	High	Low	0.24		
Low	Moderate	Low	0.20	5	2
High	High	Low	0.32	5	---
High	High	Low	0.32		
High	High	Low	0.32	5	---
High	High	Low	0.32		
High	High	Low	0.32	5	---
High	High	Low	0.32		
Very low	Moderate	Low	---	---	---
Low	High	Low	0.28	3	---
Low	High	Low	0.24		
Low	High	Low	0.24	1	---
---	---	---	---		
---	---	---	---		
Low	High	Low	0.24	1	---
---	---	---	---		
---	---	---	---		
Moderate	High	Low	0.32	5	4L
Moderate	High	Low	0.32		
Low	High	Low	0.24	1	---
---	---	---	---		
---	---	---	---		
Moderate	Moderate	Low	0.37	5	4L
Low	High	Low	0.37	5	3
Moderate	High	Low	0.43		
Low	High	Low	0.49	5	4L
Moderate	High	Low	0.43		
Low	High	Low	0.49	3	4L
Moderate	High	Low	0.43		
Low	High	Low	0.32		
Low	High	Low	0.49	5	4L
Moderate	High	Low	0.43		

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm at 25° C.*
Reakor:					
[1] RH:					
Pecos part	0–9	0.06–0.2	0.12–0.20	7.9–8.4	2–4
	9–60	<0.06	0.10–0.18	7.9–8.4	2–4
[1] RI:					
Reakor part	0–17	0.6–2.0	0.16–0.20	7.4–8.4	2–4
	17–65	0.6–2.0	0.16–0.21	7.9–8.4	2–4
Tencee part	0–9	0.6–2.0	0.09–0.14	7.9–8.4	<2
	9				
Reeves:					
RkA, RkB	0–7	0.6–2.0	0.16–0.18	7.4–8.4	2–8
	7–31	0.6–2.0	0.19–0.21	7.4–8.4	2–8
	31–40	0.6–2.0	0.05–0.08	7.4–8.4	4–8
	40–79	0.6–2.0	0.12–0.16	7.4–8.4	4–8
[1] RL:					
Reeves part	0–7	0.6–2.0	0.16–0.18	7.4–8.4	2–8
	7–31	0.6–2.0	0.19–0.21	7.4–8.4	2–8
	31–40	0.6–2.0	0.05–0.08	7.4–8.4	4–8
	40–79	0.6–2.0	0.12–0.16	7.4–8.4	4–8
Holloman part	0–6	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	6				
Holloman thick solum part	0–16	0.6–2.0	0.12–0.14	7.4–8.4	4–16
	16				
Remunda:					
[1] RM:					
Remunda part	0–3	0.6–2.0	0.16–0.18	6.6–7.8	<2
	3–60	0.06–0.2	0.16–0.18	6.6–7.8	<2
Penasco part	0–12	0.6–2.0	0.13–0.15	7.9–8.4	<2
	12–17				
	17–30				
Roswell:					
[1] Rn:					
Roswell part	0–88	6.0–20	0.05–0.07	6.6–7.3	<2
Jalmar part	0–32	6.0–20	0.06–0.08	6.6–7.8	<2
	32–64	0.2–2.0	0.12–0.18	6.6–8.4	<2
Russler:					
Ru	0–7	0.6–2.0	0.10–0.15	7.9–8.4	8–16
	7–22	0.06–0.2	0.11–0.18	7.9–8.4	8–16
	22				
Shanta:					
Sh	0–3	0.6–2.0	0.19–0.21	7.4–8.4	<2
	3–60	0.6–2.0	0.19–0.21	7.4–8.4	<2
Simona:					
Sm	0–10	2.0–6.0	0.11–0.15	7.4–8.4	<2
	10–13	2.0–6.0	0.09–0.15	7.4–8.4	<2
	13				
Sotim:					
So	0–7	2.0–6.0	0.13–0.15	7.4–8.4	<2
	7–70	0.2–0.6	0.16–0.19	7.9–8.4	<2
Tencee:					
Te	0–9	0.6–2.0	0.09–0.14	7.9–8.4	<2
	9				

properties of soils—Continued

Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
High	High	Low	0.32	5	—
High	High	Low	0.32		
Low	High	Low	0.49	5	4L
Moderate	High	Low	0.43		
Low	High	Low	0.20	1	—
Low	High	Low	0.49	2	4L
Moderate	High	Low	0.37		
Low	High	High	0.49		
Moderate	High	High	0.37		
Low	High	Low	0.49	2	4L
Moderate	High	Low	0.37		
Low	High	High	0.49		
Moderate	High	High	0.37		
Low	High	High	0.49	1	4L
Low	High	High	0.49	1	4L
Low	Low	Low	0.37	5	6
High	High	Low	0.37		
Low	High	Low	0.24	1	—
Low	Low	Low	0.20	5	1
Very low	Low	Low	0.10	5	1
Low	Moderate	Low	0.24		
Low	High	High	0.32	2	4L
Moderate	High	High	0.37		
Low	Moderate	Low	0.32	5	4L
Moderate	Moderate	Low	0.32		
Low	Moderate	Low	0.37	1	3
Low	High	Low	0.32		
Low	Moderate	Low	0.32	3	3
Moderate	Moderate	Low	0.37		
Low	High	Low	0.20	1	—

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm at 25° C.*
Tencee:					
TfD	0–9	0.6–2.0	0.08–0.12	7.9–8.4	<2
	9				
[1]Tg:					
Tencee part	0–9	0.6–2.0	0.09–0.14	7.9–8.4	<2
	9				
Upton part	0–13	0.6–2.0	0.08–0.14	7.9–8.4	<2
	13–22			7.9–8.4	<2
[1]TS:					
Tencee part	0–9	0.6–2.0	0.09–0.14	7.9–8.4	<2
	9				
Sotim part	0–7	2.0–6.0	0.13–0.15	7.4–8.4	<2
	7–70	0.2–0.6	0.16–0.19	7.9–8.4	<2
Torriorthents:					
TOF	0–60				
Upton:					
[1]UA:					
Upton part	0–13	0.6–2.0	0.08–0.14	7.9–8.4	<2
	13–22			7.9–8.4	<2
Atoka part	0–12	0.6–2.0	0.16–0.18	7.4–8.4	2–4
	12–28	0.6–2.0	0.19–0.21	7.9–8.4	2–4
	28				
Vinton:					
[1]VG:					
Vinton part	0–60	2.0–6.0	0.08–0.12	7.4–8.4	<2
Glendale part	0–16	0.6–2.0	0.13–0.15	7.9–8.4	2–4
	16–60	0.2–0.6	0.16–0.21	7.9–8.4	2–4

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

groups range from porous sands that have the lowest runoff potential (Group A) to heavy clays that have the highest runoff potential (Group D).

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on evidences in the soil profile of the effects of flooding: thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils of the area that are not subject to flooding; local information about height of flood water and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods. Most soils in low positions on the landscape where flooding is likely to occur are classified as fluvents at the suborder level or as fluventic subgroups. See the section "Classification of the Soils."

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick in soils for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil survey. Indicated is the depth to the seasonal high water tables. Only those saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are un-

properties of soils—Continued

Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
Low	High	Low	0.20	1	
Low	High	Low	0.20	1	
Low Very low	High High	Low Low	0.28	2	
Low	High	Low	0.20	1	
Low Moderate	Moderate Moderate	Low Low	0.32 0.37	3	3
Low Very low	High High	Low Low	0.28	2	
Low Moderate	High High	Low Low	0.49 0.43	2	4L
Low	Moderate	Low			
Low Moderate	High High	Low Low			

behavior of the whole mapping unit.

derlain by bedrock at depths of 5 to 6 feet or less. For many soils, limited ranges in depth to bedrock are a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and other observations during the soil mapping. The kind of bedrock and its relative hardness as related to ease of excavation are also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200 horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers that are strongly compacted (indurated). Such pans cause difficulty in excavation. Hardness of pans is defined the same way as hardness of bedrock.

Potential frost action is the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action is defined as freezing temperatures in the soil and movement of soil moisture into the freezing zone, which causes the formation of ice lenses. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Engineering test data

The results of analyses of engineering properties of several representative soils of the survey area are given in table 12.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are representative of the series discussed in the section "Descriptions of the Soils." The soil samples were analyzed by the New Mexico State Highway Department in accordance with standard procedures of the American Association of State Highway and Transportation Officials (AASHTO).

The methods that were used in obtaining the data are listed by code below. Most of the codes, in parentheses, refer to the methods codes assigned by the

TABLE 11.—*Soil and water features*

[Absence of an entry indicates the feature is not a concern. The symbol > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			High water table	Bedrock		Cemented pan		Potential frost action
		Frequency	Duration	Months	Depth	Depth	Hardness	Depth	Hardness	
					Ft	*In*		*In*		
Alama:										
Aa	B	None to rare			>6.0	>60				
Ancho:										
[1] AN:										
Ancho part	B	None to rare			>6.0	>60				Moderate.
Penasco part	D	None			>6.0	>60		7–20	Rippable	
Atoka:										
AtA, AtB	C	None			>6.0	>60		20–34	Rippable	
Balmorhea:										
Ba	C	Rare			2.0–4.0	>60				
Bd	C	Rare			>6.0	>60				
Berino:										
[1] BE:										
Berino part	B	None			>6.0	>60				
Cacique part	C	None			>6.0	>60		20–40	Hard	
[1] Bf:										
Berino part	B	None			>6.0	>60				
Pintura part	A	None			>6.0	>60				
Bigetty:										
BgA, BgB, Bh	C	None to rare			>6.0	>60				
[1] BP:										
Bigetty part	C	None to rare			>6.0	>60				
Pecos part	D	Rare			>6.0	>60				
Cuevoland:										
[1] CA:										
Cuevoland part	B	None			>6.0	>60				Moderate.
Ancho part	B	None to rare			>6.0	>60				Moderate.
Pena part	B	None			>6.0	>60				Moderate.
Deama:										
[1] De:										
Deama part	C	None			>6.0	7–20	Hard			Low.
Rock outcrop part.										
[1] DR:										
Deama part	C	None			>6.0	7–20	Hard			Low.
Remunda part	C	None			>6.0	>60				Low.
Dune land:										
Du		None			>6.0	>60				

Ector:										
[1] EcC:										
Ector part	D	None			>6.0	4–20	Hard			
Rock outcrop part.										
[1] EcD:										
Ector part	D	None			>6.0	4–20	Hard			
Rock outcrop part.										
Faskin:										
Fa	B	None			>6.0	>60		>60		
[1] FM:										
Faskin part	B	None			>6.0	>60		>60		
Malstrom part	B	None			>6.0	>60				
[1] Fr:										
Faskin part	B	None			>6.0	>60		>60		
Roswell part	A	None			>6.0	>60				
Gabaldon:										
[1] GD:										
Gabaldon part	B	None to rare			>6.0	>60				Moderate.
Dev part	A	Frequent	Brief	Apr-Jun	>6.0	>60				
Glendale:										
Ge, Gf	B	Rare			>6.0	>60				
Holloman:										
Ho	C	None			>6.0	8–20	Rippable			
[1] Hp:										
Holloman part	C	None			>6.0	4–8	Rippable			
Gypsum land part.										
Holloman thick solum part.	C	None			>6.0	8–20	Rippable			
[1] HrC:										
Holloman part	C	None			>6.0	4–8	Rippable			
Gypsum land part.										
Holloman thick solum part.	C	None			>6.0	8–20	Rippable			
[1] HSE:										
Holloman part	C	None			>6.0	4–8	Rippable			
Gypsum land part.										
Ima:										
Im	B	None			>6.0	>60				
Jal:										
Ja	B	None			>6.0	>60				
Kimbrough:										
Km	D	None			>6.0	>60		7–18	Hard	
[1] Ks:										
Kimbrough part	D	None			>6.0	>60		7–18	Hard	
Sharvana part	C	None			>6.0	>60		8–20	Hard	

TABLE 11.—*Soil and water features*—Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table	Bedrock		Cemented pan		Potential frost action
		Frequency	Duration	Months	Depth	Depth	Hardness	Depth	Hardness	
					Ft	*In*		*In*		
Kimbrough:										
[1] Kt:										
Kimbrough part	D	None			>6.0	>60		7–18	Hard	
Stegall part	C	None			>6.0	>60		20–40	Hard	
Slaughter part	C	None			>6.0	>60		10–20	Hard	
Lozier:										
[1] Lr:										
Lozier part	D	None			>6.0	6–15	Hard			
Reakor part	B	None			>6.0	>60				
Tencee part	D	None			>6.0	>60		7–20	Hard	
[1] Lt:										
Lozier part	D	None			>6.0	6–15	Hard			
Tencee part	D	None			>6.0	>60		7–20	Hard	
Pajarito:										
Pa	B	None			>6.0	>60				
[1] Pb:										
Pajarito part	B	None			>6.0	>60				
Pintura part	A	None			>6.0	>60				
Pecos:										
Pe, PfA, PGB	D	Rare			>6.0	>60				
[1] PH:										
Pecos part	D	Rare			>6.0	>60				
Dev part	A	Frequent	Brief	Apr-Jun	>6.0	>60				
Pena:										
[1] PK:										
Pena part	B	None			>6.0	>60				Moderate.
Penasco part	D	None			>6.0	>60		7–20	Rippable	
Penasco:										
[1] PL:										
Penasco part	D	None			>6.0	>60		7–20	Rippable	
Ancho part	B	None to rare			>6.0	>60				Moderate.
[1] PN:										
Penasco part	D	None			>6.0	>60		7–20	Rippable	
Gabaldon part	B	None to rare			>6.0	>60				Moderate.
Reakor:										
Ra, ReA, ReB, RF	B	None			>6.0	>60				
Reakor gravelly subsoil variant:										
Rg	B	None			>6.0	>60				

Reakor:										
[1] RH:										
Reakor part	B	None			>6.0	>60				
Pecos part	D	Rare			>6.0	>60				
[1] RI:										
Reakor part	B	None			>6.0	>60				
Tencee part	D	None			>6.0	>60		7–20	Hard	
Reeves:										
RkA, RkB	C	None			>6.0	>60				
[1] RL:										
Reeves part	C	None			>6.0	>60				
Holloman part	C	None			>6.0	4–8	Rippable			
Holloman thick solum part.	C	None			>6.0	8–20	Rippable			
Remunda:										
[1] RM:										
Remunda part	C	None			>6.0	>60				Low.
Penasco part	D	None			>6.0	>60		7–20	Rippable	
Roswell:										
[1] Rn:										
Roswell part	A	None			>6.0	>60				
Jalmar part	A	None			>6.0	>60				
Russler:										
Ru	C	None			>6.0	20–40	Rippable			
Shanta:										
Sh	B	Occasional	Very brief	May-Oct	>6.0	>60				Moderate.
Simona:										
Sm	D	None			>6.0	>60		7–20	Hard	
Sotim:										
So	B	None			>6.0	>60				
Tencee:										
Te, TfD	D	None			>6.0	>60		7–20	Hard	
[1] Tg:										
Tencee part	D	None			>6.0	>60		7–20	Hard	
Upton part	C	None			>6.0	>60		7–20	Rippable	
[1] TS:										
Tencee part	D	None			>6.0	>60		7–20	Hard	
Sotim part	B	None			>6.0	>60				
Torriorthents:										
TOF	B	None			>6.0	>60				
Upton:										
[1] UA:										
Upton part	C	None			>6.0	>60		7–20	Rippable	
Atoka part	C	None			>6.0	>60		20–40	Rippable	
Vinton:										
[1] VG:										
Vinton part	B	Common	Brief	Jun-Sep	>6.0	>60				
Glendale part	B	Common	Brief	Jun-Sep	>6.0	>60				

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 12.—*Engineering test data*

[Tests performed by the New Mexico State Highway Department in accordance with standard procedures of the American Association of State Highway and Transportation Officials (AASHTO)]

Soil name and location	New Mexico State Highway Department Report	Depth from surface	Liquid limit	Plasticity index	Mechanical analysis[1] Percentage passing sieve— (2.0 mm.) No. 10	(0.42 mm.) No. 40	(0.07 mm.) No. 200	Classification AASHTO	Unified
	Number	*Inches*							
Bigetty loam 560 feet east and 2,100 feet north of the SW corner of sec. 13, T. 11 S., R. 23 E. (modal)	983 984	11–23 23–41	40 33	14 10	100 100	99 99	81 91	A–6 (10) A–4 (8)	ML CL
Holloman loam 10 feet west and 190 feet south of crossroads which is ¼ mile west and ¼ mile south of Bottomless Lake road from highway 285, NW¼NE¼NE¼, sec. 1, T. 11 S., R. 25 E. (modal)	996	2–6	34	12	100	94	79	A–6 (9)	CL
Pajarito loamy sand (truncated) 291 feet north and 600 feet west of road intersection at the SE¼ NE¼, sec. 30, T. 14 S., R. 27 E.	976 977 978	3–15 26–38 80–90	--------- --------- 21	NP[2] NP 7	100 100 100	90 91 88	26 32 36	A–2–4 (0) A–2–4 (0) A–4 (1)	SM SM SM–SC
Pecos silty clay loam 810 feet west and 975 feet south of the SW corner of cultivated field SW¼SE¼SW¼, sec. 28, T. 15 S., R. 26 E. (modal)	979 980 981 982	3–9 16–34 34–47 47–66	33 44 53 21	11 13 22 7	100 100 100 100	99 99 80 99	81 91 62 71	A–6 (9) A–7 (10) A–7 (12) A–4 (7)	CL ML MH CL–ML
Pecos silty clay loam, nonsaline 57 feet south and 275 feet west of the SE corner of cultivated field NE¼SE¼NE¼, sec. 14, T. 11 S., R. 23 E. (modal)	985 986 987	6–11 19–42 49–65	31 42 35	8 17 13	100 100 100	98 99 99	71 90 85	A–4 (7) A–7 (11) A–6 (10)	ML CL CL
Pintura loamy fine sand 225 feet north of road and 600 feet west of road intersection at the SE¼NE¼, sec. 30, T. 14 S., R. 27 E. (modal)	974 975	0–21 21–30	--------- ---------	NP NP	100 100	97 97	25 19	A–2–4 (0) A–2–4 (0)	SM SM
Reeves loam 400 feet east and 295 feet south of the NW¼NE¼, sec. 11, T. 12 S., R. 25 E. (modal)	992 993 994	3–7 7–15 22–31	24 24 24	5 8 7	100 100 100	97 96 89	60 60 48	A–4 (5) A–4 (5) A–4 (3)	CL–ML CL SM–SC
Sotim fine sandy loam 240 feet west of the NE¼SE¼, sec. 3, T. 15 S., R. 23 E. (modal)	972 973	7–12 26–70	38 21	11 6	100 100	95 99	56 76	A–6 (5) A–4 (8)	ML CL–ML
Tencee gravelly loam 135 feet south and 20 feet west of Southwestern Public Service Company substation, NE¼NE¼ NE¼, sec. 4, T. 14 S., R. 25 E. (modal)	991	5–9	31	0	23	22	18	A–2–4 (0)	GM

[1] Mechanical analysis according to AASHTO Designation: T 88–57 (*1*). Results by this procedure frequently differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. 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 calculation of the grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soils.

[2] NP = Nonplastic

American Association of State Highway and Transportation Officials. The codes for Shrinkage and Unified Classification are those assigned by the American Society for Testing and Materials (*2*).

The methods and codes are: AASHTO classification (M–145–66); Unified classification (D–2487–66T); Mechanical analysis (T88–57); Liquid limit (T89–60); and Plasticity index (T90–56).

Formation and Classification of the Soils

This section discusses the genetic and environmental factors and processes involved in soil formation, and classifies the soils of the Chaves County, Southern Part, survey area.

Factors of Soil Formation

Soil is a natural body and is the result of interaction of the genetic and environmental factors of parent material, climate, plant and animal life, relief, and time. These factors produce many kinds of soils that differ from the material from which they are derived in many physical, chemical, biological, and morphological properties and characteristics.

A soil has length, breadth, and thickness. Individual soils range from a few square yards to several hundred acres in size and have various shapes, as revealed by their delineations on soil maps. Soil thickness or depth is divided into kinds of horizons based on soil characteristics.

The characteristics of a soil are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material accumulated and has existed since accumulation; plant and animal life on and in the soil; relief, or lay of the land; and the length of time these factors 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 they slowly change it into a soil 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 some 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. Each factor as it occurs in Chaves County, Southern Part is described in the paragraphs that follow.

Parent material

Parent material, to a large degree, determines texture, structure, color, fertility, mineralogy, and chemical composition of a soil. Geologic formations of Permian, Triassic, Tertiary, and Quaternary age form the parent materials of the soils in Chaves County, Southern Part (*4, 5, 6, 7, 8, 9, 11, 14*).

The western and southwest part of the area is dominated by fine grained limestone of Permian age. This limestone weathers dominantly into very fine sand, silt, cobblestones, and pebbles. The very shallow and shallow Deama, Ector, and Lozier soils formed in residual materials from this limestone. The soils on fans, terraces, and flood plains of this area formed in alluvial sediments derived mostly from the limestone. Some of these soils, for example Penasco and Cuevoland soils, have horizons high in carbonates. Other soils, such as Ancho and Gabaldon soils, have profiles low in carbonates. Pena and Dev soils have cobbly and gravelly profiles. Remunda soils have a strong structured subsoil.

The central part of the area is dominated by alluvial sediments of Quaternary age that are derived mainly from limestone. Tencee, Upton, Atoka, and Reakor soils formed in these sediments. These soils are highly calcareous. The recent alluvium of the Pecos River flood plain is derived from materials of mixed oirgin. Glendale and Pecos soils formed in these coarse to fine textured stratified sediments. Reeves, Holloman, and Russler soils formed in thin alluvial sediments over thin and thick gypsum beds of Quaternary and Permian age.

The east-central part of the area is dominated by eolian and alluvial sediments of Quaternary age. These sediments are mostly fine sand. Some of the soils, such as Berino, Faskin, and Jalmar soils, have a well developed subsoil of sandy clay loam. Simona and Tencee soils have profiles with layers of shallow indurated caliche. Jal, Sotim, and Malstrom soils have a substratum high in content of lime. Pintura and Roswell soils have profiles of fine sand and loamy fine sand.

The far eastern part of the area is dominated by alluvium, eolian sediments, caprock caliche of the Tertiary Ogallala Formation, and eolian deposits of Quaternary age. Kimbrough, Slaughter, Stegall, and Sharvana soils formed in these sediments. These soils have profiles with shallow and moderately deep layers of indurated caliche. Slaughter and Stegall soils have a strong structured, moderately fine textured subsoil.

Climate

Chaves County, Southern Part, has a semi-arid climate. This climate is characterized by abundant sunshine, low relative humidity, erratic rainfall, wind, and a wide variation in daily and seasonal temperatures. Winters are short and mild, and summers are long and hot. The soils rarely freeze to a depth of more than a few inches. March is the windiest month. Soils associated with older Quaternary landscapes (pre-Holocene greater than 10,000 years) were influenced by climates somewhat cooler and more humid than the present.

Climate has a direct influence on soil formation. The temperature and rainfall affect the kind and amount of vegetation that grows. Organic matter decomposes more rapidly in warmer climates than in cooler climates. Precipitation affects the amount and depth of leaching and clay movements in soils. Warmer temperatures along with precipitation causes more rapid weathering of parent materials than cooler temperatures. Strong winds influence the formation of some soils.

The relatively low precipitation, its distribution, and the high temperatures of Chaves County, Southern Part, resulted in a dominantly grassland vegetation. The soils at the higher elevations receive more precipitation and are cooler than soils at the lower elevations, and so they have relatively higher amounts of organic matter in the surface layer and are darker colored. Ector soils are an example. Pajarito soils, at a relatively low elevation, receive less precipitation, are warmer, support less vegetation, have less organic matter in the surface layer, and have a lighter colored surface layer. Some soils at the lower elevations, such as Penasco soils, have a dark colored surface layer and relatively high content of organic matter. These are a result of added moisture as runoff or overflow from higher lying soils.

The total precipitation in the area is insufficient to completely wet and leach the soils that have a high available water capacity. Reakor soils are an example. In these soils calcium carbonate has been leached from the surface layer, accumulating in the substratum at about the normal depth of wetting. Moisture moves through Roswell soils because the precipitation exceeds the available water capacity.

Remunda soils have an accumulation of clay in the subsoil. These soils formed over a sufficiently long period so the calcium carbonate is leached, some clay-forming minerals are weathered, and clay minerals are translocated and have accumulated in the subsoil. Jalmar and Faskin soils also have clay accumulations in the subsoil.

Strong winds in the area have eroded or partially eroded the surface layers of many soils of this area and surrounding areas. The result is that sandy materials have accumulated in areas of lower wind velocities, and in some areas the strong winds have reworked the materials into dunes. Roswell soils formed in these undulating to rolling dunes. In recent years, wind has caused severe soil blowing in areas overgrazed by livestock. Removal or partial removal of the surface layer and subsequent deposition on Berino, Faskin, and Pajarito soils will influence the use and management and future development of these soils.

Plant and animal life

Plants and animals influence the formation of soils mostly by supplying organic matter and recycling plant nutrients from the subsoil and substrata to the surface layers. Decomposition of plant and animal remains by micro-organisms adds organic matter to the soil, which generally darkens the soil color, increases available water capacity, improves tilth, water infiltration, and permeability, and releases plant nutrients. Organic matter provides food for bacteria, fungi, earthworms, insects, and rodents. The latter three can destroy developed soil horizons by mixing them with other horizons.

When the first settlers arrived, vegetation in Chaves County, Southern Part, was mostly grassland with scattered shrubs. Scattered one-seed juniper, pinyon pine, and shrubs grew at the higher elevations. Mid and tall grasses dominated the plant community on the deep sandy soils and soils of the flood plains. Short and mid grasses were dominant on alluvial fans and terraces in the mid positions. Shrubs were most common on shallow gravelly soils and soils in the drainageways.

Except in areas at the higher elevations and on flood plains, annual accumulation of organic matter is small. Because of the low production of vegetation and high temperatures most of the soils have a relatively low content of organic matter in the surface layer. This causes loamy surface layers to be generally crust-like and poorly aggregated. This poorly aggregated surface layer retards water infiltration and increases runoff.

Relief

Relief, or position, shape, and slope of the landscape, influences soil formation, mostly through its effects upon drainage, plant cover, soil temperature, surface runoff, and erosion. If other soil forming factors were constant, the degree of individual horizon development within a soil would depend upon the amount of moisture entering and passing through the soil. Steeply sloping soils have higher runoff rates, absorb less moisture, and have a greater risk of erosion than the less sloping soils. As a result the steeply sloping soils have less distinct horizon development. Exposure has little effect on soil formation in this area.

Soils in concave positions frequently receive additional moisture as runoff from surrounding higher soils. The added moisture gives rise to a more abundant vegetative cover and thus a thicker surface layer that has a higher organic-matter content. Some eroded soil materials have also been deposited in these areas, and may be a contributing factor to the thickness of the surface layers. This contrast is evident in Pecos soils as compared to Reakor soils.

Time

Time is required for the formation of soils. The length of time necessary for distinct horizons to develop depends on the other soil forming factors. The degree of expression of genetic soil horizons is directly related to the length of time that other soil forming factors have exerted their influence on the parent material. Parent materials which climate, plant and animal life, and relief have only begun to alter have few, if any, horizons; these are young soils. Soils that have well defined genetic horizons are old soils.

In the survey area, Faskin soils are among the oldest soils. They formed in a thin mantle of aeolian and alluvial sediments deposited during Pleistocene time. The surface layer has been very slightly darkened by accumulations of organic matter. Water percolating through the soil profile has weathered clay-forming minerals and has translocated them into the subsoil. Calcium carbonate has been leached downward and a zone of carbonate has built up in the lower part of the substratum.

Glendale and Pecos soils formed in recently deposited alluvial materials. The youth of these soils is apparent from the lack of modification of the parent material. Roswell and Pintura soils formed in recent aeolian sands. These soils are also young; the parent material is not modified.

Classification of the Soils

This section defines the current system of classifying soils and classifies the soils of the area according to that system.

Classification

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*17*).

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 13, the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based mainly on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Psamments (*Psamm*, meaning sand, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Torripsamments (*Torr* meaning hot and dry, plus *psamments*, the suborder of Entisols that are sands).

SUBGROUP. Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Typic Torripsamments.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil that is penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is mixed, thermic Typic Torripsamments.

SERIES. The series consists of a group of soils that formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consis-

TABLE 13.—*Classification of the soils*

Soil name	Family or higher taxonomic class
Alama	Fine-silty, mixed, thermic Ustollic Camborthids
Ancho	Fine-silty, mixed, mesic Torriorthentic Haplustolls
Atoka	Fine-loamy, mixed, thermic Typic Paleorthids
Balmorhea	Fine-silty, mixed (calcareous), thermic Cumulic Haplaquolls
Berino	Fine-loamy, mixed, thermic Typic Haplargids
Bigetty	Fine-silty, mixed, thermic Cumulic Haplustolls
Cacique	Fine-loamy, mixed, thermic Petrocalcic Paleargids
Cuevoland	Fine-silty, mixed, mesic Aridic Calciustolls
Deama	Loamy-skeletal, carbonatic, mesic Lithic Calciustolls
Dev	Loamy-skeletal, carbonatic, thermic Cumulic Haplustolls
Ector	Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Faskin	Fine-loamy, mixed, thermic Ustalfic Haplargids
Gabaldon	Fine-silty, mixed, mesic Cumulic Haplustolls
Glendale	Fine-silty, mixed (calcareous), thermic Typic Torrifluvents
Holloman	Fine-loamy, gypsic, thermic, shallow Typic Torriorthents
Ima	Coarse-loamy, mixed, thermic Ustochreptic Camborthids
Jal	Fine-loamy, carbonatic, thermic Typic Calciorthids
Jalmar	Loamy, mixed, thermic Arenic Ustalfic Haplargids
Kimbrough	Loamy, mixed, thermic, shallow Petrocalcic Calciustolls
Lozier	Loamy-skeletal, carbonatic, thermic Lithic Calciorthids
Malstrom	Coarse-loamy, mixed, thermic Ustochreptic Calciorthids
Pajarito	Coarse-loamy, mixed, thermic Typic Camborthids
Pecos	Fine, mixed, thermic Torrertic Haplustolls
Pena	Loamy-skeletal, mixed, mesic Aridic Calciustolls
Penasco	Loamy-skeletal, carbonatic, mesic Petrocalcic Calciustolls
Pintura	Mixed, thermic Typic Torripsamments
Reakor	Fine-silty, mixed, thermic Typic Calciorthids
Reakor gravelly subsoil variant.	Fine-loamy, mixed, thermic Typic Calciorthids
Reeves	Fine-loamy, gypsic, thermic Typic Gypsiorthids
Remunda	Fine, mixed, mesic Aridic Argiustolls
Roswell	Mixed, thermic Ustic Torripsamments
Russler	Fine-silty, mixed, thermic Typic Camborthids
Shanta	Fine-loamy, mixed, mesic Cumulic Haplustolls
Sharvana	Loamy, mixed, thermic, shallow Petrocalcic Ustalfic Paleargids
Simona	Loamy, mixed, thermic, shallow Typic Paleorthids
Slaughter	Clayey, mixed, thermic, shallow Petrocalcic Paleustolls
Sotim	Fine-loamy, mixed, thermic Typic Calciorthids
Stegall	Fine, mixed, thermic Petrocalcic Paleustolls
Tencee	Loamy-skeletal, carbonatic, thermic, shallow Typic Paleorthids
Torriorthents	Torriorthents
Upton	Loamy, carbonatic, thermic, shallow Typic Paleorthids
Vinton	Sandy, mixed, thermic Typic Torrifluvents

tence, and mineralogical and chemical composition. An example is the Vinton series.

Environmental Features That Affect Soil Use in the Survey Area

This section discusses the water supply, transportation and markets, and climate of Chaves County, Southern Part.

Water Supply

There are two basic sources of irrigation water in the Chaves County, Southern Part, survey area (*12*): surface and ground water. Surface water was first diverted for irrigation in the basin in the early 1870's from tributaries of the Pecos River such as North Spring Creek, South Spring Creek, and Berrendo Creek. These creeks were fed by large artesian springs. In the early 1900's expanded drilling of artesian wells for irrigation reduced the flow of the artesian springs until it was no longer economically feasible to maintain the diversion ditches used to irrigate from these tributaries. At present only about 5 percent of the irrigation water supply is surface water. For the most part, this water is diverted from the Pecos River or is return flow from applied ground water surplus.

The Hagerman Canal supplies most of the surface water in the survey area. It has been in use since 1879 and has decreed water rights for 9,026 acres. The canal receives water from several sources: return flow from irrigation; surplus water from the Berrendo Creek, North Spring Creek, Rio Hondo, and South Spring Creek; supplemental water from artesian wells and tile drainage systems; and shallow wells.

Ground water pumped from wells supplies all municipal and industrial requirements and about 95 percent of the water used for irrigation. The main water-yielding formations are the deep San Andres limestone (artesian aquifer) and the Quaternary alluvium (shallow aquifer or valley fill).

The use of artesian water for irrigation expanded rapidly until 1916, but artesian pressure declined until pumps had to be installed in order to continue irrigation. Overuse of the underground water supply for irrigation finally resulted in the enactment of a State law to control and regulate the use of this water.

The State court set an annual duty of water at 3.5 acre feet per acre, to be exceeded only if the total amount of water diverted in any period of 5 consecutive years does not exceed 15 acre feet. The metering of all wells was begun in January 1967.

Wells range in depth from 100 to 1,000 feet. The average depth in the Roswell-East Grand Plains area is about 600 feet. Wells in the Dexter-Hagerman area are about 1,000 feet deep.

Yield from the wells has been tested at rates as high as 9,225 gallons per minute, but the average yield of the deep wells is generally between 200 and 300 gallons per minute. The average yield of the shallow wells is about 1,000 gallons per minute.

All the soils of the survey area have been classified for their suitability for irrigation (*10*). Approximately 90,000 acres are presently being irrigated. Additional expansion of irrigation farming does not appear probable.

Transportation and Markets

The survey area consists of 2,023,471 acres or 3,162 square miles. It is easily accessible by highways and trucking is readily available. A municipal airport is located at Roswell. The Atchison, Topeka, and Santa Fe Railroad runs north and south through the Pecos Valley.

Processing and marketing of vegetables has had little success even though the soils are suitable for growing many such crops.

There are some highly successful processing and marketing cooperatives in the survey area. These cooperatives mostly process and market cotton, cotton by-products, alfalfa hay, wool, and feed grains.

Livestock feeding and dairying furnishes a ready market for most of the feed grains and alfalfa hay grown. A private meat processing and marketing company is located in the survey area, but many cattle, sheep, and pigs are shipped out for processing and marketing. After fall harvest, croplands are planted to winter small grains for grazing by livestock to prepare the animals for the feed pens and to supplement the range.

Climate[5]

Precipitation in the northeastern part of Chaves County, Southern Part, based on data from Roswell, is shown in table 14. The average annual total precipitation is about 11 inches along Pecos River and rises to 12 inches in the west and to 14 inches in the east. Increases correspond generally to increases in elevation. As elevation increases in the southwestern part of the area, the average annual precipitation increases from about 13 inches in the northeastern part to about 18 inches in the west-central part.

Table 15 shows precipitation and temperature data for Elk, Chaves County, which is in the higher area of the county at an elevation of 5,700 feet, or about 2,000 feet higher than Roswell. Comparison with table 14 shows that greater differences in amount of precipitation occur in summer, and differences are small in winter. This illustrates the effect of increasing elevation. In the mountains greater amounts of precipitation are caused by the added uplift given to moist air flowing inland over the area from the Gulf of Mexico. In winter, the mountains to the west are a barrier to most moisture from the Pacific Ocean. The eastern mountain slopes and the valley plains of Chaves County, therefore, receive little increase in precipitation.

Rainfall of 0.10 inch or more may be expected to fall on an average of 20 to 25 days a year in the lower elevations; this increases to about 35 days a year in the mountains of the southwest. On the average, one-half or more of the total yearly precipitation falls on just 5 days in the lower elevations and on 10 days in the southwestern mountains.

[5] By Frank E. Houghton, State climatologist for New Mexico, U.S. Department of Commerce.

TABLE 14.—*Temperature and precipitation*

[All data from Roswell, New Mexico (1931–1960)]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Number of days with precipitation	
			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.	In.	In.	In.		
January	55	21	71	13	0.5	(3)	1.2	2	1
February	60	24	75	15	0.4	(3)	0.9	1	1
March	69	30	81	21	0.5	(3)	1.4	1	1
April	79	39	89	32	0.7	0.1	1.3	2	1
May	87	49	96	43	1.3	0.1	2.7	2	1
June	96	59	103	55	1.1	0.1	2.2	2	1
July	95	62	101	62	1.8	0.4	3.3	4	2
August	93	60	100	59	1.6	0.3	3.3	3	2
September	87	52	96	46	1.8	(3)	5.0	3	2
October	77	41	89	35	1.1	0.1	2.9	2	1
November	65	27	78	19	0.3	(3)	0.9	1	(4)
December	57	21	71	14	0.5	(3)	1.8	1	1
Year	77	40	[1] 104	[2] 4	11.6	7.0	14.8	24	14

[1] Average annual highest temperature.
[2] Average annual lowest temperature.
[3] Less than 0.05 inch.
[4] Less than ½ day.

TABLE 15.—*Temperature and precipitation*

[All data from Elk, New Mexico (1931–1960)]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Number of days with precipitation—	
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than		Less than	More than	0.10 inch or more (1954–60)	0.50 inch or more (1951–60)
	°F.	°F.	°F.	°F.	In.	In.	In.		
January	55	21	71	7	0.6	(3)	1.2	2	(4)
February	58	23	72	8	0.5	(3)	1.2	2	(4)
March	63	28	77	14	0.6	(3)	1.6	2	(4)
April	70	35	83	25	0.6	(3)	1.1	1	(4)
May	77	42	88	33	1.3	0.1	3.3	2	1
June	85	51	94	41	1.7	0.2	3.5	3	1
July	87	56	94	50	2.5	0.9	4.6	6	2
August	85	53	90	50	3.0	1.2	5.3	7	3
September	80	48	87	38	2.6	0.3	5.8	4	1
October	72	37	83	30	1.4	0.4	3.3	4	1
November	63	26	75	13	0.4	(3)	0.8	1	(4)
December	57	22	71	9	0.6	(3)	1.7	2	(4)
Year	71	37	[1] 95	[2] −2	15.8	9.1	19.7	36	9

[1] Average annual highest temperature.
[2] Average annual lowest temperature.
[3] Less than 0.05 inch.
[4] Less than ½ day.

Annual daily temperature averages about 59° F. in the northern part of the survey area. It is about 60° in the Pecos Valley and adjacent east and 58° in the west. Temperatures decrease more rapidly with elevation in the southwest to about 54° at the western boundary of Chaves County. Daily maximum temperature averages in the mid-seventies in the lower elevations to 70° in the mountains. Daily minimum temperature averages in the middle forties in the lower elevations and in the upper thirties in the mountains. Tables 14 and 15 show the general pattern of monthly temperature for these two areas. In winter there are rather small differences in the average high and low temperatures in the two areas, but differences are pronounced in the summer, both in high and low readings. Extremes of temperature in the area are a high of 111° F. at Hagerman, July 21, 1936, and a low of 29° below zero at Roswell, February 13, 1905. Temperatures below zero, however, occur on an average of one day per year at Roswell. Daily maximum temperatures of 90° or more occur on an average of 20 to 25 days a year. Temperatures fall to 32° (freezing) or below on an average of 110 to 120 days per year in the lower elevations and on about 150 days per year in the mountains.

Relative humidity in Chaves County, Southern Part, is illustrated by measurements made at Roswell, where the annual average is approximately 50 percent. Early morning humidity, which is generally highest at the time of lowest temperature, averages 70 percent, and afternoon humidity averages 30 percent. Lowest humidity is in spring, when morning highs average 55 percent and afternoon lows average 20 percent. Humidity is highest late in summer and early in fall, the rainy season, at which time the range of averages is from 75 percent in the early morning to 35 percent later in afternoon. Because of the generally lower temperatures in the mountains of the southwest, the relative humidity of that area averages about 5 percent higher than in the Pecos Valley.

Evaporation from a Class A evaporation pan at Bitter Lakes National Wildlife Refuge averages 96 inches a year, two-thirds of which (65 inches) is during the period May through October. These values are generally representative of Chaves County, Southern Part. Because temperatures are cooler in the higher lands in southwestern Chaves County, the evaporation there is generally about 10 percent lower than at Bitter Lakes.

Sunshine occurs about three-fourths of the possible hours in Chaves County, Southern Part, or an average of near 3,300 hours annually. The average cloudiness is 40 percent of the sky covered by clouds. An average 185 days a year may be called clear (less than 14 percent of the sky covered by clouds) while 80 days may be called cloudy (more than 70 percent of the sky covered by clouds).

An average of 41 thunderstorms a year occur at Roswell, and this figure is generally representative of Chaves County, Southern Part. Two-thirds of these occur during summer, and thunderstorms seldom occur in winter. An average of one or two days a month with heavy fog occur from late fall through early spring.

Tornadoes have been reported mainly in the vicinity of Roswell where most of the county population lives. The greatest damage from a tornado occurred on June 8, 1923 when a tornado hit the northwest corner of the city. About 7 tornadoes in 50 years were reported in the area north of Roswell, and about 6 in the area south of Roswell. Damage is generally light.

Hail occurs about twice a year in the Roswell area. It occurs most often late in spring and early in summer, April through July, with 69 percent of the annual occurrences. In some years (about 1 year in 6) there is no hail, while as many as eight hailstorms occurred in one year, 1919. In the 14 year period 1950–1963, hail three-fourths of an inch in diameter or more has fallen 12 times. During this period damage has occurred to property three times and to crops twice; one storm caused severe damage to crops.

Annual average windspeed at the Roswell Airport is 10 miles per hour. Strongest average winds, about 12 miles per hour, are in spring, mainly in June. At other times winds are about 8 to 9 miles per hour. Nearly 40 percent of the time the wind is from the southeasterly quadrant. Strongest winds, those above 24 miles per hour, are most often from westerly directions. Easterly winds average the lightest, while westerly winds are strongest. The general north-south orientation of the Pecos Valley at Roswell probably in-

TABLE 16.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Roswell, Chaves County, New Mexico]

Probability	Dates for given probability and temperature						
	16 F. or lower	20 F. or lower	24 F. or lower	28 F. or lower	32 F. or lower	36 F. or lower	40 F. or lower
Spring:							
1 year in 10 later than	Mar. 15	Mar. 24	Apr. 5	Apr. 10	Apr. 24	May 2	May 13
2 years in 10 later than	Mar. 7	Mar. 17	Mar. 29	Apr. 6	Apr. 19	Apr. 27	May 8
5 years in 10 later than	Feb. 18	Mar. 2	Mar. 16	Mar. 27	Apr. 9	Apr. 17	Apr. 27
Fall:							
1 year in 10 earlier than	Nov. 17	Nov. 9	Nov. 5	Oct. 30	Oct. 21	Oct. 9	Sep. 29
2 years in 10 earlier than	Nov. 24	Nov. 14	Nov. 9	Nov. 3	Oct. 25	Oct. 13	Oct. 3
5 years in 10 earlier than	Dec. 9	Nov. 26	Nov. 16	Nov. 11	Nov. 2	Oct. 24	Oct. 12

creases the frequency of wind in those directions to values higher than those in localities at a greater distance from the river, particularly in the southwest. These areas outside the valley probably receive a greater windflow from the westerly directions than does Roswell.

Table 16 shows the probability of last freezing temperatures in spring and first in fall at Roswell. The average date is that of 50 percent probability. The average length of the growing season, the period between the last freezing temperature in spring and the first freezing temperature in fall, is 207 days.

In the lower elevations the season for snowfall is November through April; the winter months receive the most snow. An average of about 10 inches of snow may be expected in the area, but seasonal totals vary from 2 to 31 inches at Roswell. Although 15.3 inches of snow fell at Roswell in 24 hours on December 8–9, 1960, generally only an inch or two falls in a day, and it does not stay on the ground long. In the higher elevations of the southwest, snowfall is heavier and the season is a bit longer. Average annual snowfall is 14 to 17 inches or more, but a total of 34 inches fell at Elk in December 1931.

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Glossary

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

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	Less than 3.75
Low	3.75 to 5
Moderate	5 to 7.5
High	More than 7.5

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Chlorosis. A yellowing between veins on upper foliage which results from chlorophyll deficiency. Many factors cause chlorosis.

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 bridging. Accumulation of alluvial clay on and between grains of sand.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A mapping unit of two or more kinds of soil occuring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

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

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

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

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Favorable. Favorable soil features for the specified use.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not probable; rare that it is unlikely but possible under unusual weather conditions; occasional that it occurs on an average of once or less in 2 years; and frequent that it occurs on an average of more than once in 2 years. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, and long if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

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 a combination of these; (2) by prismatic or blocky structures; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Indurated. Cemented, having a hard, brittle consistency because the particles are held together by cementing substances such as calcium carbonate or the oxides of silicon, iron, and aluminum. The hardness and brittleness persist even when wet.

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

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

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

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

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

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

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

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

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Low strength. Inadequate strength for supporting loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Pores. That part of the bulk volume of soil not occupied by soil particles; interstices; voids.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

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

Redbed (geology). Sedimentary strata, largely of Permian and Triassic age, that are predominantly red in color. Redbeds contain few fossils.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

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

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles 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 soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope class name: Word description of slopes provided in addition to the numerical slope range given in the correlated name of a mapping unit. The slope class name provides additional information by indicating whether slopes are single or complex, thus describing shape to some extent. These are the slope class names for this survey area:

Soil slope percentage	*Single slopes*	*Complex slopes*
0–1	Level	Level
1–3	Nearly level	Gently undulating
3–5	Gently sloping	Undulating
5–9	Moderately sloping	Gently rolling
9–15	Strongly sloping	Rolling
15–30	Moderately steep	Hilly
30–50	Steep	Steep
50–80	Very steep	Very steep

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

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, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. The nonirrigated capability classification of the soils are described on page 56.

Map symbol: Narrowly defined	Map symbol: Broadly defined	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Range site	Page
Aa		Alama loam	9	------	--	VIe	Bottomland SD-3	59
	AN	Ancho-Penasco association	10	------	--	------	------------------	--
		Ancho loam part	--	------	--	VIe	Loamy CP-4	64
		Penasco cobbly loam part	--	------	--	VIIs	Shallow CP-4	66
AtA		Atoka loam, 0 to 1 percent slopes	11	IIIs-7	54	VIIs	Loamy SD-3	64
AtB		Atoka loam, 1 to 3 percent slopes	11	IIIe-12	54	VIIe	Loamy SD-3	64
Ba		Balmorhea loam	12	IVw-3	56	VIw	Salt Meadow SD-3	65
Bd		Balmorhea loam, drained	12	IIIs-9	55	VIs	Salty Bottomland SD-3	65
	BE	Berino-Cacique association	13	------	--	VIIe	Sandy SD-3	66
Bf		Berino-Pintura complex	13	------	--	VIIe	------------------	--
		Berino sandy clay loam part	--	------	--	------	Sandy SD-3	66
		Pintura loamy fine sand part	--	------	--	------	Deep Sand SD-3	61
BgA		Bigetty loam, 0 to 1 percent slopes	15	I	53	VIc	Loamy SD-3	64
BgB		Bigetty loam, 1 to 3 percent slopes	15	IIe-6	53	VIe	Loamy SD-3	64
Bh		Bigetty loam, moderately saline	15	IIIs-9	55	VIIs	Salt Flats SD-3	64
	BP	Bigetty-Pecos association	15	------	--	------	------------------	--
		Bigetty loam part	--	------	--	VIc	Loamy SD-3	64
		Pecos silty clay loam, nonsaline, part	--	------	--	VIs	Bottomland SD-3	59
	CA	Cuevoland-Ancho association	17	------	--	VIe	------------------	--
		Cuevoland loam part	--	------	--	------	Loamy CP-4	64
		Ancho loam part	--	------	--	------	Loamy CP-4	64
		Pena cobbly loam part	--	------	--	------	Hills CP-4	62
De		Deama-Rock outcrop complex	17	------	--	VIIs	------------------	--
		Deama cobbly loam part	--	------	--	------	Limestone Hills CP-4	62
		Rock outcrop part	--	------	--	------	------------------	--
	DR	Deama-Remunda association	18	------	--	------	------------------	--
		Deama cobbly loam part	--	------	--	VIIs	Shallow CP-4	66
		Remunda loam part	--	------	--	VIe	Loamy CP-4	64
Du		Dune land	19	------	--	VIIIe	------------------	--
EcC		Ector-Rock outcrop complex, 0 to 9 percent slopes	19	------	--	VIIs	------------------	--
		Ector cobbly loam part	--	------	--	------	Shallow CP-4	66
		Rock outcrop part	--	------	--	------	------------------	--
EcD		Ector-Rock outcrop complex, 9 to 30 percent slopes	19	------	--	VIIs	------------------	--
		Ector cobbly loam part	--	------	--	------	Limestone Hills CP-4	62
		Rock outcrop part	--	------	--	------	------------------	--
Fa		Faskin fine sand	20	------	--	VIe	Deep Sand CP-2	60
	FM	Faskin-Malstrom association	20	------	--	VIe	Deep Sand CP-2	60
Fr		Faskin-Roswell complex	21	------	--	VIIe	------------------	--
		Faskin sandy clay loam part	--	------	--	------	Sandy CP-2	65
		Roswell loamy fine sand part	--	------	--	------	Sandhills CP-2	65
	GD	Gabaldon-Dev association	22	------	--	------	------------------	--
		Gabaldon silt loam part	--	I	53	VIc	Loamy CP-4	64
		Dev gravelly loam part	--	------	--	VIw	Bottomland CP-4	59
Ge		Glendale fine sandy loam	23	IIe-2	53	VIIe	Bottomland SD-3	59
Gf		Glendale loam	23	I	53	VIIc	Bottomland SD-3	59
Ho		Holloman loam, thick solum	24	IVs-2	55	VIIs	Loamy SD-3	64
Hp		Holloman-Gypsum land complex, 0 to 3 percent slopes	24	------	--	VIIs	------------------	--
		Holloman loam part	--	------	--	------	Gyp SD-3	62
		Holloman loam, thick solum, part	--	------	--	------	Loamy SD-3	64
		Gypsum land part	--	------	--	------	------------------	--

Map symbol: Narrowly defined	Map symbol: Broadly defined	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Range site	Page
HrC		Holloman-Gypsum land complex, 3 to 5 percent slopes	24	------	--	VIIs	------------------	--
		Holloman loam part	--	------	--	------	Gyp SD-3	62
		Holloman loam, thick solum part	--	------	--	------	Loamy SD-3	64
		Gypsum land part	--	------	--	------	------------------	--
	HSE	Holloman-Gypsum land complex, 30 to 50 percent slopes	24	------	--	VIIe	------------------	--
		Holloman loam part	--	------	--	------	Gyp SD-3	62
		Gypsum land and Rock outcrop part	--	------	--	------	------------------	--
Im		Ima fine sandy loam	25	------	--	VIe	Sandy CP-2	65
Ja		Jal fine sandy loam	26	------	--	VIIe	Limy SD-3	63
Km		Kimbrough gravelly loam	27	------	--	VIIs	Shallow HP-3	67
Ks		Kimbrough-Sharvana complex	28	------	--	VIIs	Shallow HP-3	67
Kt		Kimbrough-Stegall-Slaughter complex	28	------	--	VIIs	------------------	--
		Kimbrough gravelly fine sandy loam part	--	------	--	------	Shallow HP-3	67
		Stegall loam part	--	------	--	------	Clayey HP-3	60
		Slaughter loam part	--	------	--	------	Clayey HP-3	60
Lr		Lozier-Reakor complex	29	------	--	VIIs	------------------	--
		Lozier cobbly loam part	--	------	--	------	Gravelly SD-3	61
		Reakor loam part	--	------	--	------	Loamy SD-3	64
		Tencee cobbly loam part	--	------	--	------	Gravelly SD-3	61
Lt		Lozier-Tencee complex	29	------	--	VIIs	Gravelly SD-3	61
Pa		Pajarito loamy fine sand	31	------	--	VIIe	Sandy SD-3	66
Pb		Pajarito-Pintura complex	31	------	--	VIIe	------------------	--
		Pajarito fine sandy loam part	--	------	--	------	Sandy SD-3	66
		Pintura loamy fine sand part	--	------	--	------	Deep Sand SD-3	61
Pe		Pecos silty clay loam	32	IVs-11	55	VIIs	Salty Bottomland SD-3	65
PfA		Pecos silty clay loam, nonsaline, 0 to 1 percent slopes	32	IIs-1	54	VIs	Bottomland SD-3	59
	PGB	Pecos silty clay loam, nonsaline, 0 to 3 percent slopes	32	------	--	VIe	Bottomland SD-3	59
	PH	Pecos-Dev association	33	------	--	------	------------------	--
		Pecos silty clay loam, nonsaline, part	--	------	--	VIe	Bottomland SD-3	59
		Dev cobbly loam part	--	------	--	VIw	Bottomland CP-4	59
	PK	Pena-Penasco association	34	------	--	------	------------------	--
		Pena gravelly loam part	--	------	--	VIe	Hills CP-4	62
		Penasco cobbly loam part	--	------	--	VIIs	Shallow CP-4	66
	PL	Penasco-Ancho association	35	------	--	------	------------------	--
		Penasco cobbly loam part	--	------	--	VIIs	Shallow CP-4	66
		Ancho loam part	--	------	--	VIe	Loamy CP-4	64
	PN	Penasco-Gabaldon association	35	------	--	------	------------------	--
		Penasco gravelly loam part	--	------	--	VIIs	Shallow CP-4	66
		Gabaldon silt loam part	--	------	--	VIc	Loamy CP-4	64
Ra		Reakor sandy loam	37	IIe-2	53	VIIe	Sandy SD-3	66
ReA		Reakor loam, 0 to 1 percent slopes	37	I	53	VIIc	Loamy SD-3	64
ReB		Reakor loam, 1 to 3 percent slopes	38	IIe-6	53	VIIe	Loamy SD-3	64
	RF	Reakor loam, 0 to 3 percent slopes	38	------	--	VIIe	Loamy SD-3	64
Rg		Reakor loam, gravelly subsoil variant	39	IIs-4	54	VIIe	Loamy SD-3	64
	RH	Reakor-Pecos association	38	------	--	------	------------------	--
		Reakor loam part	--	------	--	VIIe	Loamy SD-3	64
		Pecos silty clay loam, nonsaline, part	--	------	--	VIe	Bottomland SD-3	59

Map symbol: Narrowly defined	Map symbol: Broadly defined	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Range site	Page
	RI	Reakor-Tencee association-------------	38	------	--	VIIe	-------------------	--
		Reakor loam part------------------	--	------	--	------	Loamy SD-3	64
		Tencee gravelly loam part---------	--	------	--	------	Gravelly SD-3	61
RkA		Reeves loam, 0 to 1 percent slopes----	40	IIIs-9	55	VIIs	Loamy SD-3	64
RkB		Reeves loam, 1 to 3 percent slopes----	40	IIIe-12	54	VIIe	Loamy SD-3	64
	RL	Reeves-Holloman association-----------	41	------	--	------	-------------------	--
		Reeves loam part------------------	--	------	--	VIIe	Loamy SD-3	64
		Holloman loam part----------------	--	------	--	VIIs	Gyp SD-3	62
		Holloman loam, thick solum, part--	--	------	--	VIIs	Loamy SD-3	64
	RM	Remunda-Penasco association-----------	42	------	--	------	-------------------	--
		Remunda loam part-----------------	--	------	--	VIe	Loamy CP-4	64
		Penasco cobbly loam part----------	--	------	--	VIIs	Shallow CP-4	66
Rn		Roswell-Jalmar complex----------------	42	------	--	VIIe	-------------------	--
		Roswell fine sand part------------	--	------	--	------	Sandhills CP-2	65
		Jalmar fine sand part-------------	--	------	--	------	Deep Sand CP-2	60
Ru		Russler silty clay loam---------------	43	------	--	VIIe	Loamy SD-3	64
Sh		Shanta silt loam----------------------	44	------	--	------	-------------------	--
		Protected areas-------------------	--	IIe-6	53	VIe	-------------------	--
		Ocassionally flooded areas--------	--	------	--	VIw	Bottomland CP-4	59
Sm		Simona fine sandy loam----------------	46	------	--	VIIe	Shallow Sand SD-3	67
So		Sotim fine sandy loam-----------------	47	------	--	VIIe	Loamy SD-3	64
Te		Tencee gravelly sandy loam------------	48	------	--	VIIe	Gravelly SD-3	61
TfD		Tencee cobbly loam, 5 to 30 percent slopes-----------------------------	49	------	--	VIIe	Hills CP-4	62
Tg		Tencee-Upton complex------------------	49	------	--	VIIe	Gravelly SD-3	61
	TS	Tencee-Sotim association--------------	49	------	--	VIIe	-------------------	--
		Tencee gravelly fine sandy loam part----------------------------	--	------	--	------	Gravelly SD-3	61
		Sotim fine sandy loam part--------	--	------	--	------	Loamy SD-3	64
	TOF	Torriorthents, very steep-------------	49	------	--	VIIe	Breaks HP-3	60
	UA	Upton-Atoka association---------------	50	------	--	VIIs	-------------------	--
		Upton gravelly loam part----------	--	------	--	------	Gravelly SD-3	61
		Atoka loam part-------------------	--	------	--	------	Loamy SD-3	64
	VG	Vinton-Glendale association-----------	51	------	--	VIIe	Bottomland SD-3	59

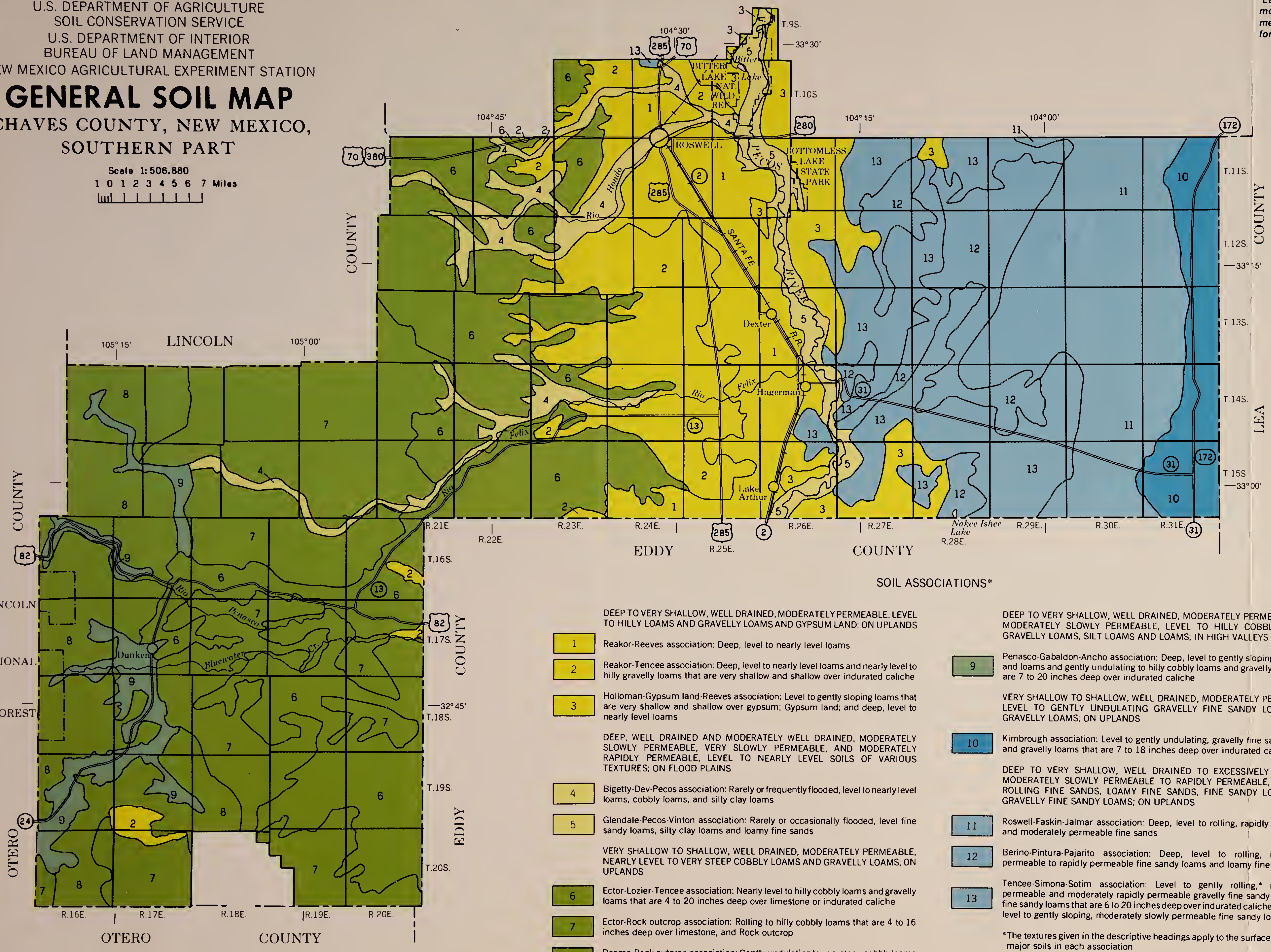
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
NEW MEXICO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART

Scale 1: 506,880
1 0 1 2 3 4 5 6 7 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SOIL ASSOCIATIONS*

DEEP TO VERY SHALLOW, WELL DRAINED, MODERATELY PERMEABLE, LEVEL TO HILLY LOAMS AND GRAVELLY LOAMS AND GYPSUM LAND: ON UPLANDS

1 Reakor-Reeves association: Deep, level to nearly level loams

2 Reakor-Tencee association: Deep, level to nearly level loams and nearly level to hilly gravelly loams that are very shallow and shallow over indurated caliche

3 Holloman-Gypsum land-Reeves association: Level to gently sloping loams that are very shallow and shallow over gypsum; Gypsum land; and deep, level to nearly level loams

DEEP, WELL DRAINED AND MODERATELY WELL DRAINED, MODERATELY SLOWLY PERMEABLE, VERY SLOWLY PERMEABLE, AND MODERATELY RAPIDLY PERMEABLE, LEVEL TO NEARLY LEVEL SOILS OF VARIOUS TEXTURES; ON FLOOD PLAINS

4 Bigetty-Dev-Pecos association: Rarely or frequently flooded, level to nearly level loams, cobbly loams, and silty clay loams

5 Glendale-Pecos-Vinton association: Rarely or occasionally flooded, level fine sandy loams, silty clay loams and loamy fine sands

VERY SHALLOW TO SHALLOW, WELL DRAINED, MODERATELY PERMEABLE, NEARLY LEVEL TO VERY STEEP COBBLY LOAMS AND GRAVELLY LOAMS; ON UPLANDS

6 Ector-Lozier-Tencee association: Nearly level to hilly cobbly loams and gravelly loams that are 4 to 20 inches deep over limestone or indurated caliche

7 Ector-Rock outcrop association: Rolling to hilly cobbly loams that are 4 to 16 inches deep over limestone, and Rock outcrop

8 Deama-Rock outcrop association: Gently undulating to very steep cobbly loams that are 7 to 18 inches deep over limestone, and Rock outcrop

DEEP TO VERY SHALLOW, WELL DRAINED, MODERATELY PERMEABLE AND MODERATELY SLOWLY PERMEABLE, LEVEL TO HILLY COBBLY LOAMS, GRAVELLY LOAMS, SILT LOAMS AND LOAMS; IN HIGH VALLEYS

9 Penasco-Gabaldon-Ancho association: Deep, level to gently sloping silt loams and loams and gently undulating to hilly cobbly loams and gravelly loams that are 7 to 20 inches deep over indurated caliche

VERY SHALLOW TO SHALLOW, WELL DRAINED, MODERATELY PERMEABLE, LEVEL TO GENTLY UNDULATING GRAVELLY FINE SANDY LOAMS AND GRAVELLY LOAMS; ON UPLANDS

10 Kimbrough association: Level to gently undulating, gravelly fine sandy loams and gravelly loams that are 7 to 18 inches deep over indurated caliche

DEEP TO VERY SHALLOW, WELL DRAINED TO EXCESSIVELY DRAINED, MODERATELY SLOWLY PERMEABLE TO RAPIDLY PERMEABLE, LEVEL TO ROLLING FINE SANDS, LOAMY FINE SANDS, FINE SANDY LOAMS AND GRAVELLY FINE SANDY LOAMS; ON UPLANDS

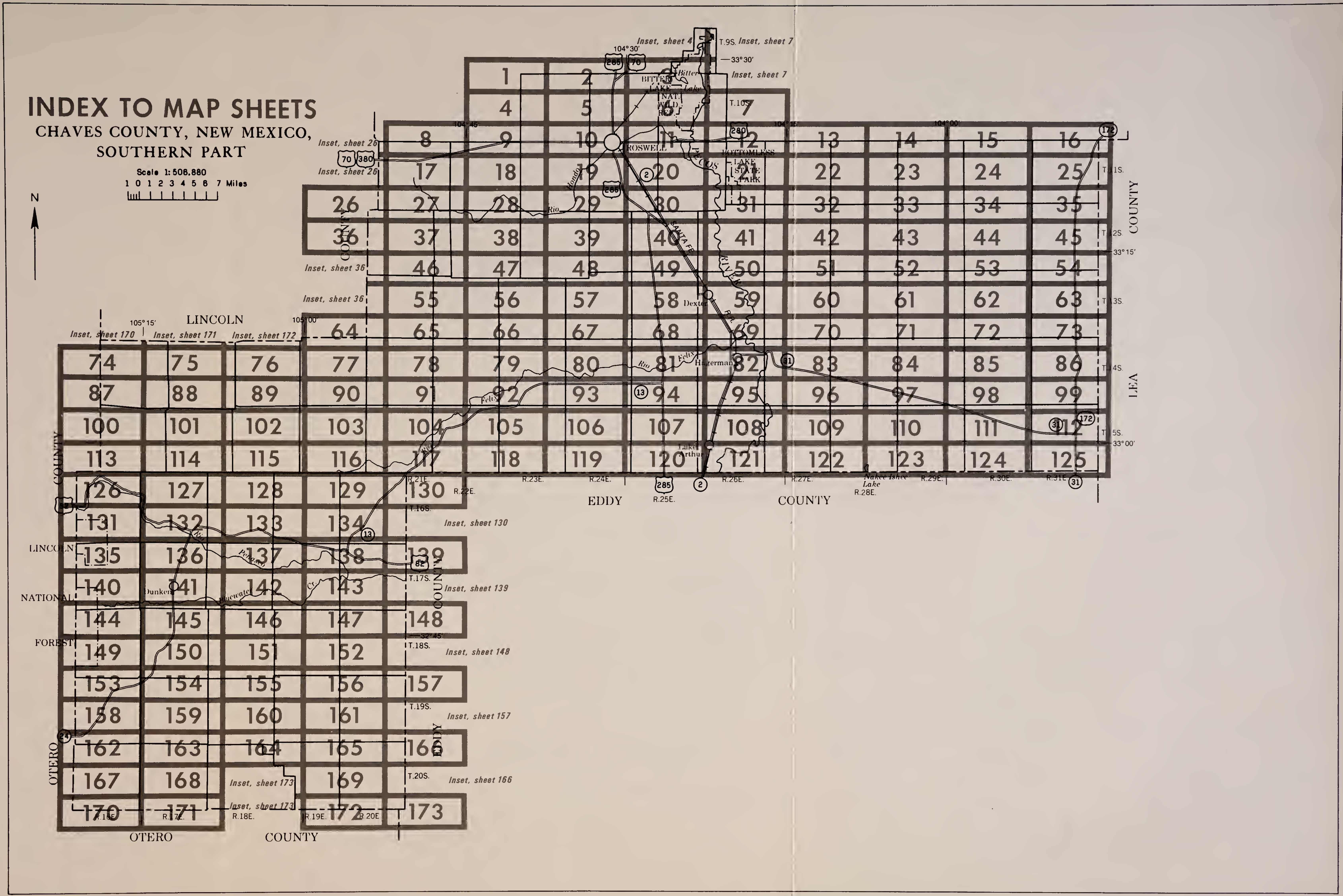
11 Roswell-Faskin-Jalmar association: Deep, level to rolling, rapidly permeable and moderately permeable fine sands

12 Berino-Pintura-Pajarito association: Deep, level to rolling, moderately permeable to rapidly permeable fine sandy loams and loamy fine sands

13 Tencee-Simona-Sotim association: Level to gently rolling,* moderately permeable and moderately rapidly permeable gravelly fine sandy loams and fine sandy loams that are 6 to 20 inches deep over indurated caliche; and deep, level to gently sloping, moderately slowly permeable fine sandy loams

*The textures given in the descriptive headings apply to the surface layer of the major soils in each association

Compiled 1979



INDEX TO MAP SHEETS
CHAVES COUNTY, NEW MEXICO,
SOUTHERN PART
Scale 1:506,880
1 0 1 2 3 4 5 6 7 Miles
N
LINCOLN
EDDY
COUNTY
LEA
COUNTY
OTERO
COUNTY
LINCOLN
NATIONAL
FOREST
ROSWELL
Dexter
Hagerman
Lake Arthur
Dunken
BITTER LAKE NAT. WILD. REF.
BOTTOMLESS LAKE STATE PARK
Inset, sheet 4
Inset, sheet 7
Inset, sheet 26
Inset, sheet 36
Inset, sheet 130
Inset, sheet 139
Inset, sheet 148
Inset, sheet 157
Inset, sheet 166
Inset, sheet 170
Inset, sheet 171
Inset, sheet 172
Inset, sheet 173

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital if the map unit is broadly defined; otherwise, it is a lower case letter. A third letter, always a capital A, B, C, D, E or F shows the slope. Most symbols without slope letters are those of nearly level soils but some are for miscellaneous land types, soil associations or soil complexes with a considerable range of slope.

SYMBOL	NAME
Aa	Alama loam
AN	Ancho-Penasco association
AtA	Atoka loam, 0 to 1 percent slopes
AtB	Atoka loam, 1 to 3 percent slopes
Ba	Balmorhea loam
Bd	Balmorhea loam, drained
BE	Berino-Cacique association
Bf	Berino-Pintura complex
BgA	Bigetty loam, 0 to 1 percent slopes
BgB	Bigetty loam, 1 to 3 percent slopes
Bh	Bigetty loam, moderately saline
BP	Bigetty-Pecos association
CA	Cuevoland-Ancho association
De	Deama-Rock outcrop complex
DR	Deama-Remunda association
Du	Dune land
EcC	Ector-Rock outcrop complex, 0 to 9 percent slopes
EcD	Ector-Rock outcrop complex, 9 to 30 percent slopes
Fa	Faskin fine sand
FM	Faskin-Malstrom association
Fr	Faskin-Roswell complex
GD	Gabaldon-Dev association
Ge	Glendale fine sandy loam
Gf	Glendale loam
HO	Holloman loam, thick solum
Hp	Holloman-Gypsum land complex, 0 to 3 percent slopes
HrC	Holloman-Gypsum land complex, 3 to 5 percent slopes
HSE	Holloman-Gypsum land complex, 30 to 50 percent slopes
Im	Ima fine sandy loam
Ja	Jal fine sandy loam
Km	Kimbrough gravelly loam
Ks	Kimbrough-Sharvana complex
Kt	Kimbrough-Stegall-Slaughter complex
Lr	Lozier-Reakor complex
Lt	Lozier-Tencee complex
Pa	Pajarito loamy fine sand
Pb	Pajarito-Pintura complex
PeA	Pecos silty clay loam
PfA	Pecos silty clay loam, nonsaline, 0 to 1 percent slopes
PGB	Pecos silty clay loam, nonsaline, 0 to 3 percent slopes
PH	Pecos-Dev association
PK	Pena-Penasco association
PL	Penasco-Ancho association
PN	Penasco-Gabaldon association
Ra	Reakor sandy loam
ReA	Reakor loam, 0 to 1 percent slopes
ReB	Reakor loam, 1 to 3 percent slopes
RF	Reakor loam, 0 to 3 percent slopes
Rg	Reakor loam, gravelly subsoil variant
RH	Reakor-Pecos association
Rl	Reakor-Tencee association
RkA	Reeves loam, 0 to 1 percent slopes
RkB	Reeves loam, 1 to 3 percent slopes
RL	Reeves-Holloman association
RM	Remunda-Penasco association
Rn	Roswell-Jalmar complex
Ru	Russler silty clay loam
Sh	Shanta silt loam
Sm	Simona fine sandy loam
So	Sotim fine sandy loam
Te	Tencee gravelly sandy loam
TfD	Tencee cobbly loam, 5 to 30 percent slopes
Tg	Tencee-Upton complex
TS	Tencee-Sotim association
TOF	Torriorthents, very steep
UA	Upton-Atoka association
VG	Vinton-Glendale association

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit — G.P.
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CeA; FoB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

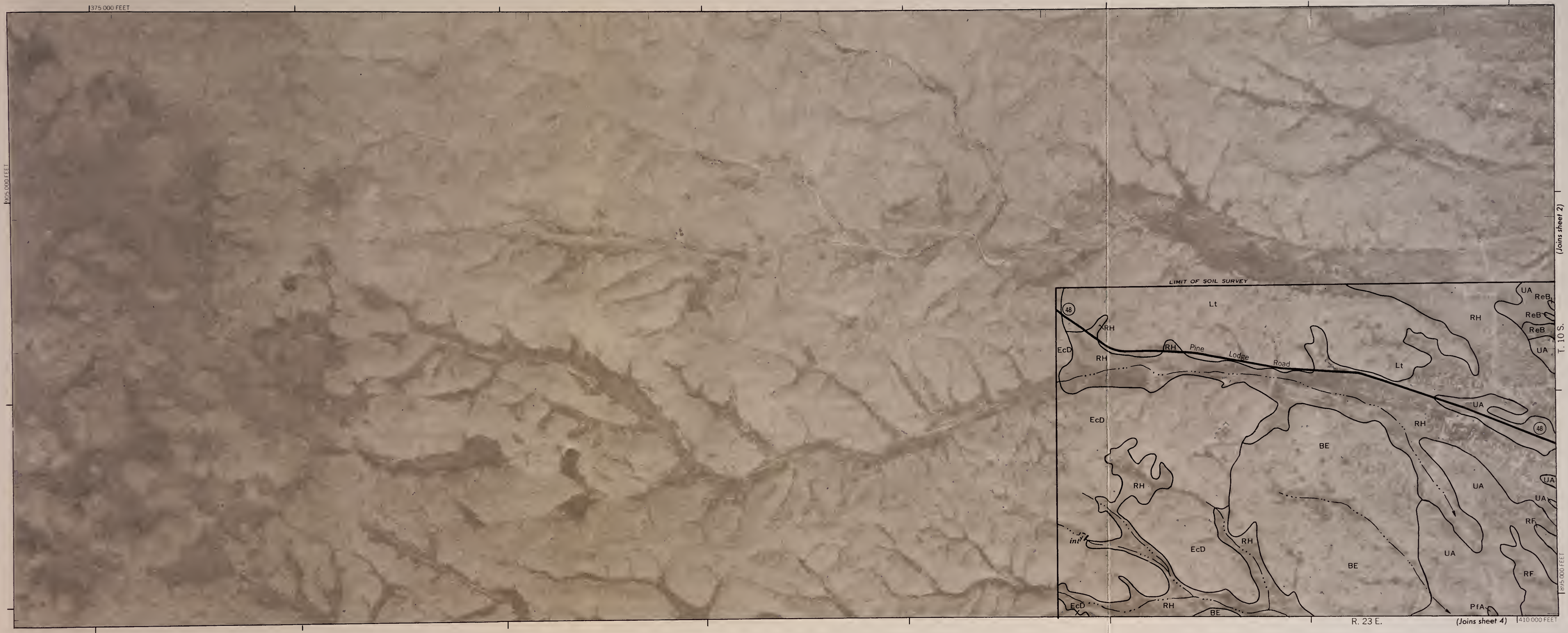
SOIL SAMPLE SITE (normally not shown) — S

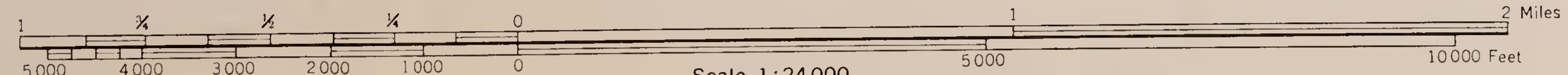
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Borrow pit — B.P.
- Glacial till

1

N





Scale 1:24 000

2

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 2

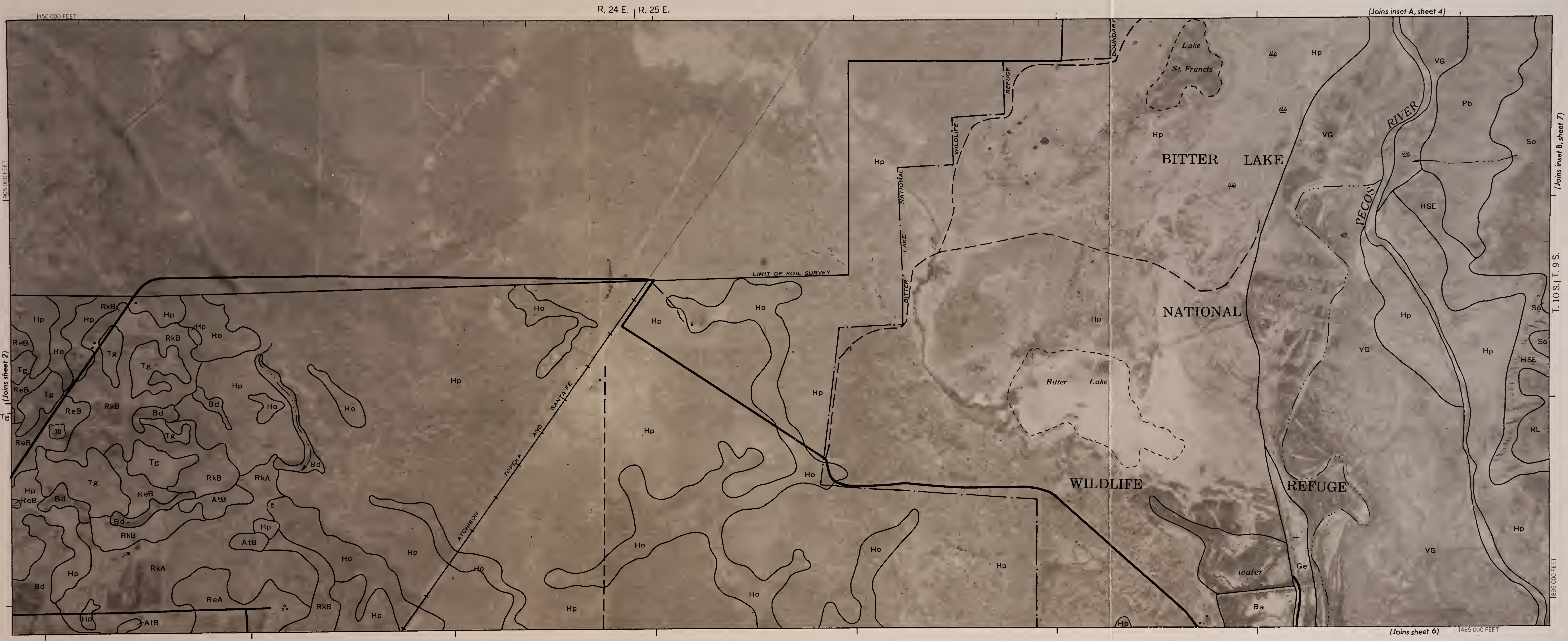
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

3

N



1 ¾ ½ ¼ 0 1 2 Miles

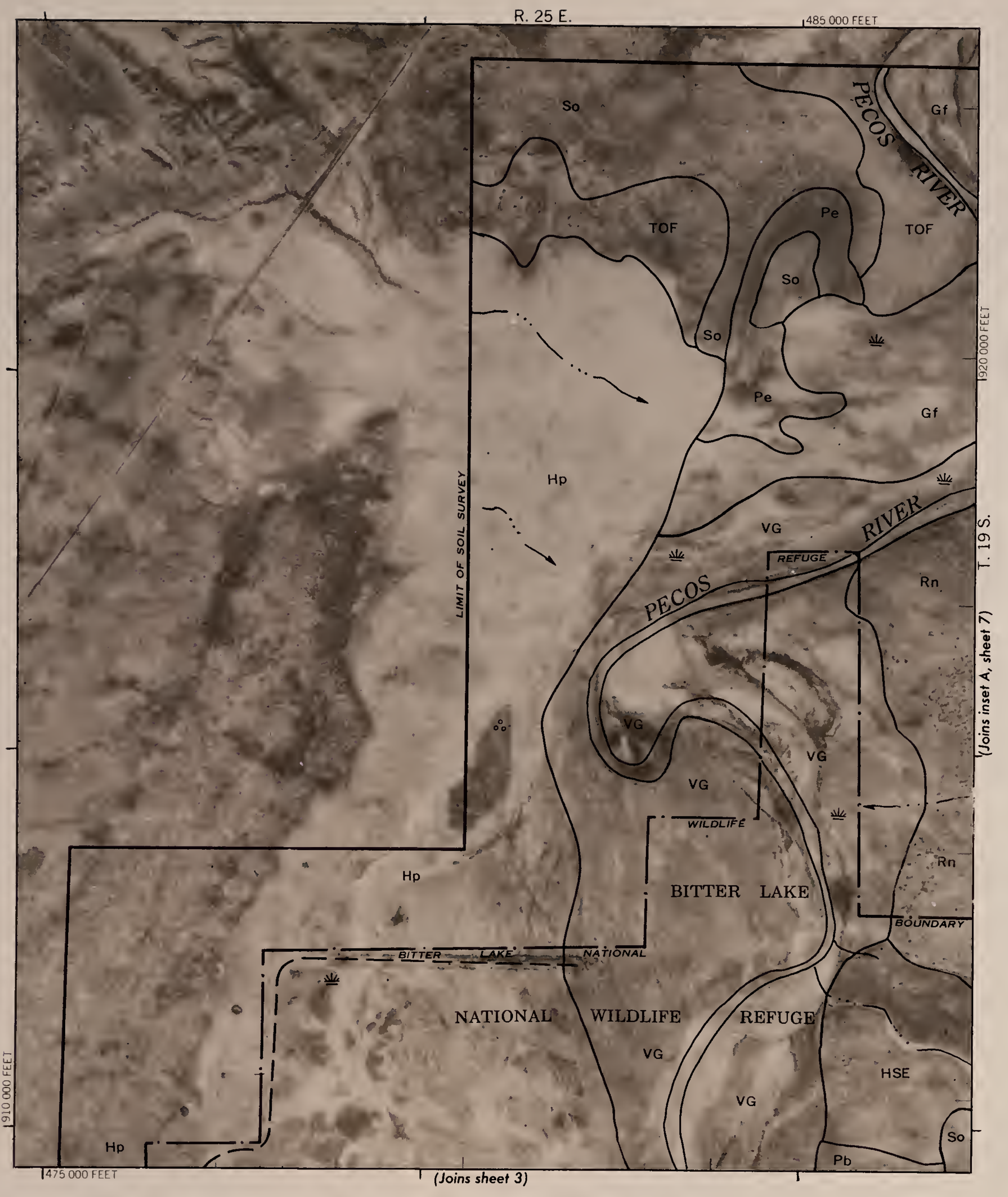
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 4

INSET A

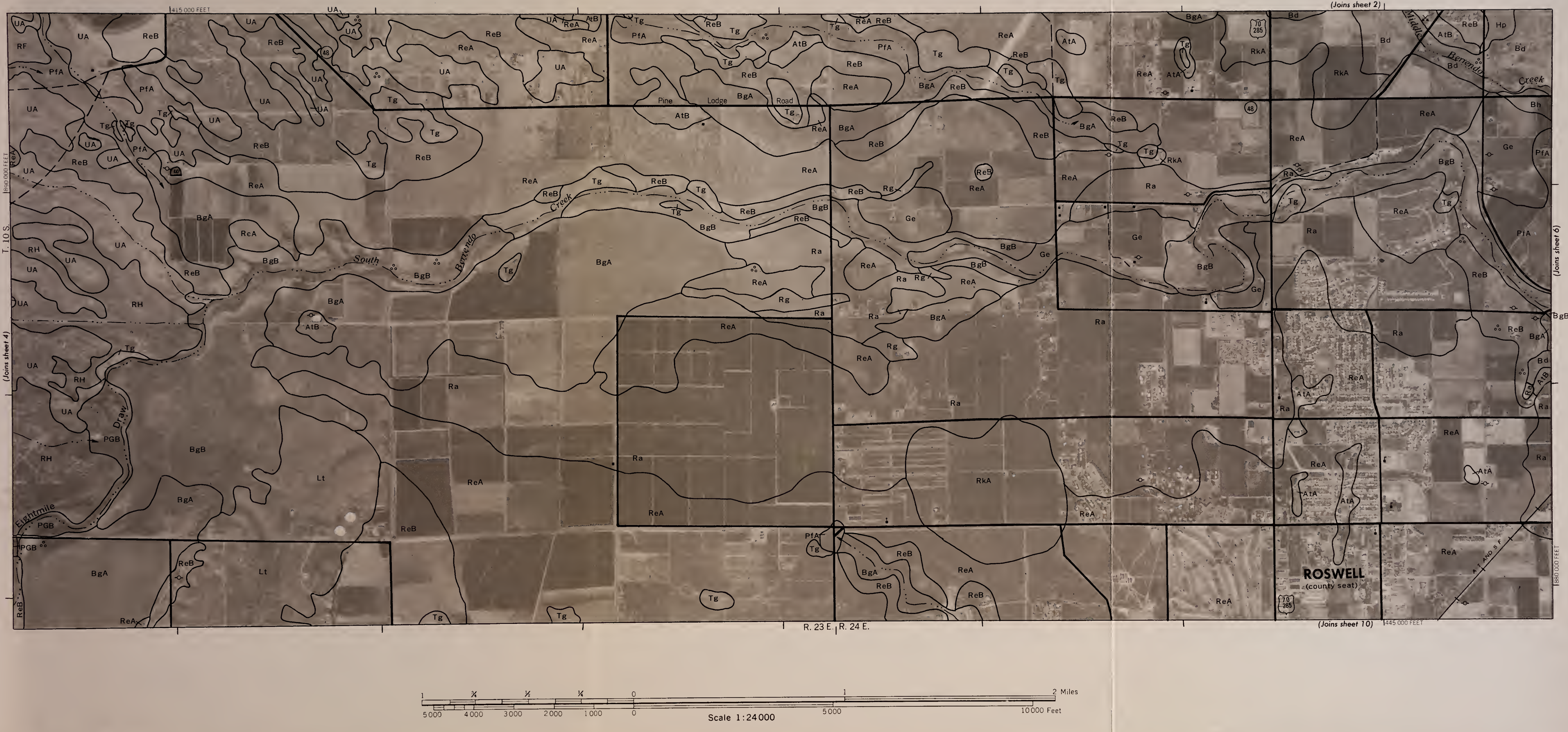


1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 5



N

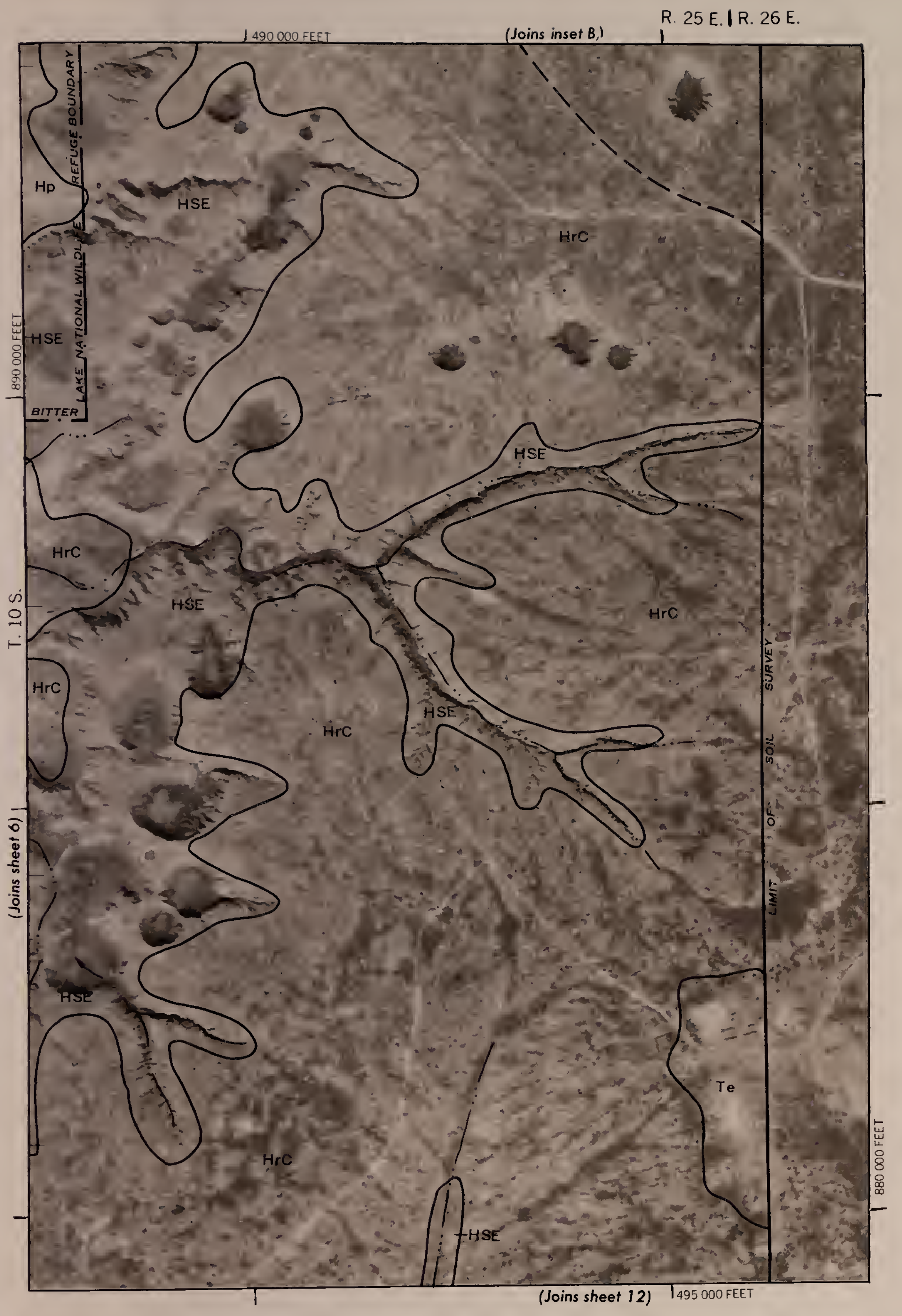
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 6

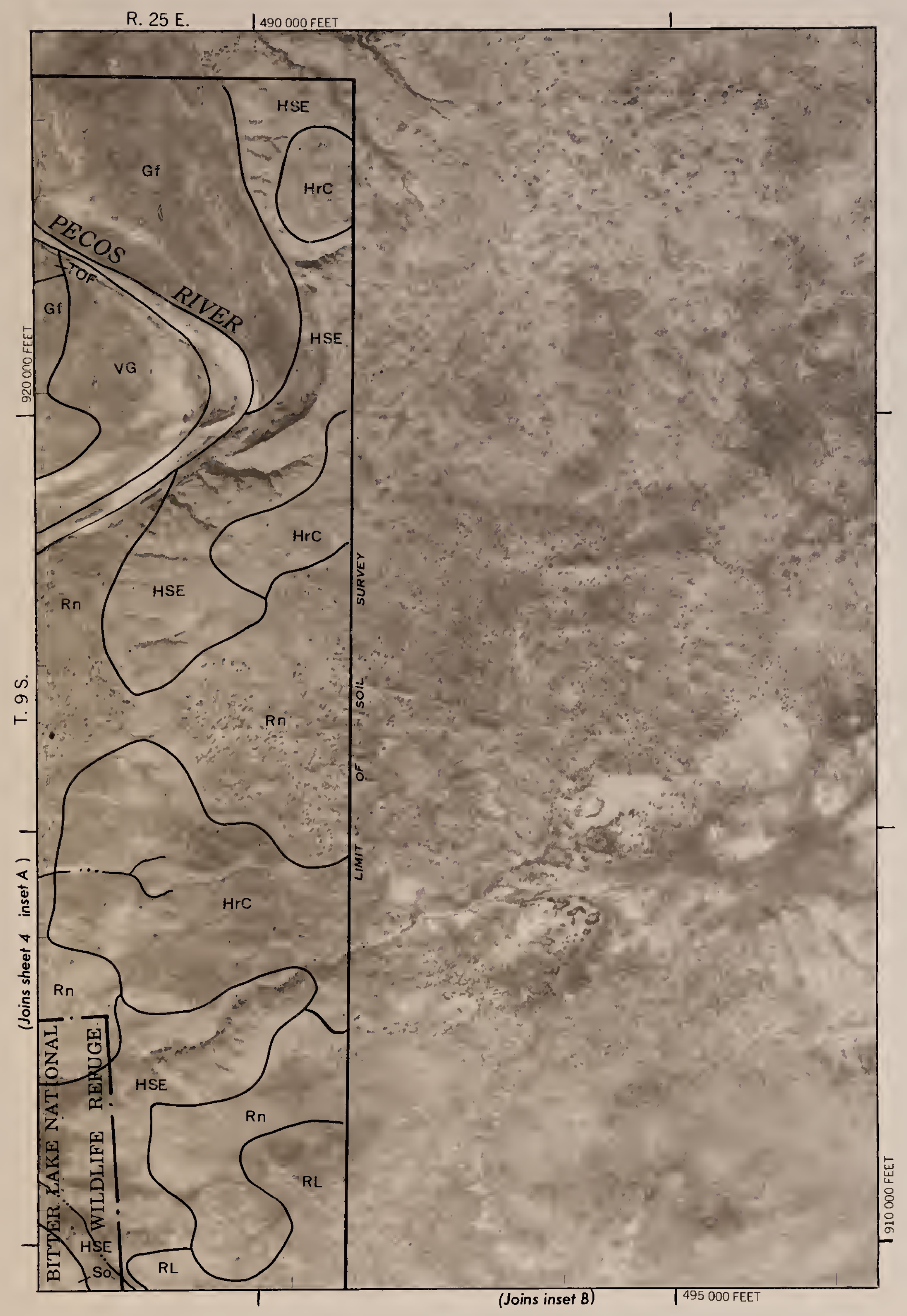
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

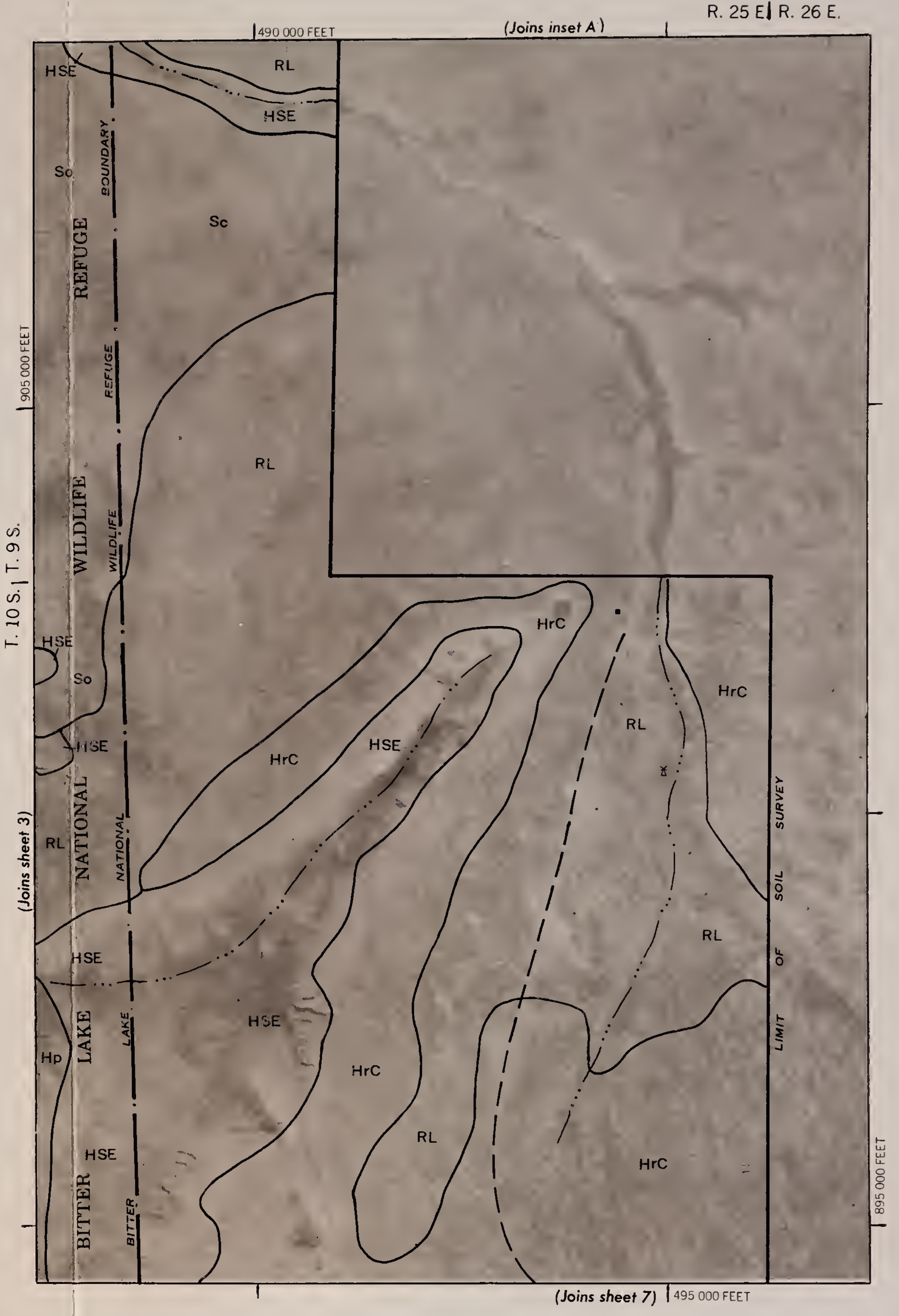
Scale 1:24000

N





INSET A



INSET B

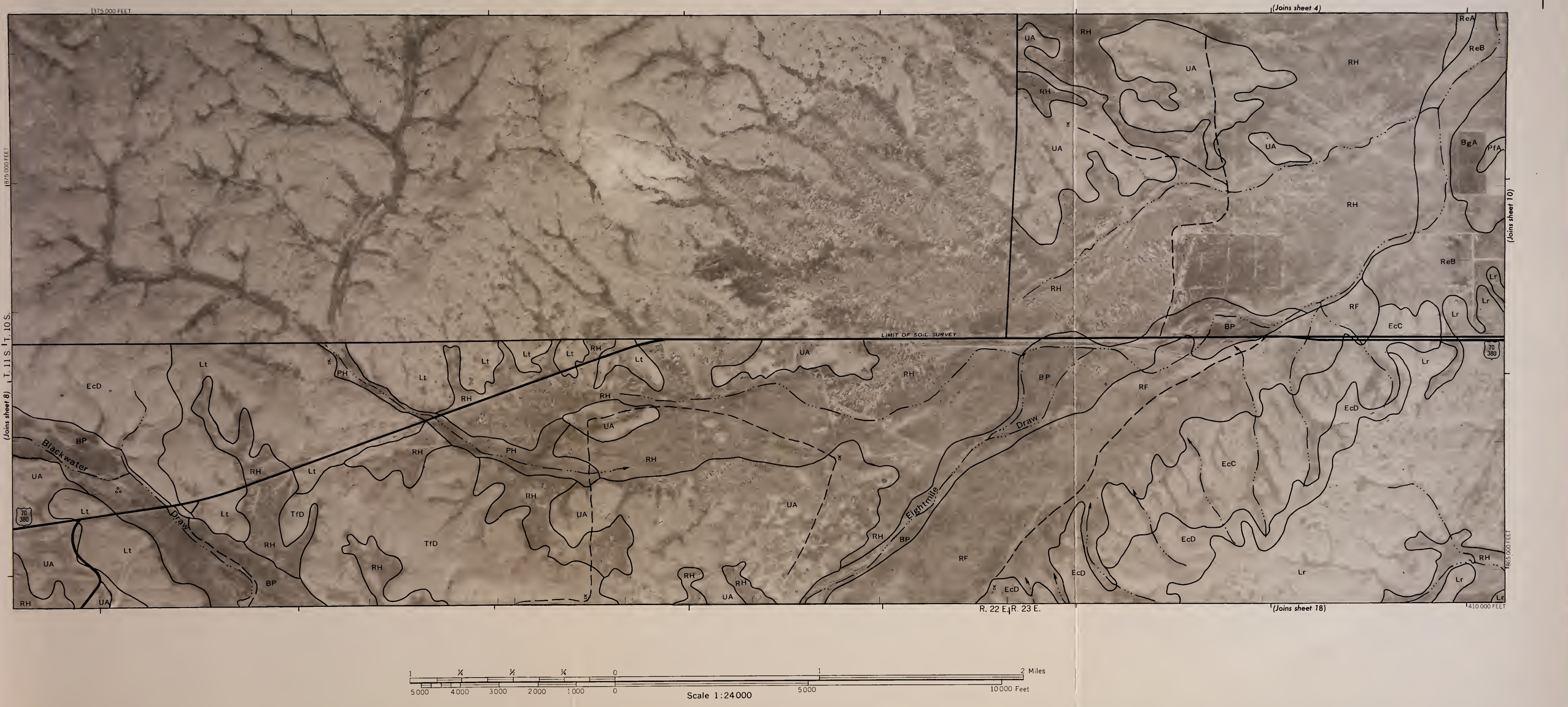
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

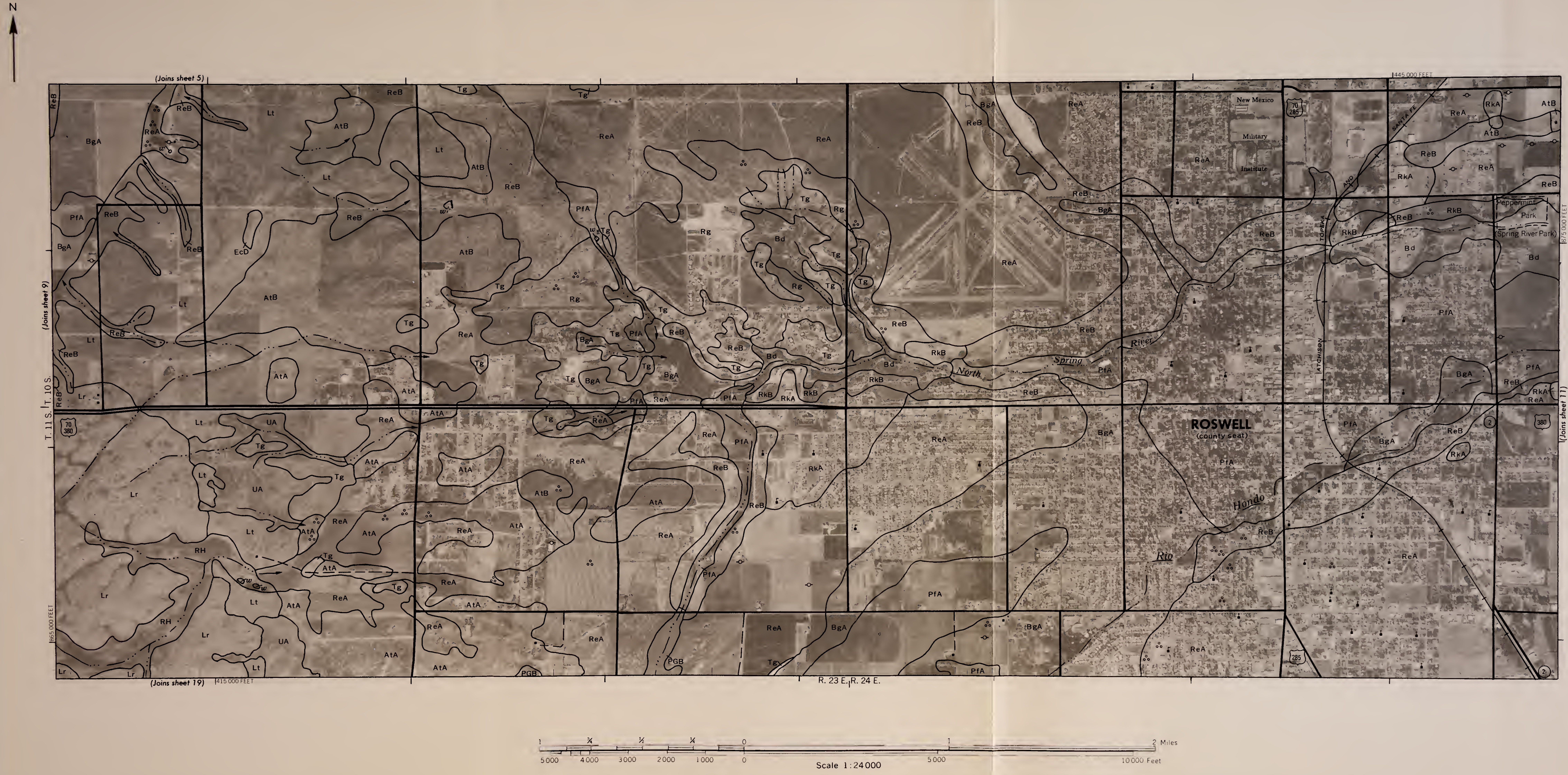
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 8

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

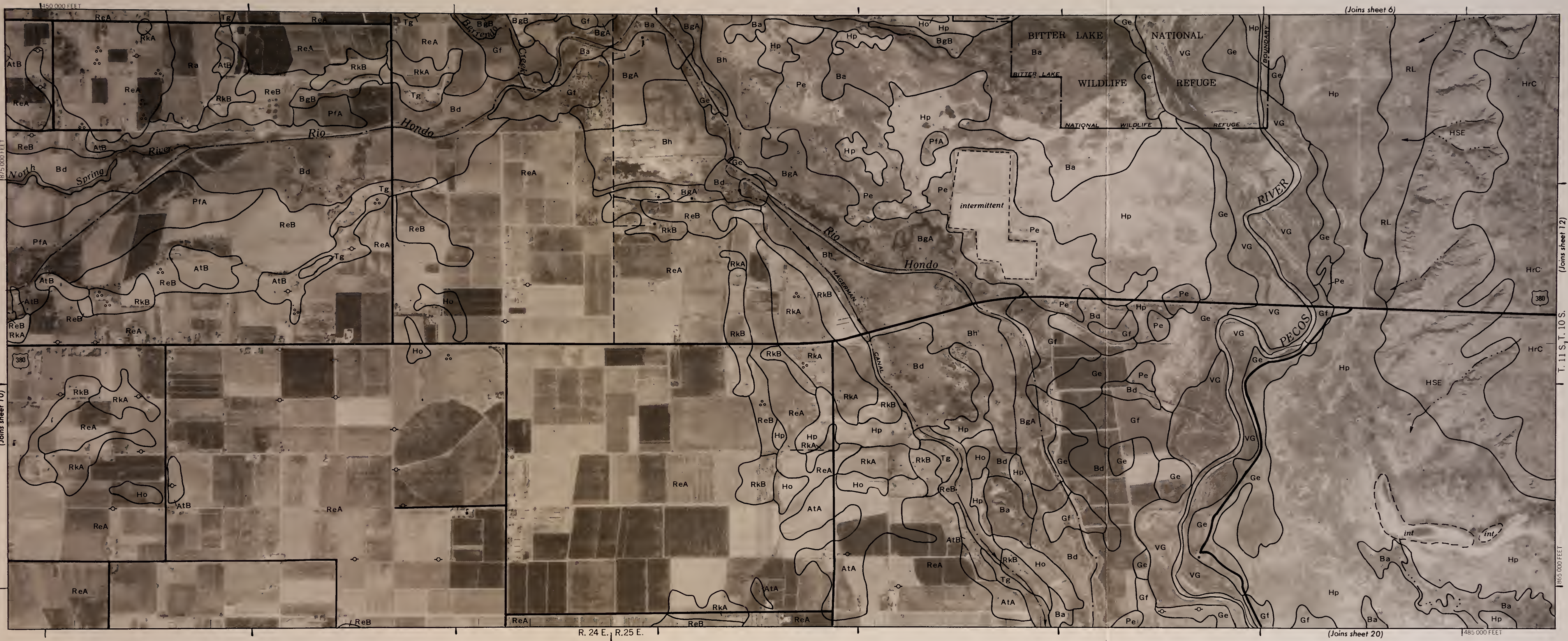


N
(Joins sheet 4)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 18)
375 000 FEET
875 000 FEET
865 000 FEET
410 000 FEET
T. 10 S.
T. 11 S.
R. 22 E.
R. 23 E.
LIMIT OF SOIL SURVEY
Blackwater
Draw
Eightmile
Draw
70
380
UA
RH
RF
BP
EcD
EcC
Lt
PH
TfD
ReA
ReB
BgA
PfA
Lr
1
¾
½
¼
0
1
2 Miles
5000
4000
3000
2000
1000
0
5000
10000 Feet
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 10



N

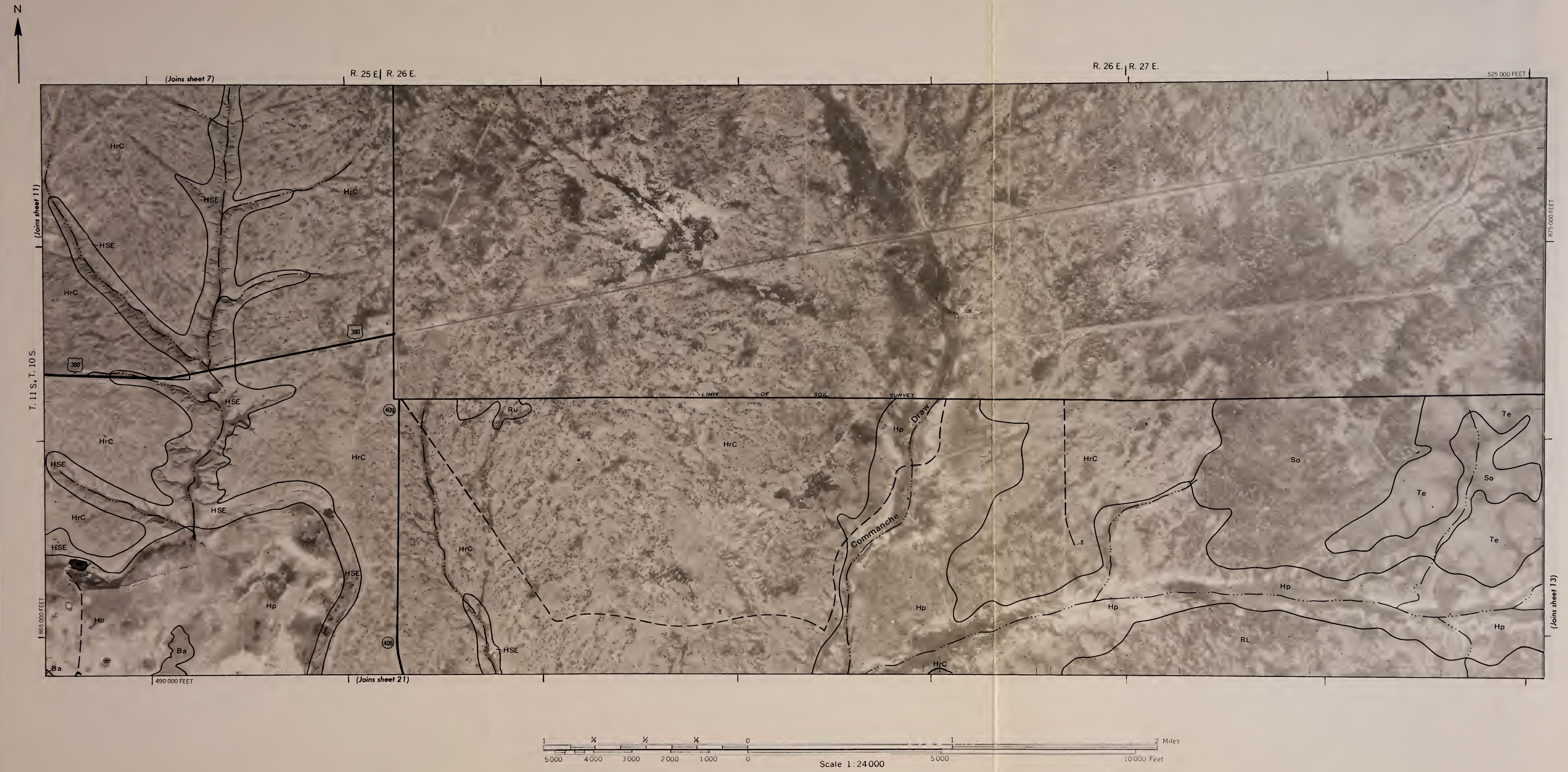


1 ¾ ½ ¼ 0 1 2 Miles

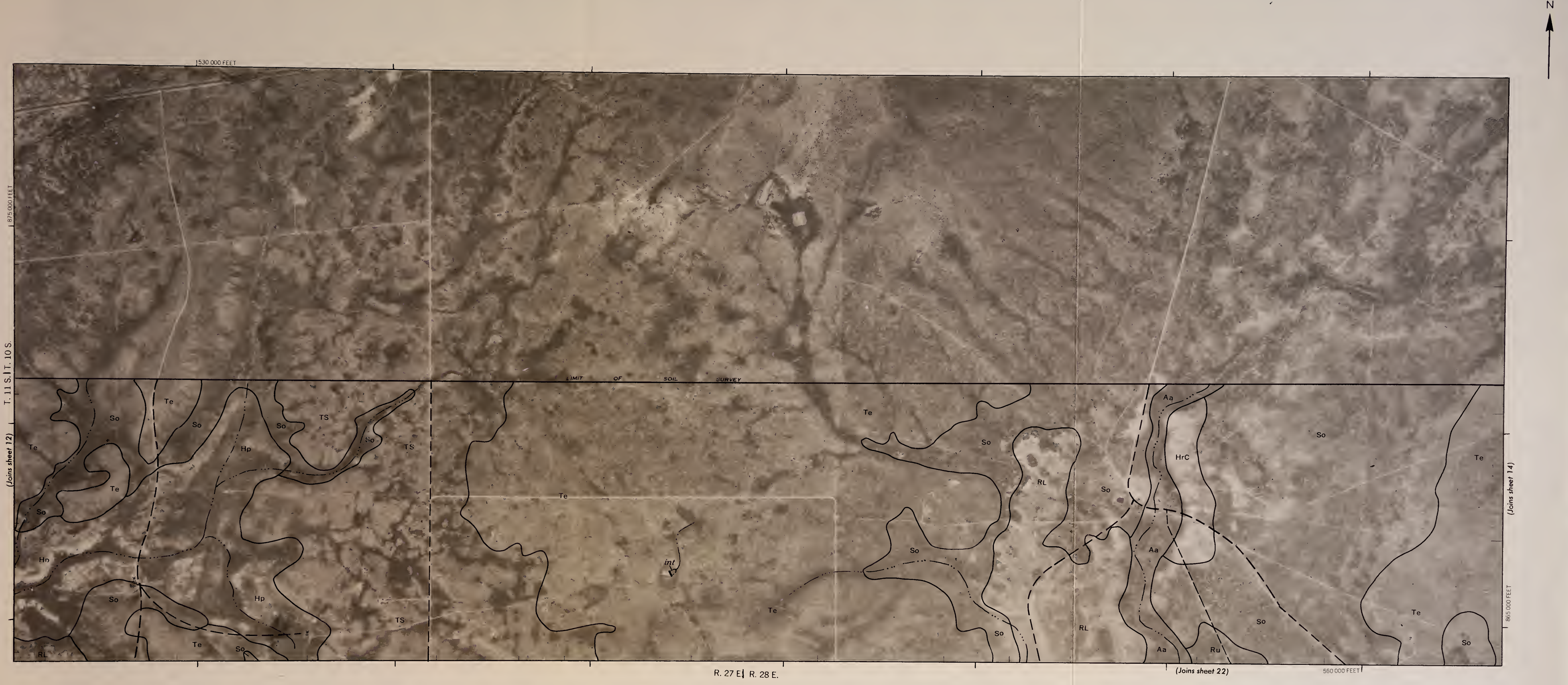
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 12



CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 13



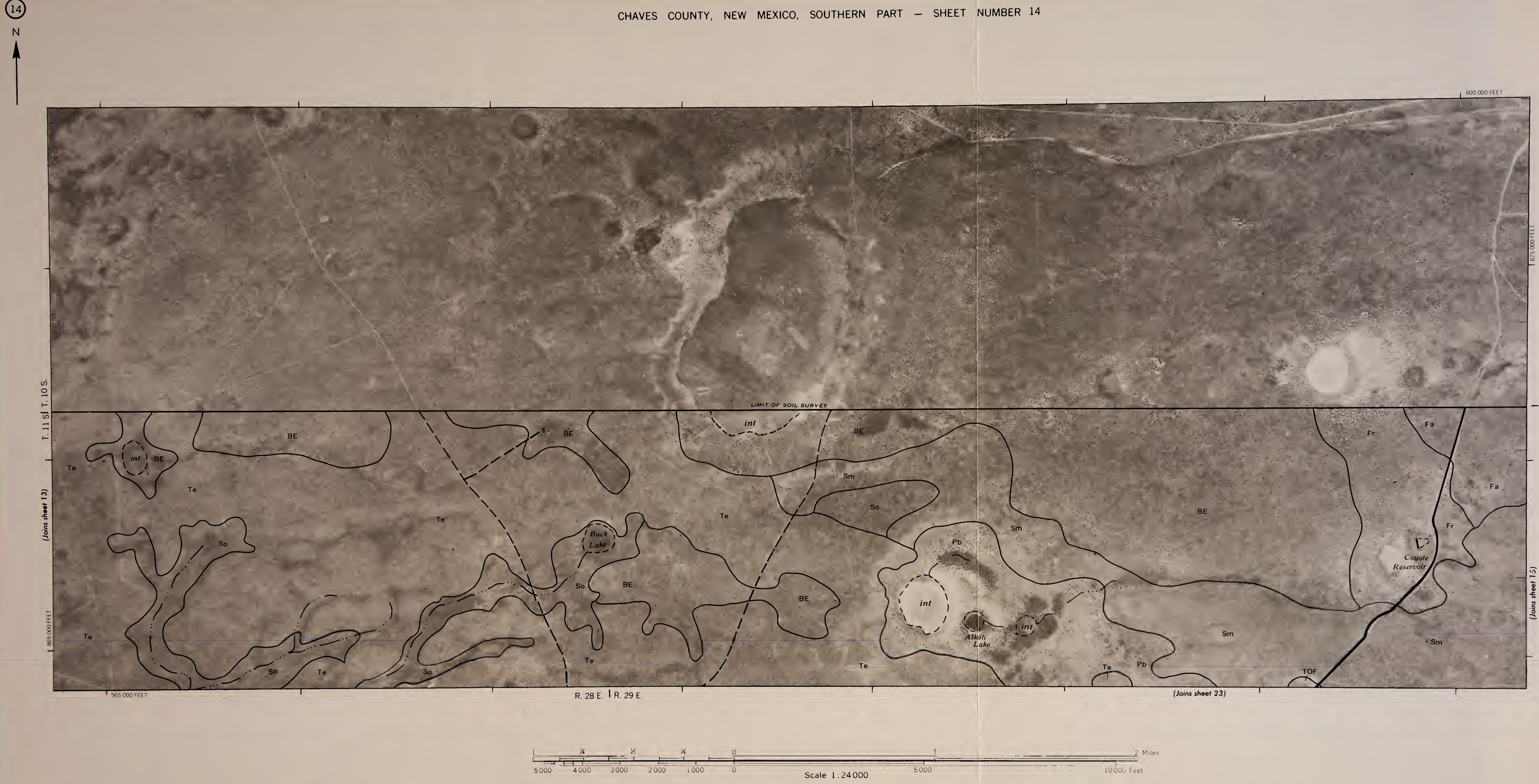
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

... Department of Agriculture Soil Conservation Service and cooperating agencies
5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 14



15

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 16

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

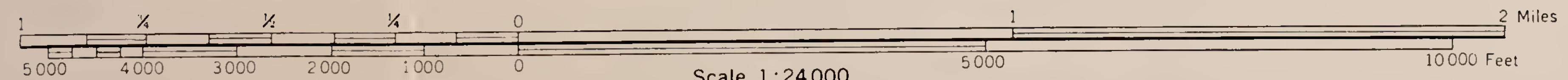
N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 18

1 ¼ ½ ¾ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

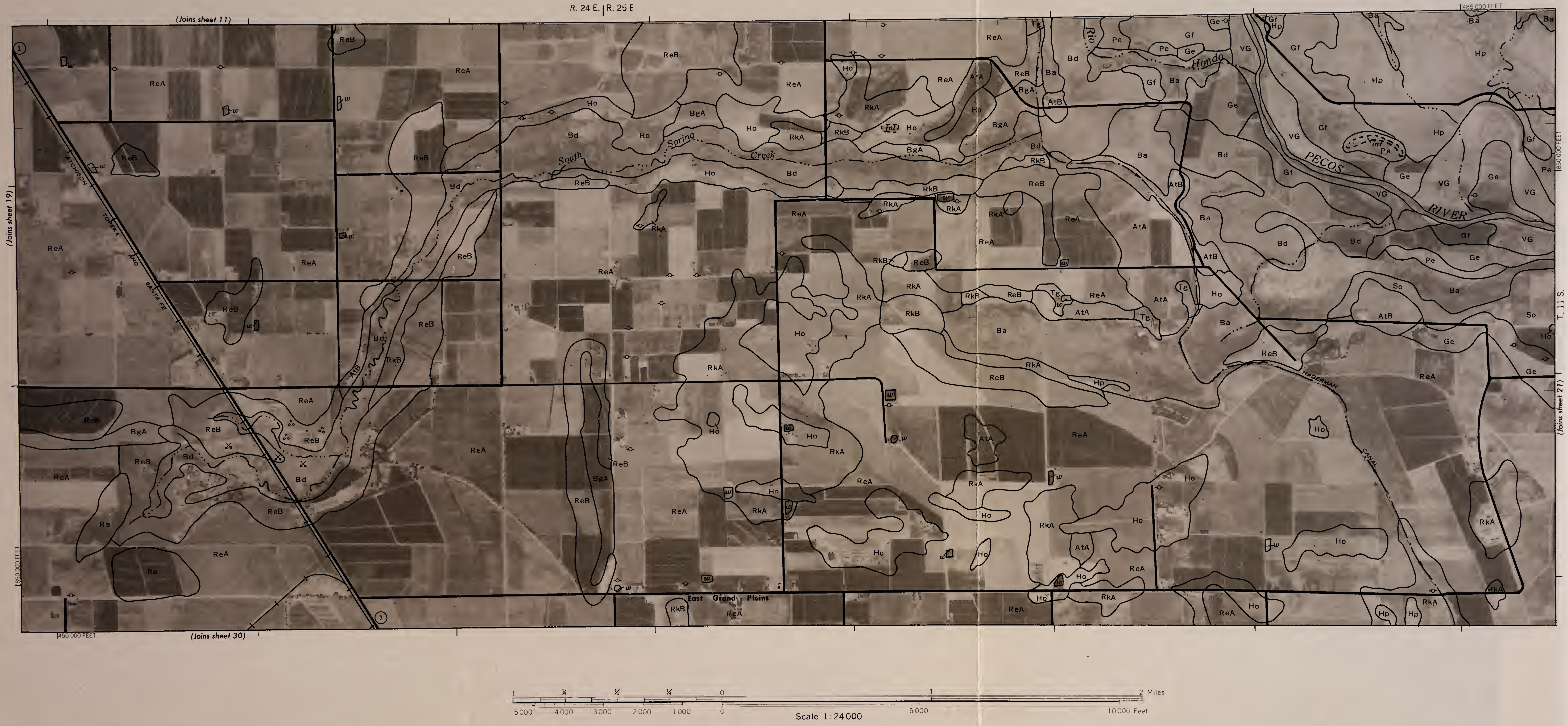
Scale 1:24000



Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 20

N



Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 22

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24 000

24

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 24

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 25

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

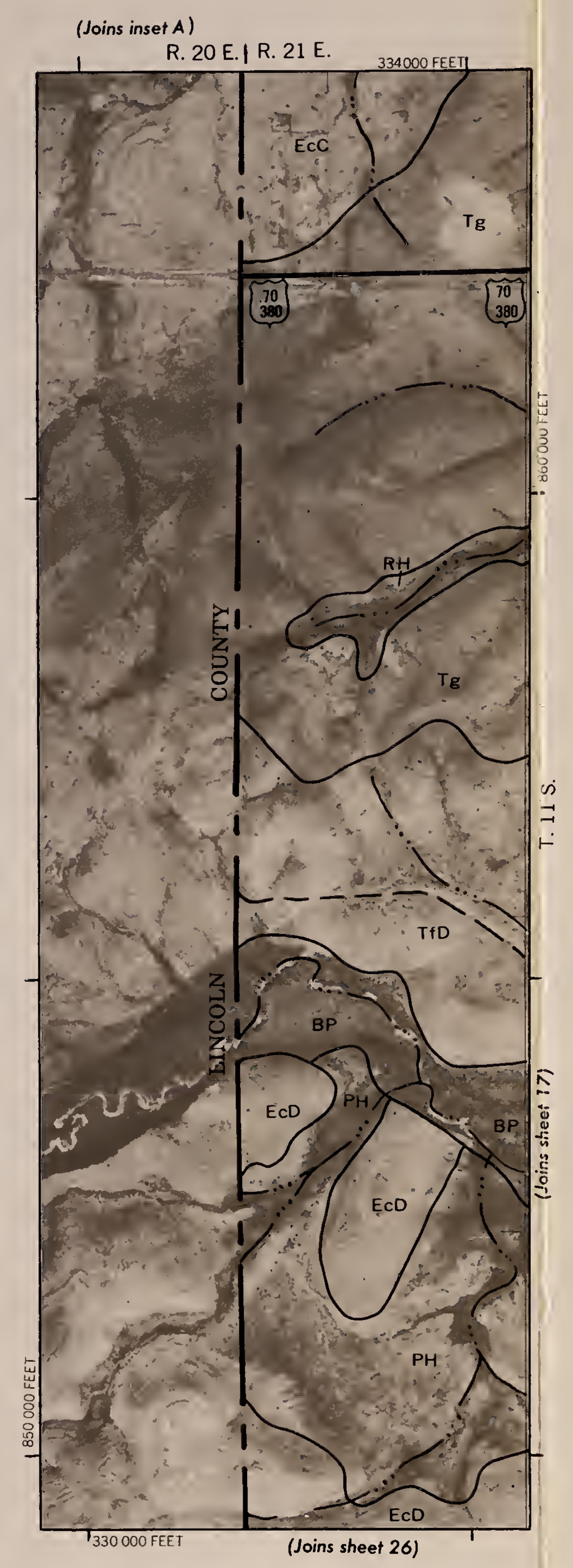
N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 26

INSET A

4000 AND 5000-FOOT GRID TICKS

INSET B



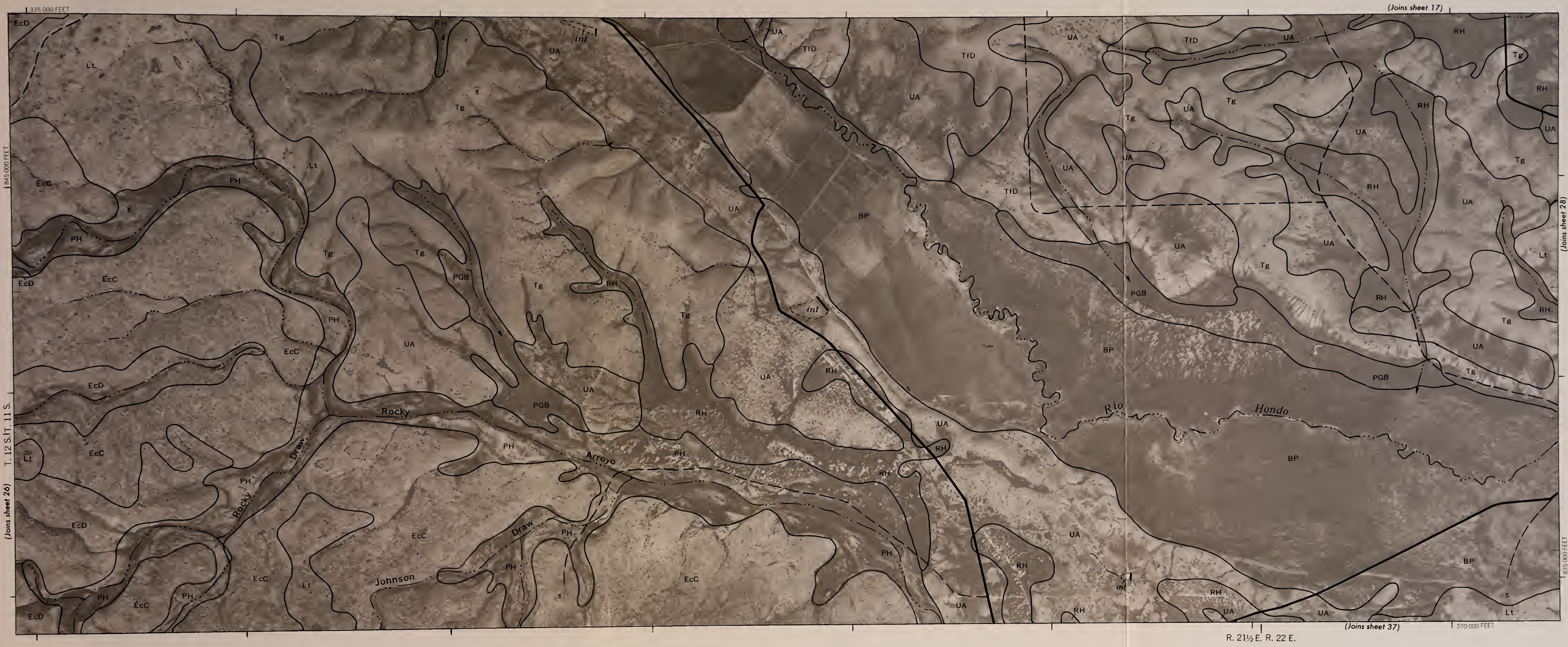
4000 AND 5000-FOOT GRID TICKS

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N



Scale 1:24000

28

Scale 1:24000

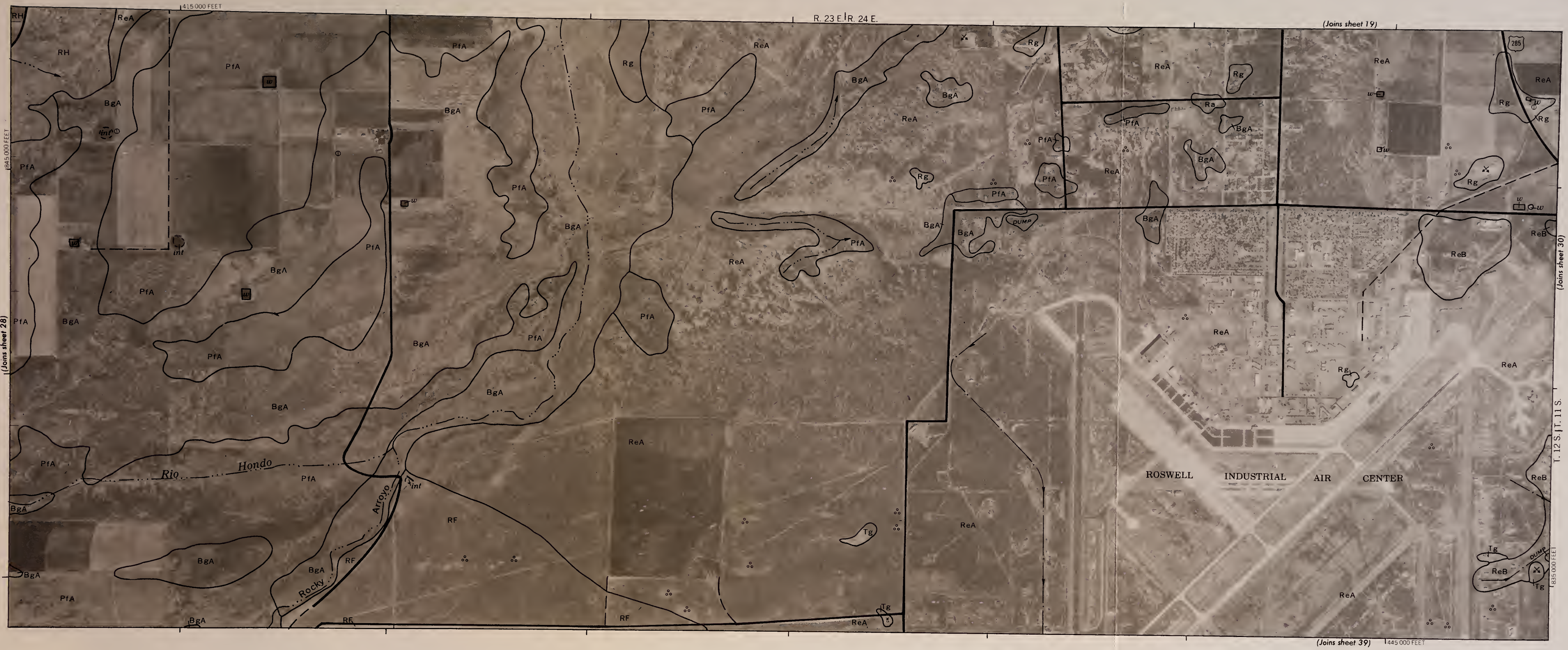
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 29

29

N

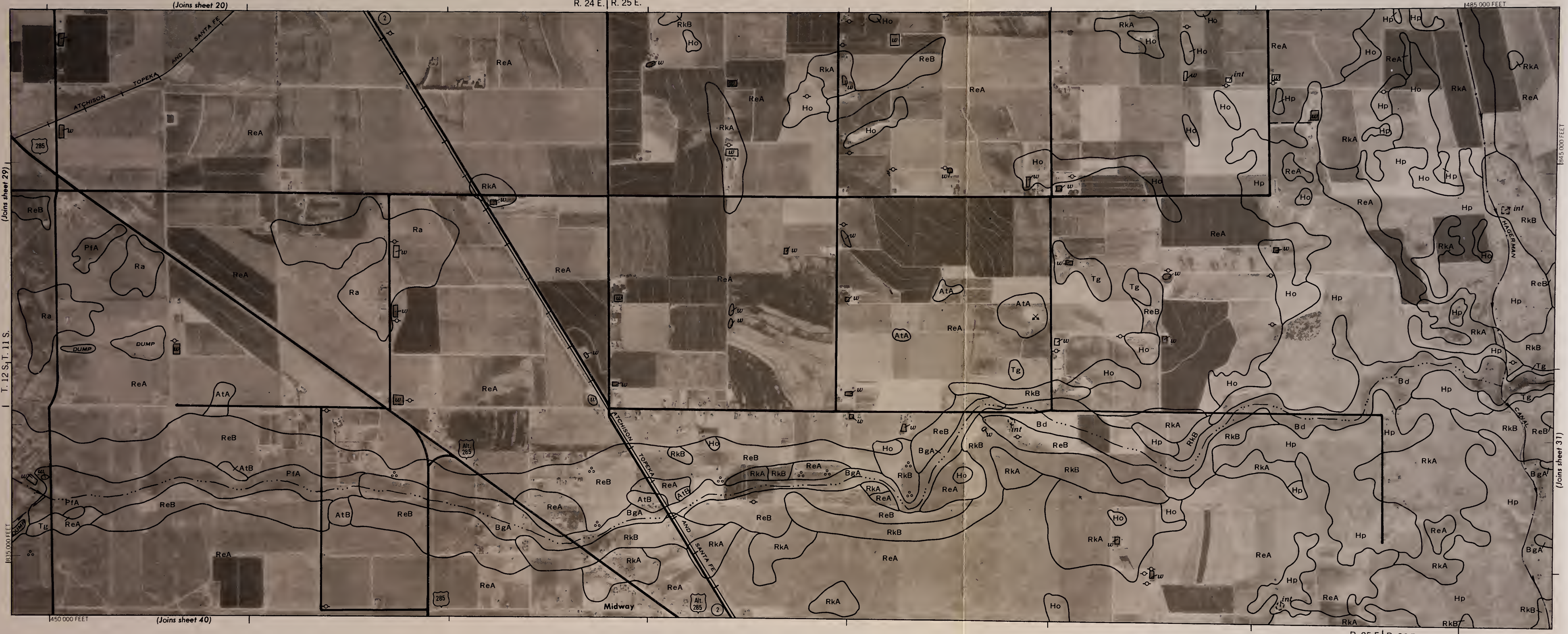


1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 30



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 32

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 34

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

Scale 1:24 000

5 000 foot grid ticks based on state coordinate system. Land division corners if shown are approximately positioned

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 36

INSET A

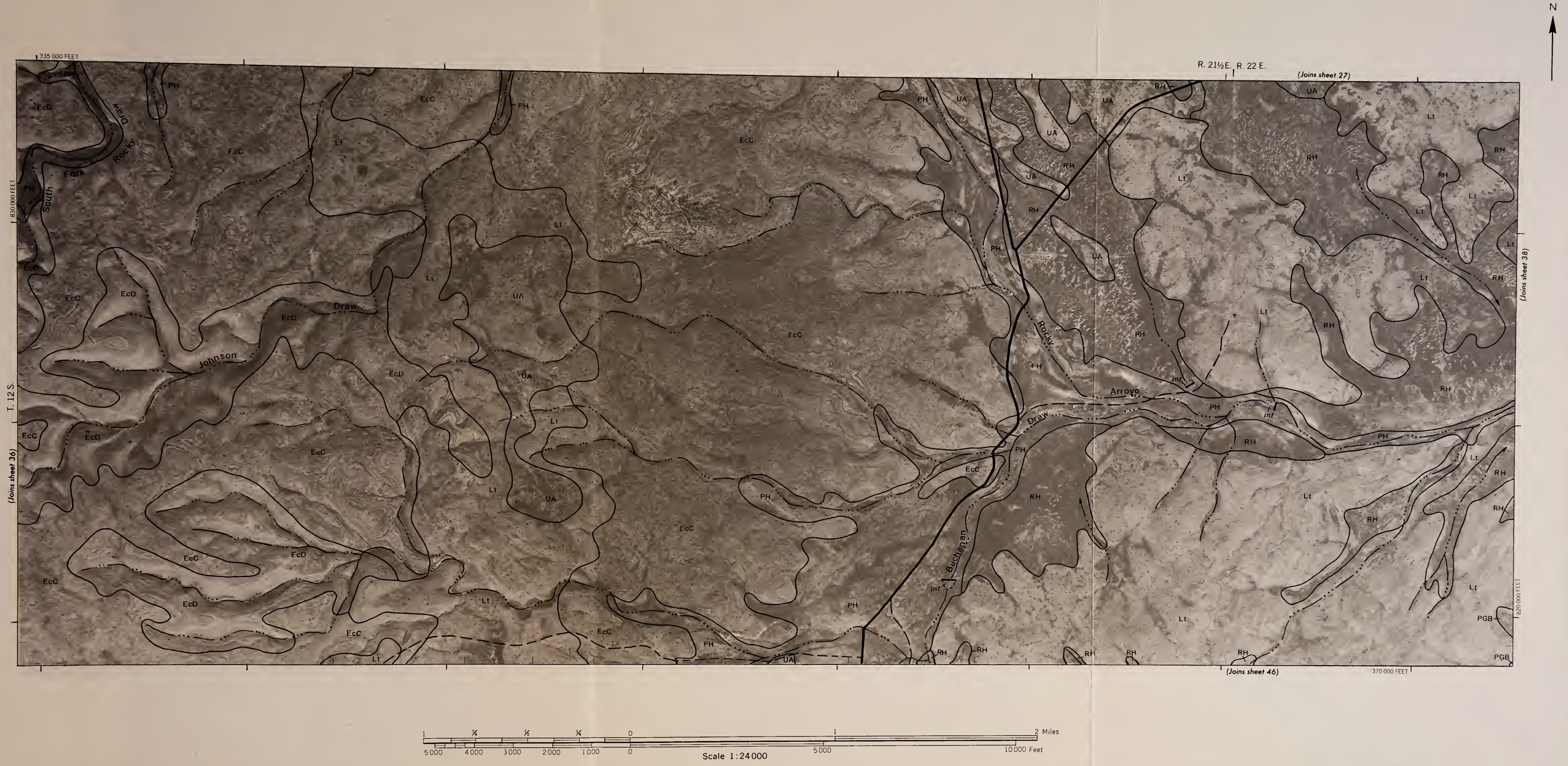
INSET B

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 37



CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 38

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 39

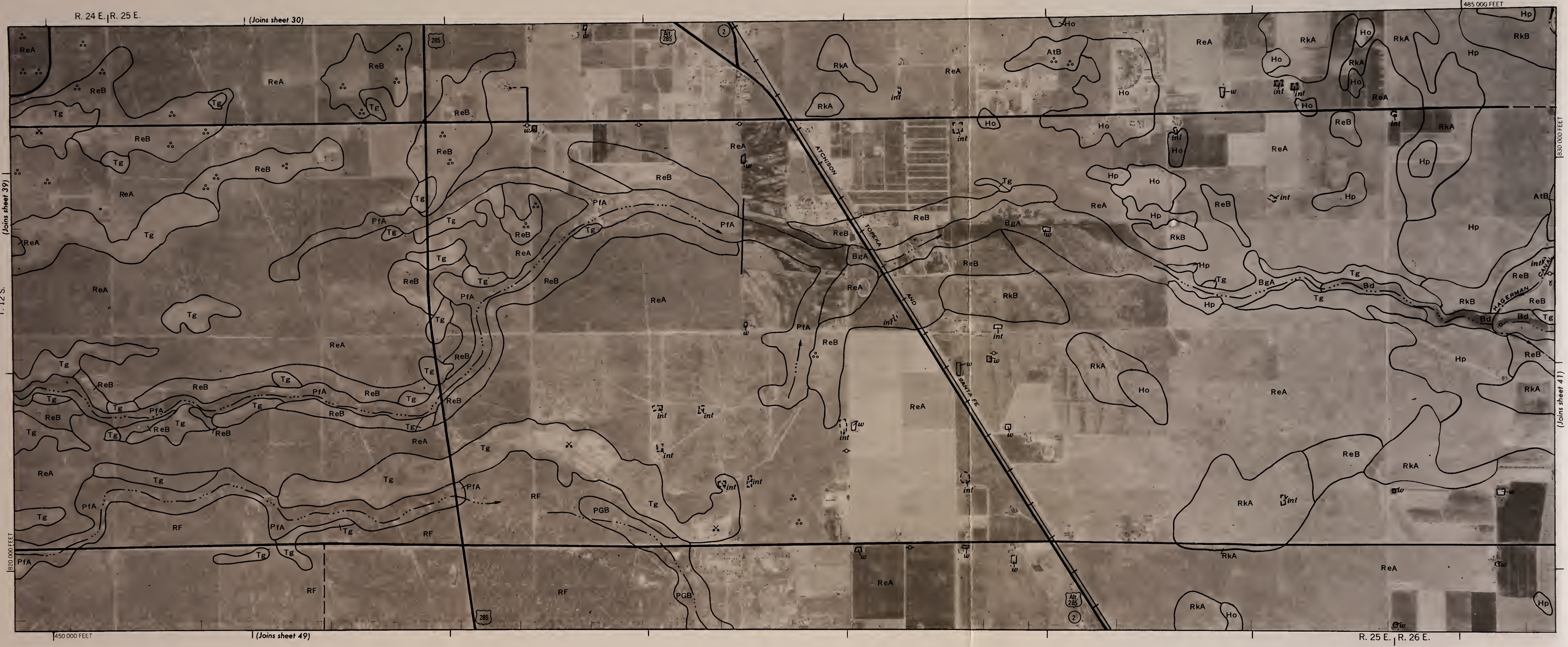
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 40

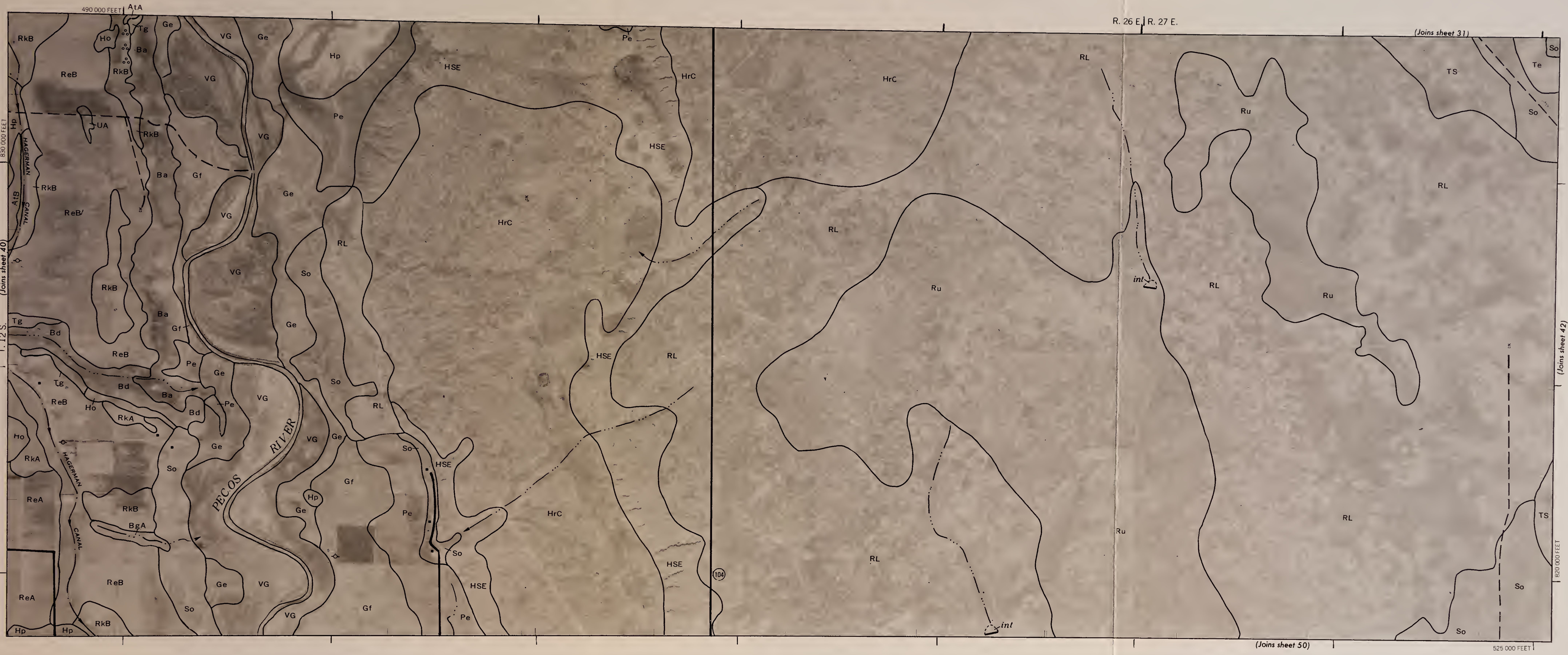


1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N



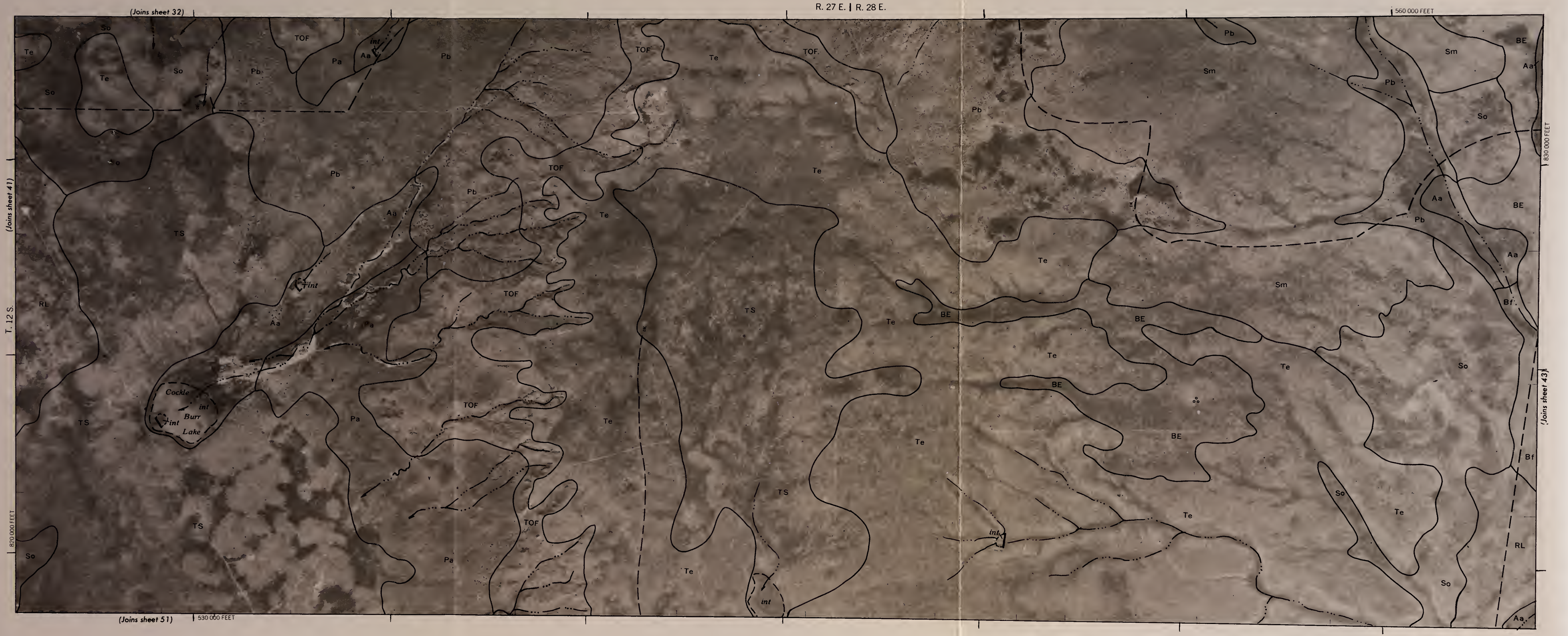
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 42



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

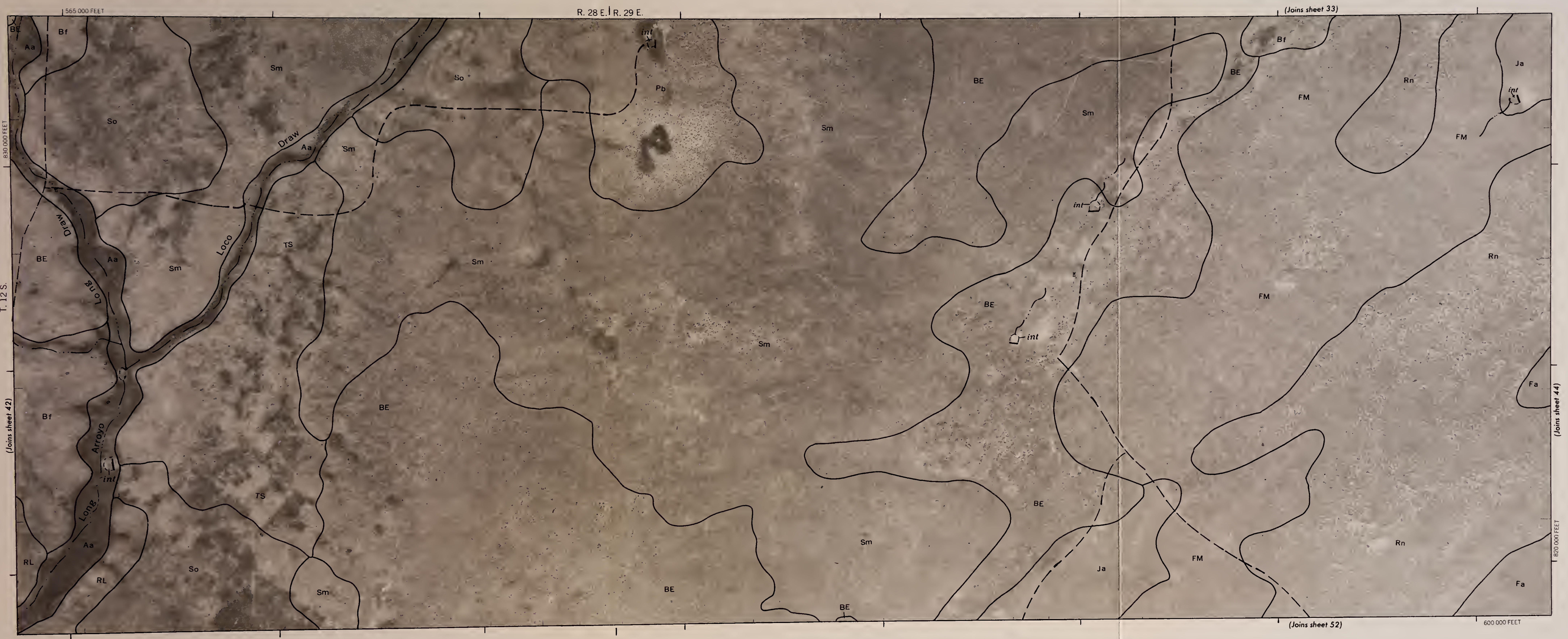
Scale 1:24000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 43

N

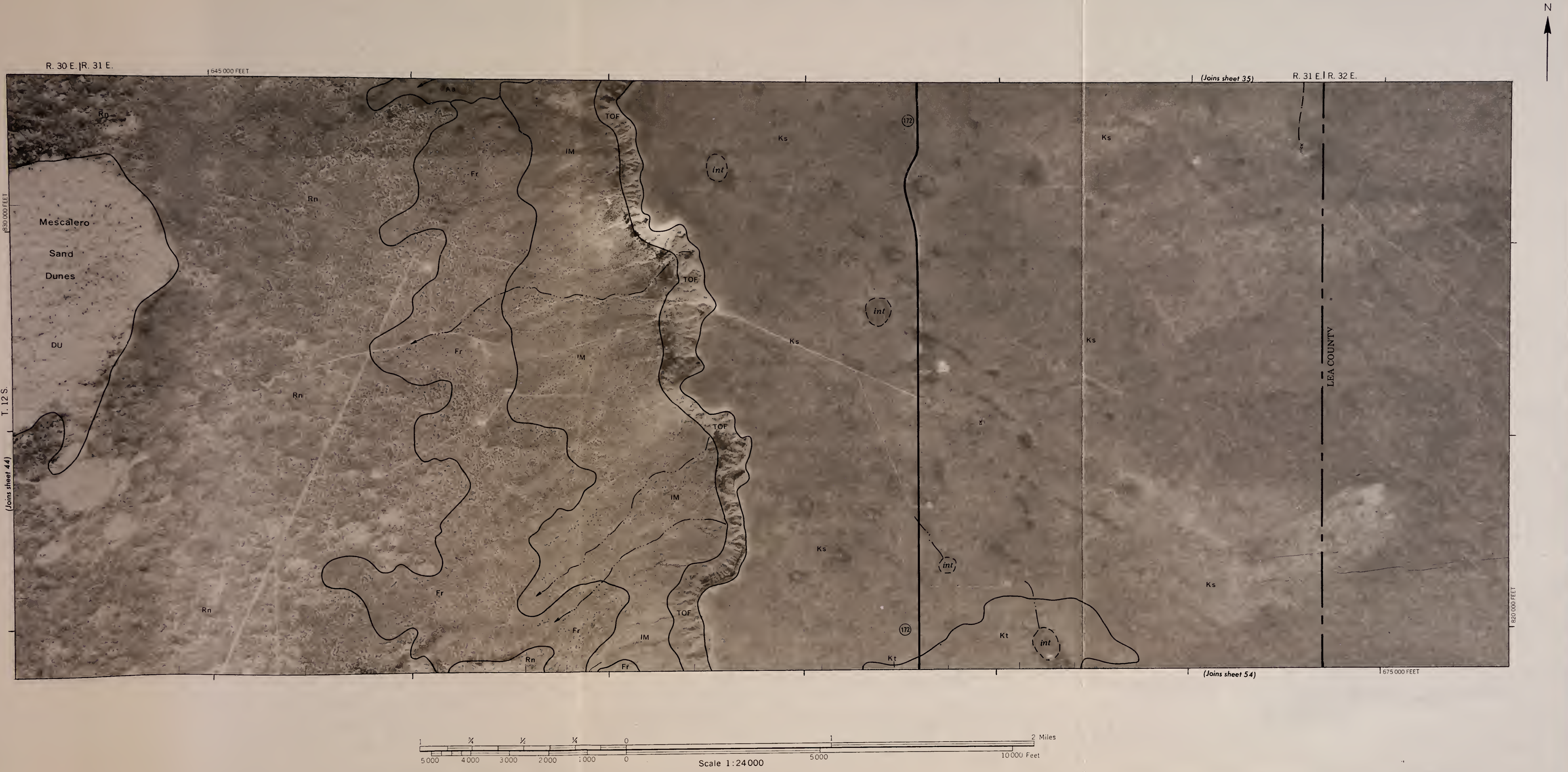


1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

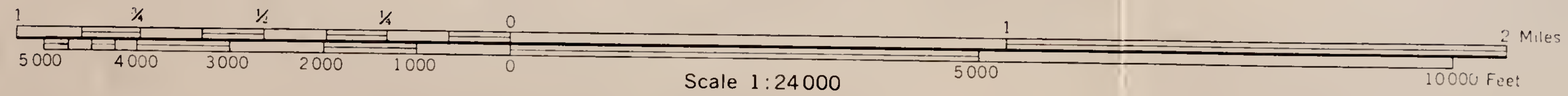
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 44


N
R. 30 E. | R. 31 E.
645 000 FEET
(Joins sheet 35)
R. 31 E. | R. 32 E.
830 000 FEET
T. 12 S.
(Joins sheet 44)
Mescalero
Sand
Dunes
DU
Rn
Aa
Fr
IM
TOF
Ks
int
172
Kt
LEA COUNTY
820 000 FEET
(Joins sheet 54)
675 000 FEET
1
¾
½
¼
0
1
2 Miles
5000
4000
3000
2000
1000
0
5000
10000 Feet
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 46

N



Scale 1:24000

1 ½ ¼ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

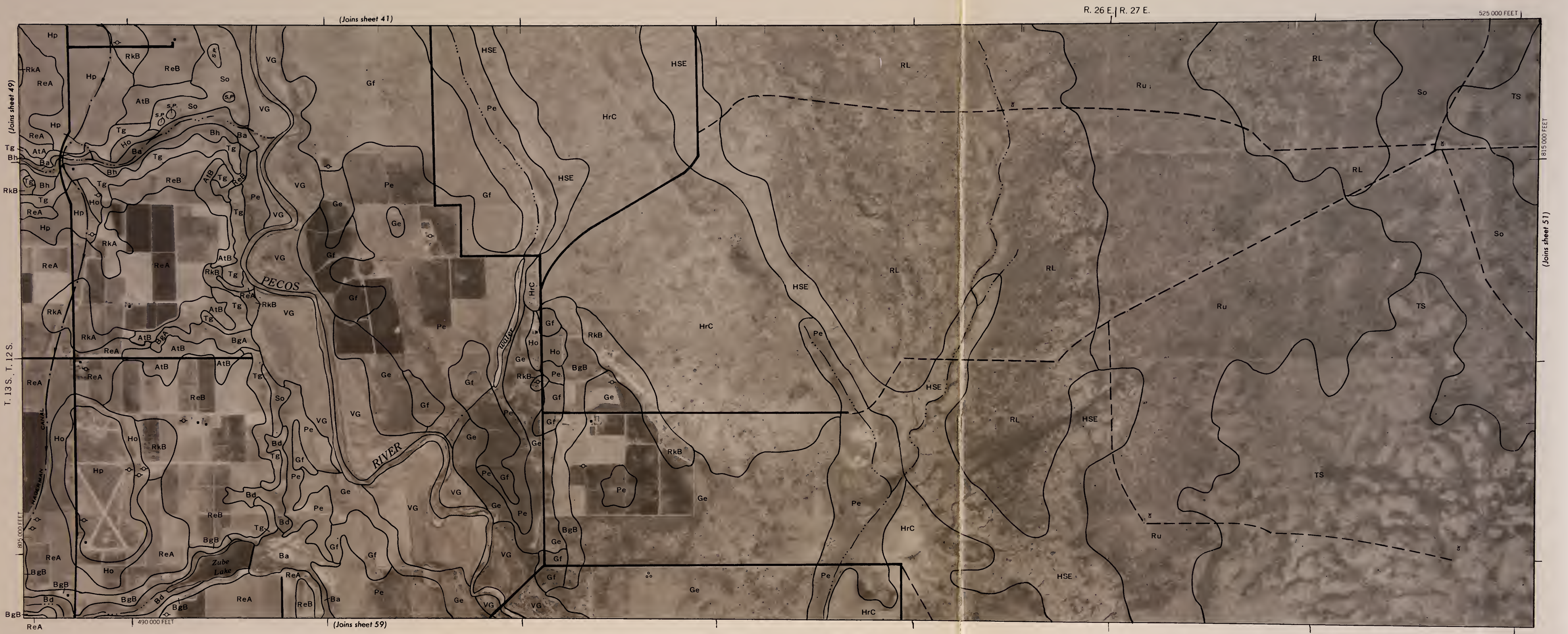
Scale 1:24000


N
(Joins sheet 39)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 57)
445 000 FEET
815 000 FEET
805 000 FEET
415 000 FEET
T. 13 S. | T. 12 S.
R. 23 E. | R. 24 E.
Thirteenmile Draw
intermittent
int
PGB
ReA
PfA
RF
UA
RH
Tg
1
¾
½
¼
0
1
2 Miles
5000
4000
3000
2000
1000
0
5000
10000 Feet
Scale 1:24000


49
N
R. 24 E. R. 25 E.
450 000 FEET
815 000 FEET
T. 13 S. T. 12 S.
(Joins sheet 48)
(Joins sheet 40)
(Joins sheet 50)
(Joins sheet 58)
R. 25 E. R. 26 E.
485 000 FEET
805 000 FEET
Thirteenmile
Draw
ATCHISON
TOPEKA
AND
SANTA FE
HAGERMAN
CANAL
RF
RH
PGB
PfA
Tg
ReA
ReB
RkA
RkB
Ho
AtA
Bh
Bd
BgB
int
285
Alt. 285
2
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 50



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 52

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

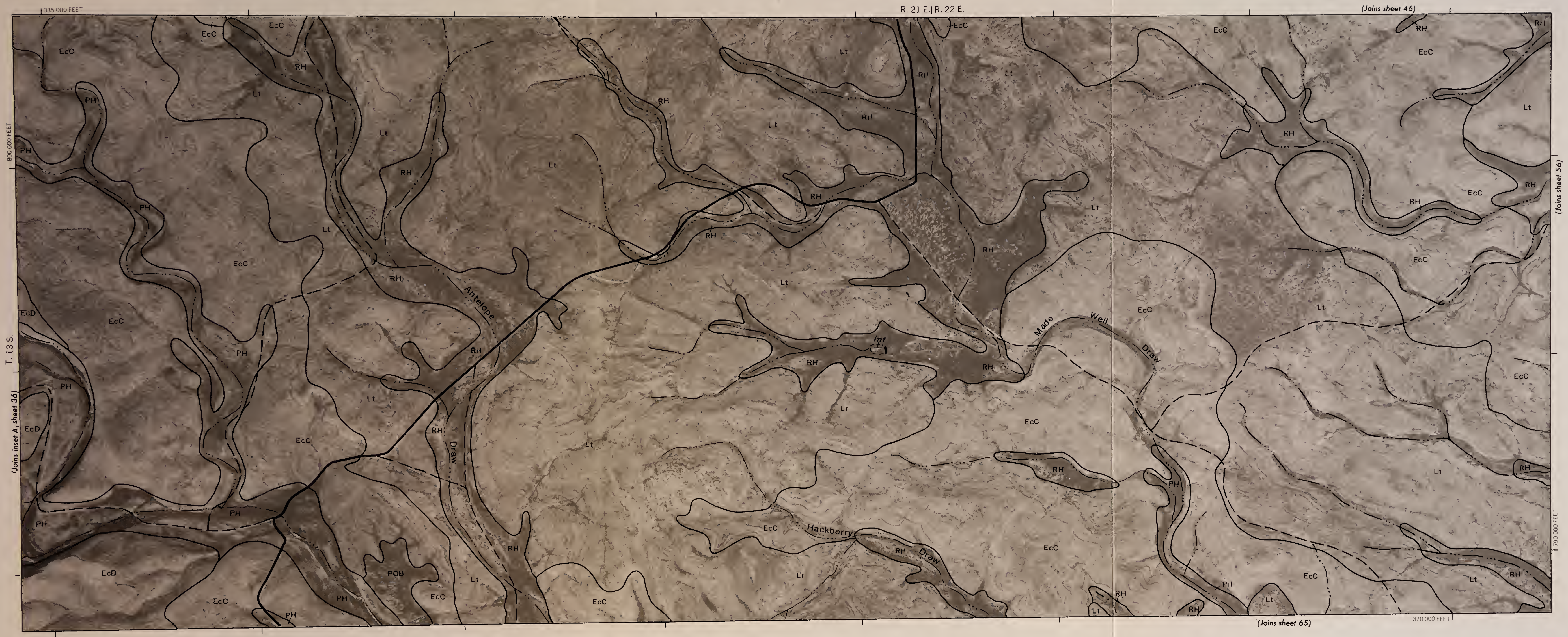
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 54

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 55



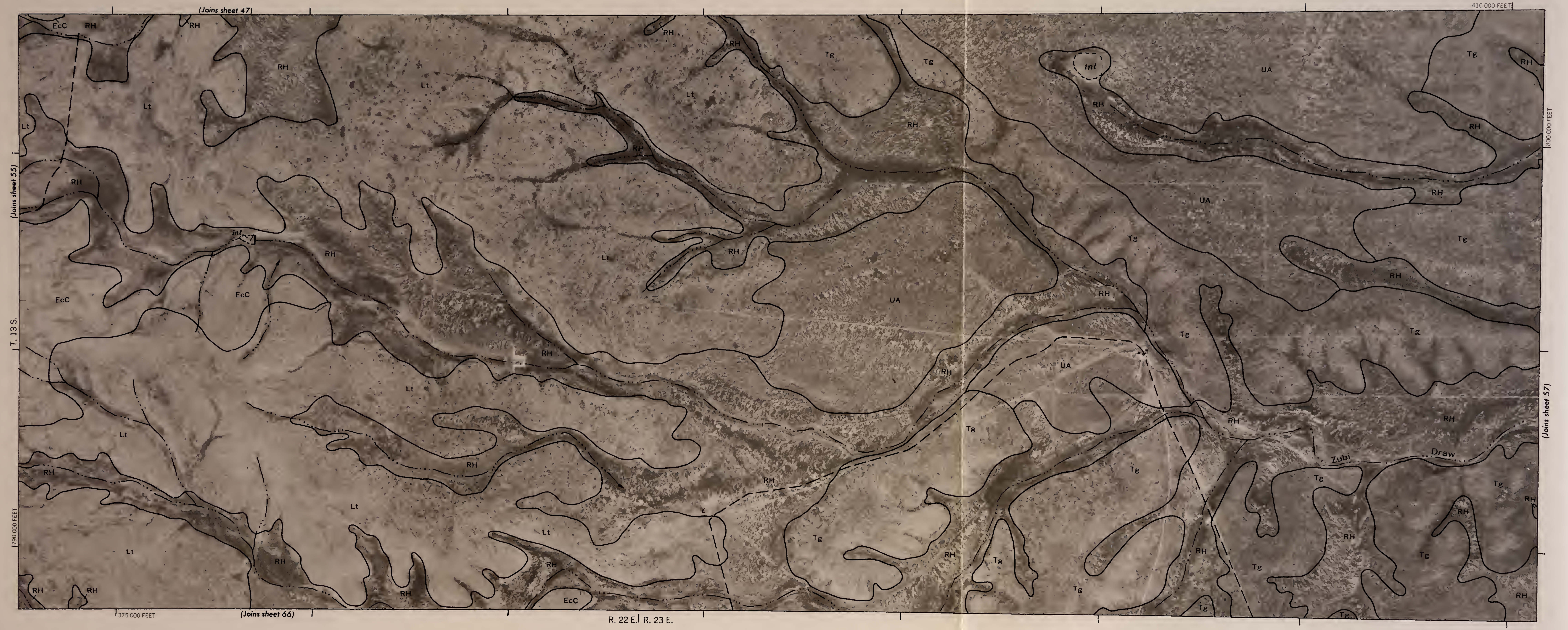
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

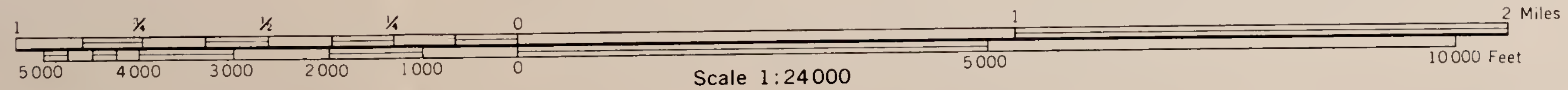
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 56



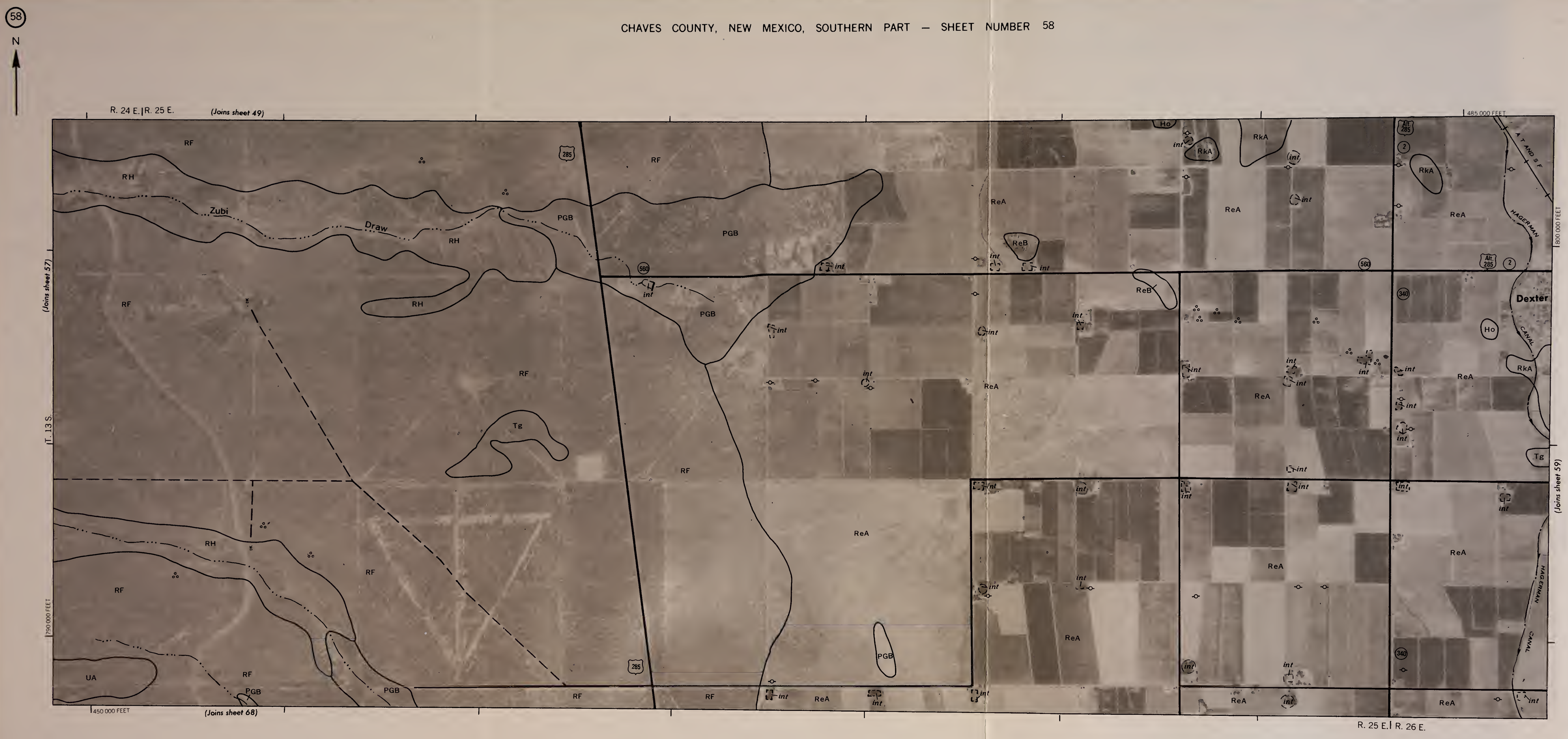
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



Scale 1:24000



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

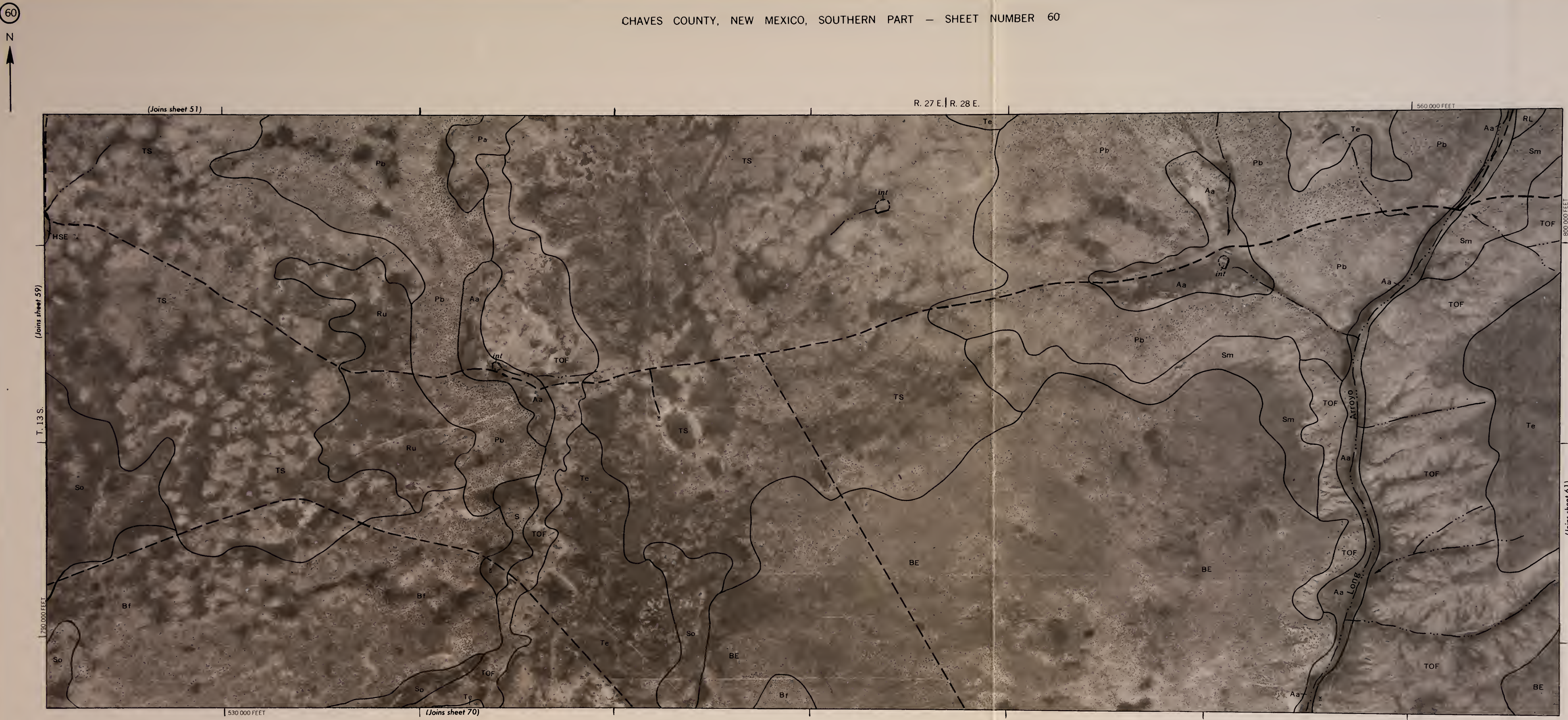
N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

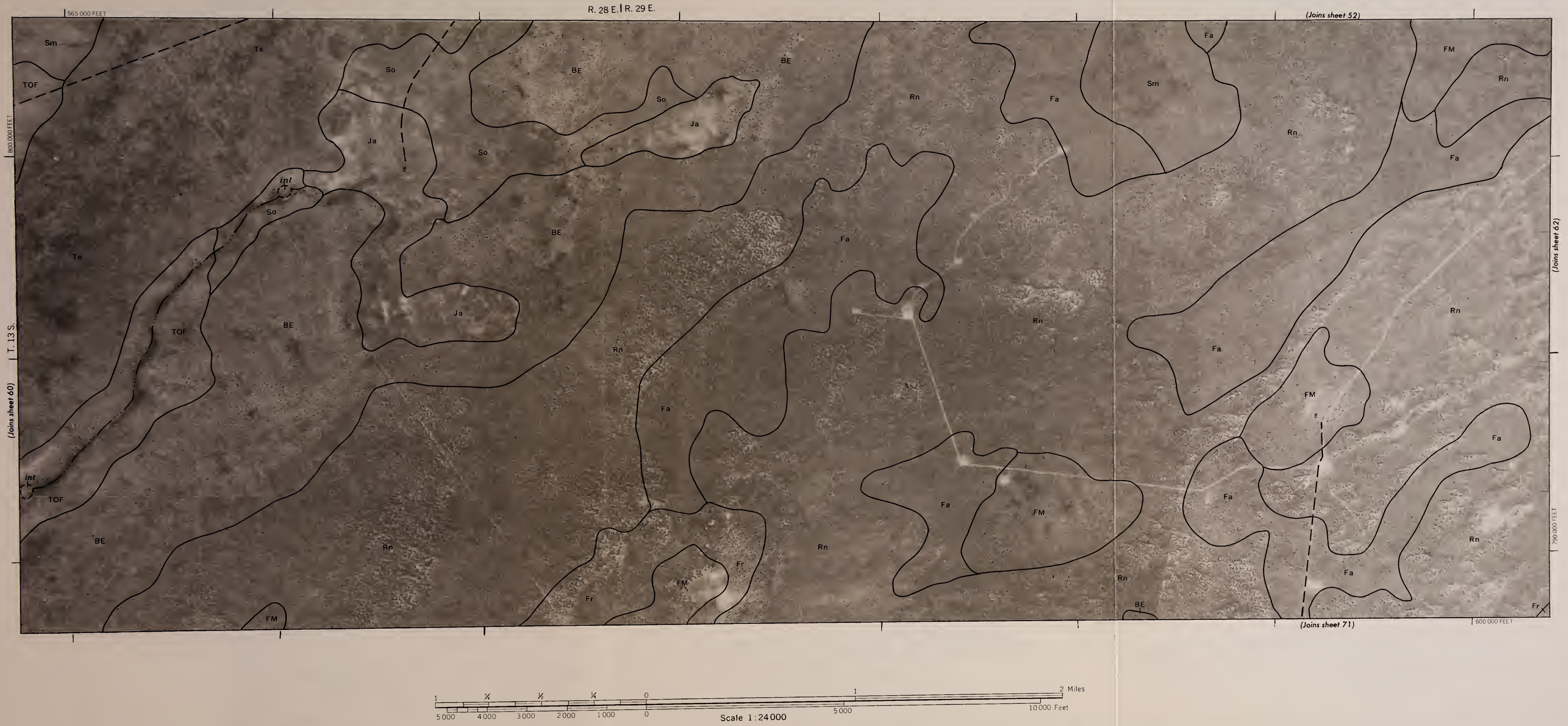
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 60



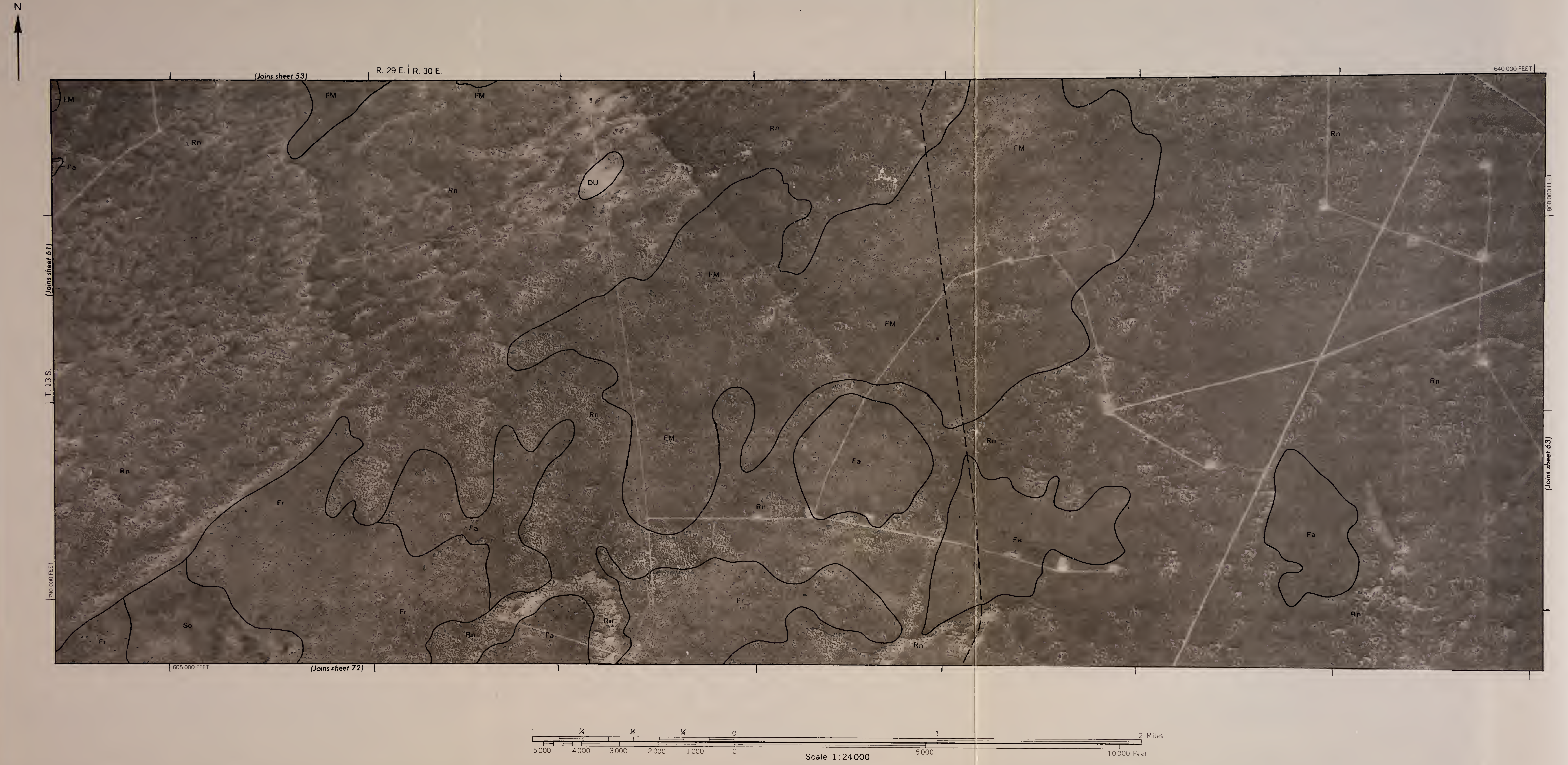
1 ¾ ½ ¼ 0 1 2 Miles

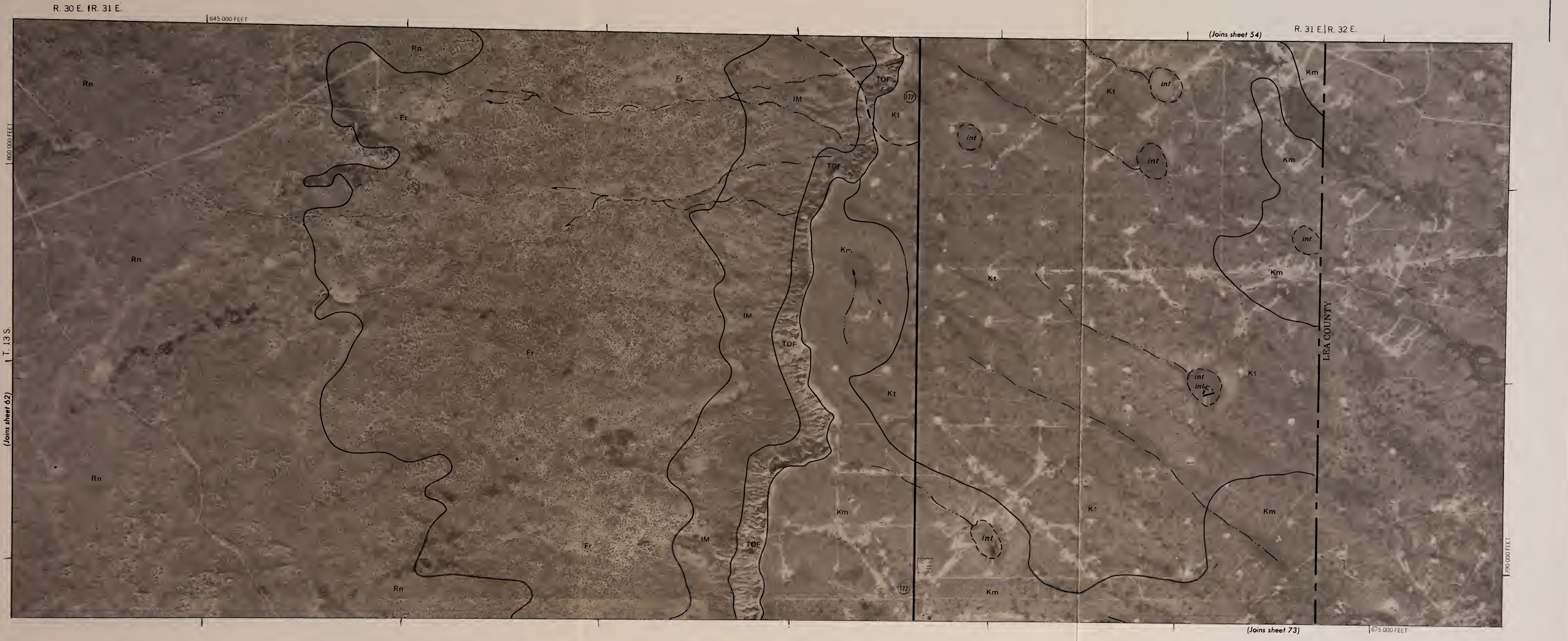
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

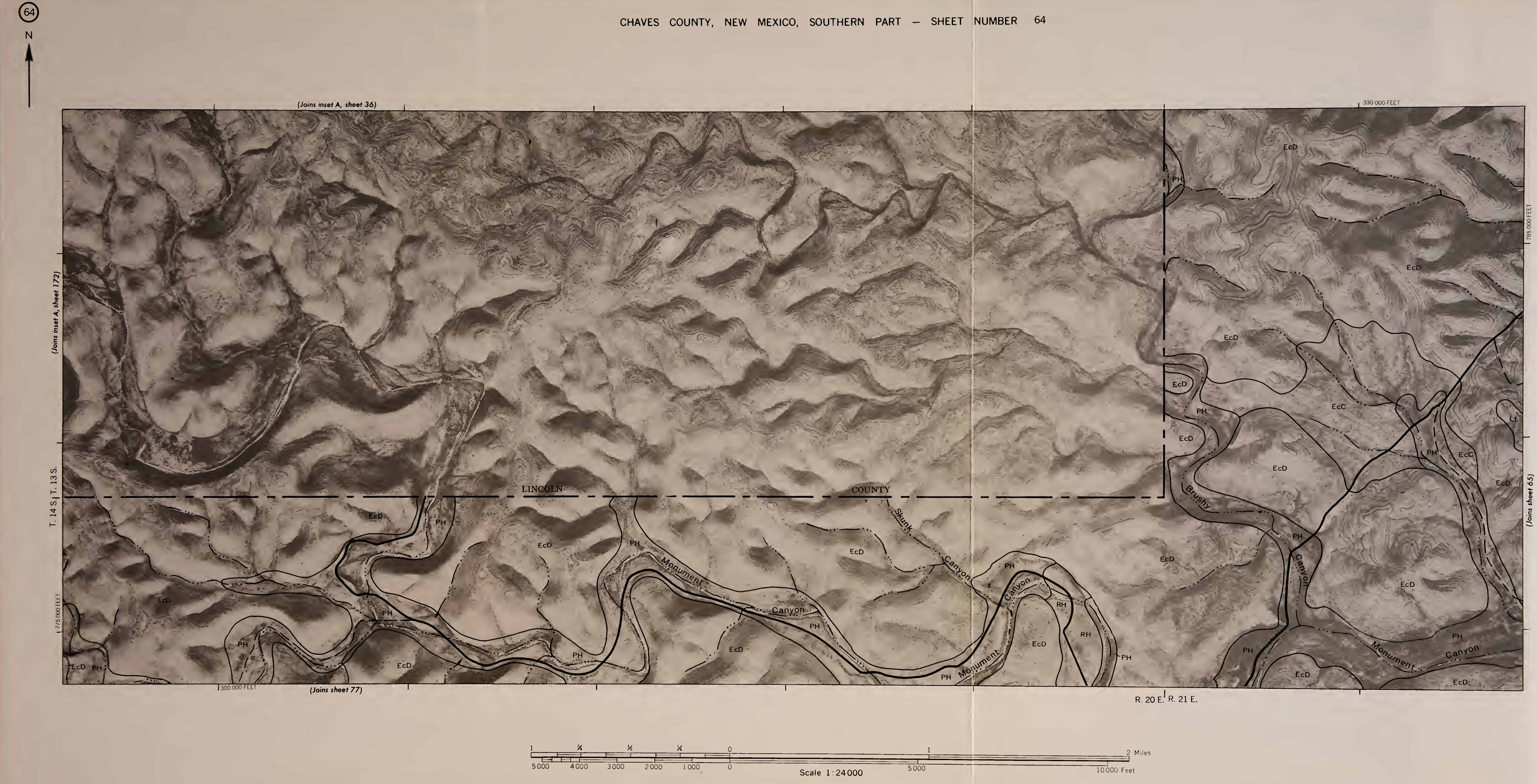

N
565 000 FEET
R. 28 E. | R. 29 E.
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 71)
T. 13 S.
800 000 FEET
790 000 FEET
600 000 FEET
Sm
TOF
Te
So
BE
Ja
Rn
Fa
FM
int
Fr
2 Miles
10 000 Feet
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 62





1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000


64
N
(Joins inset A, sheet 36)
330 000 FEET
785 000 FEET
(Joins inset A, sheet 172)
(Joins sheet 65)
775 000 FEET
300 000 FEET
(Joins sheet 77)
T. 14 S. T. 13 S.
R. 20 E. R. 21 E.
LINCOLN
COUNTY
Skunk
Canyon
Monument
Canyon
Brushy
Canyon
Monument
Canyon
EcD
EcC
PH
RH
Lt
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

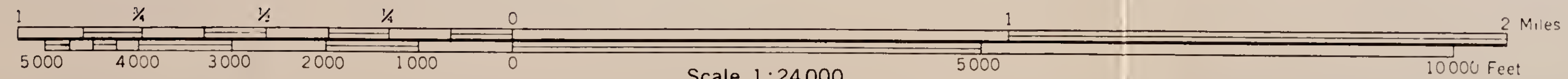
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

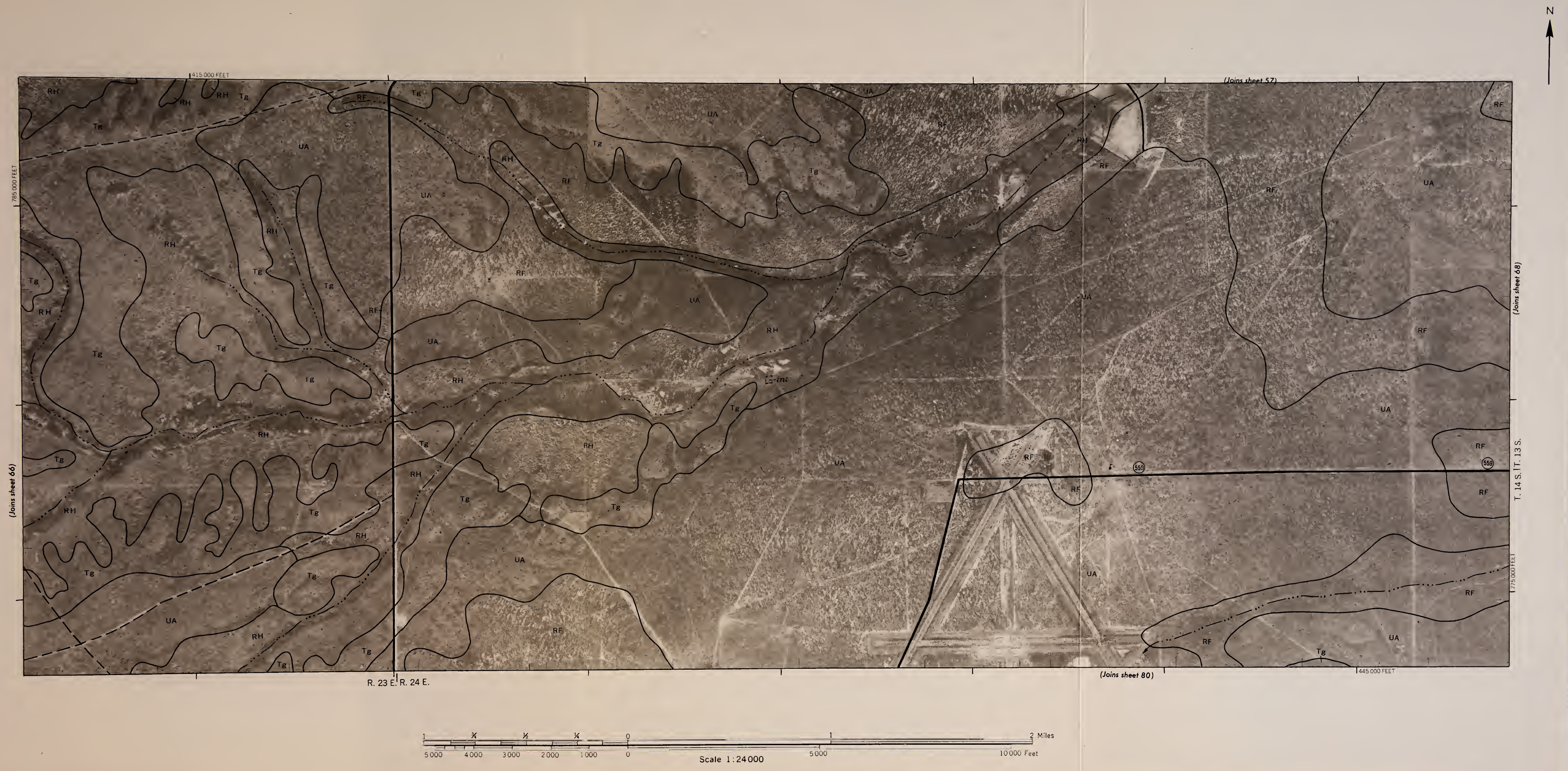
Scale 1:24000

66

N



Scale 1:24000



This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. 5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 68

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 69

69

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

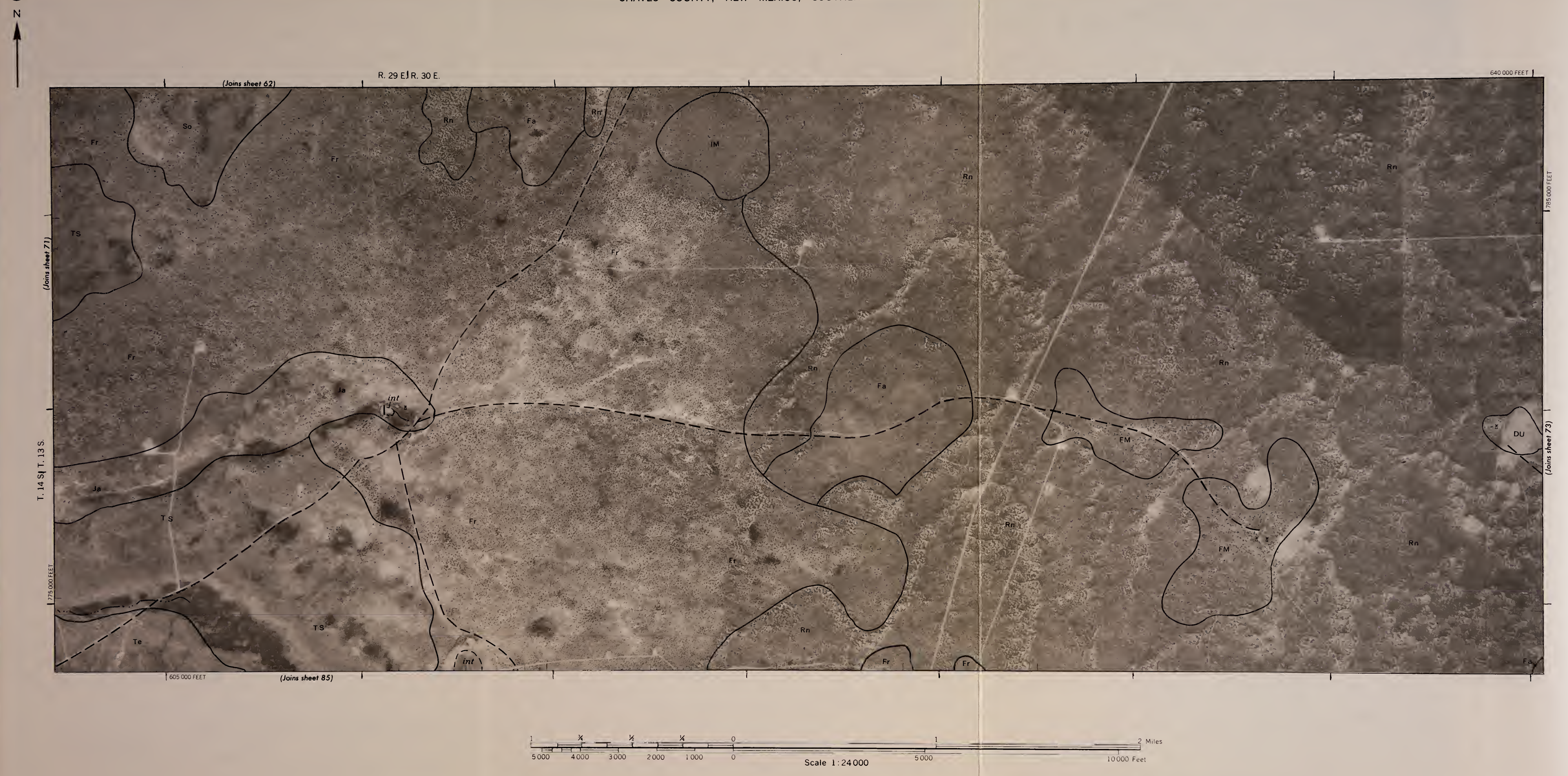
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 70

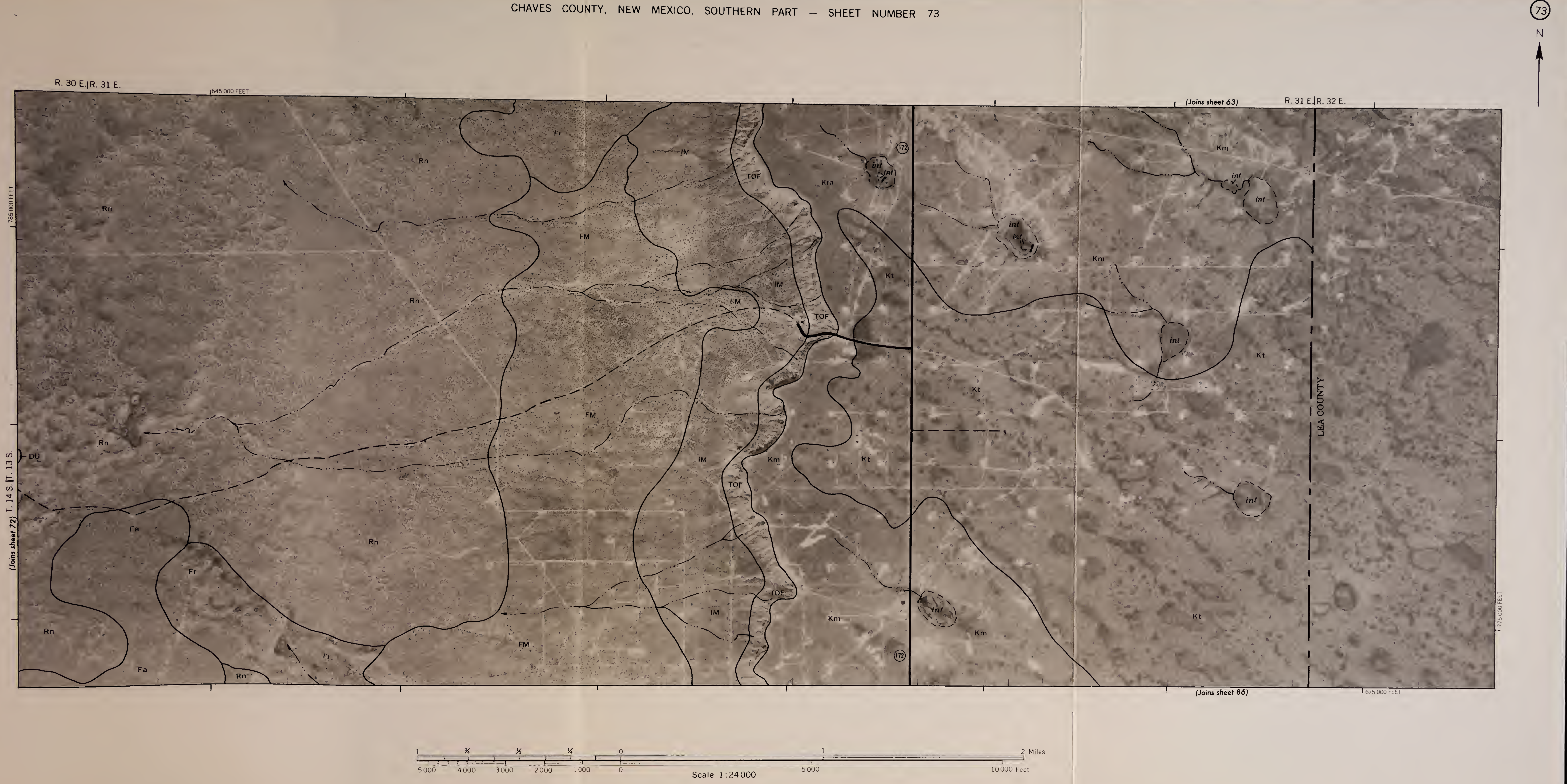
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 71

71

This map was compiled on 1974 and 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 72





This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 74

Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10 000 Feet

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 75

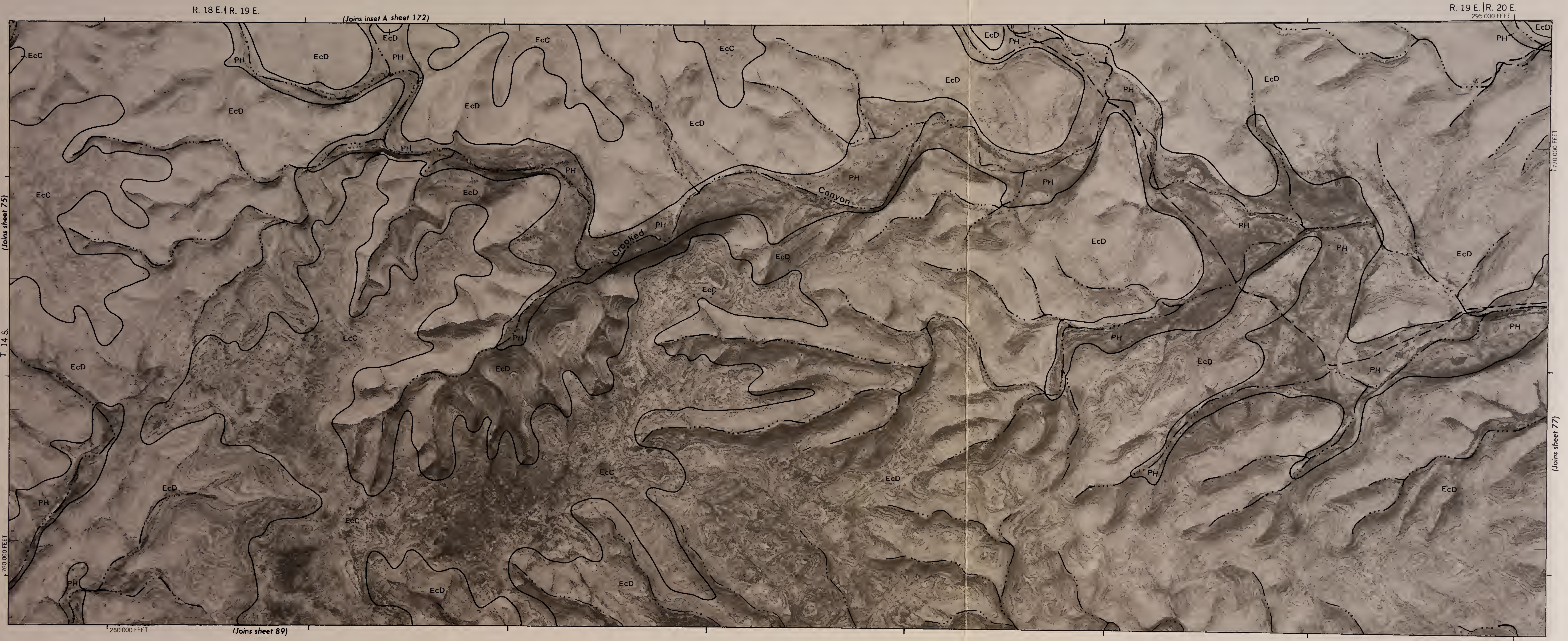
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

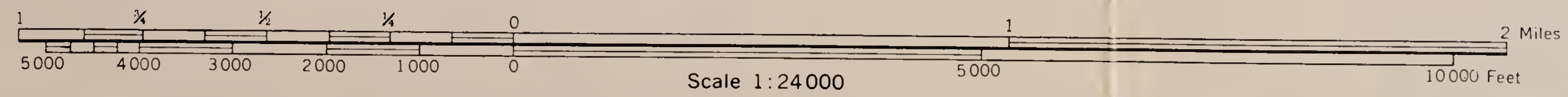
This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

76

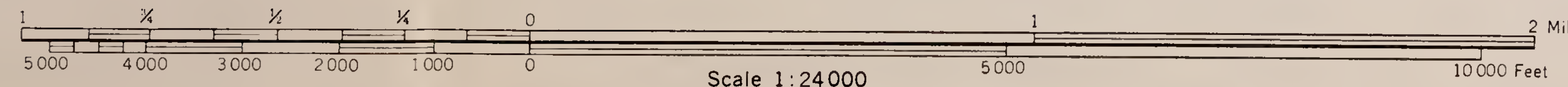
N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 76





Scale 1:24000



Scale 1:24 000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 78

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of the Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

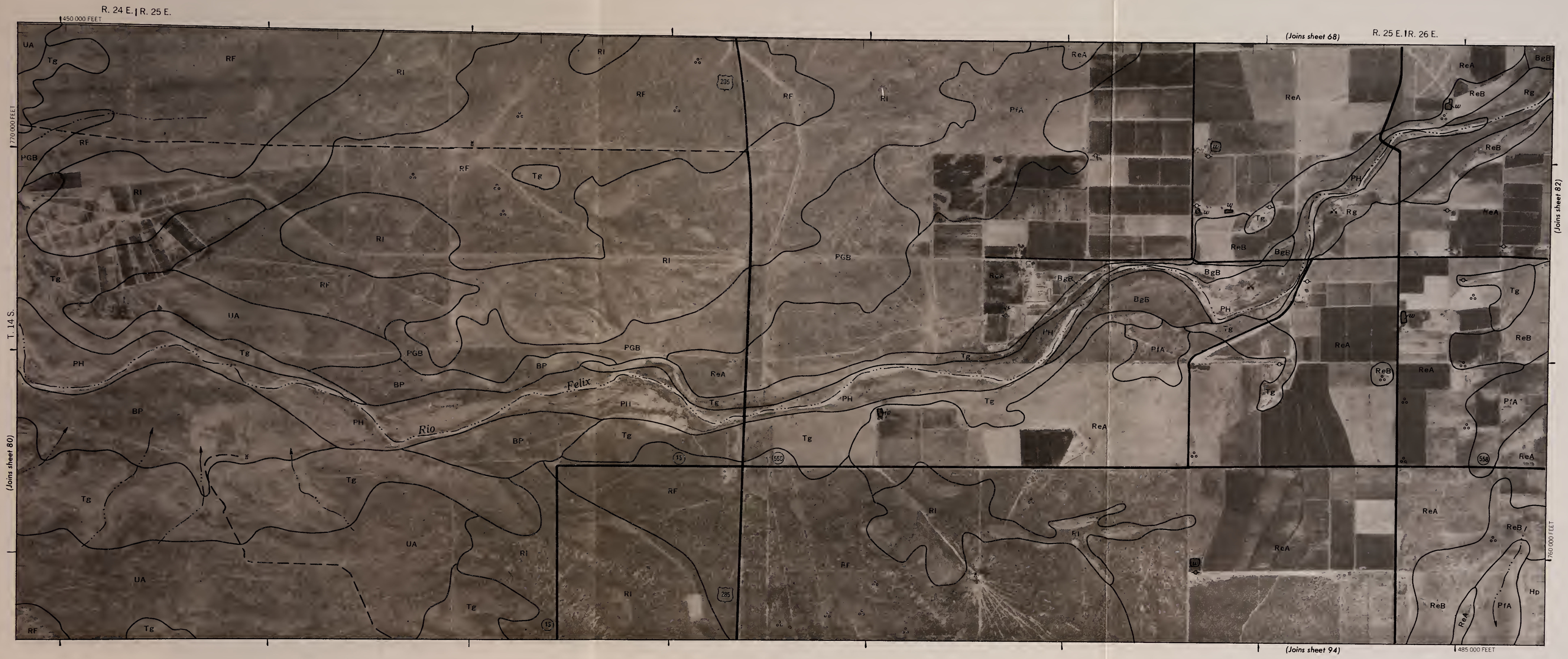
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 80

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

N



1 ¾ ½ ¼ 0 1 2 Miles

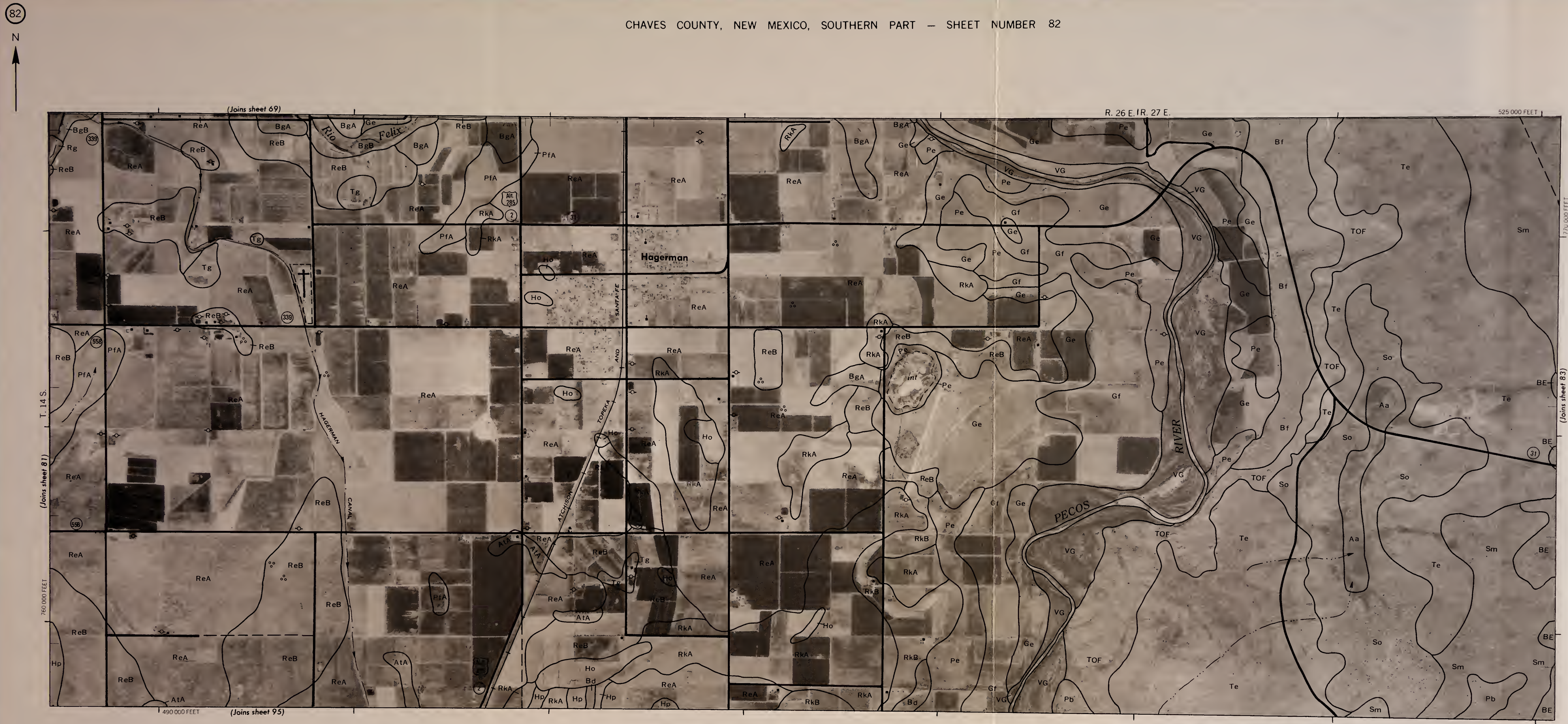
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

5,000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 82



1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10 000 Feet

Scale 1:24 000

N

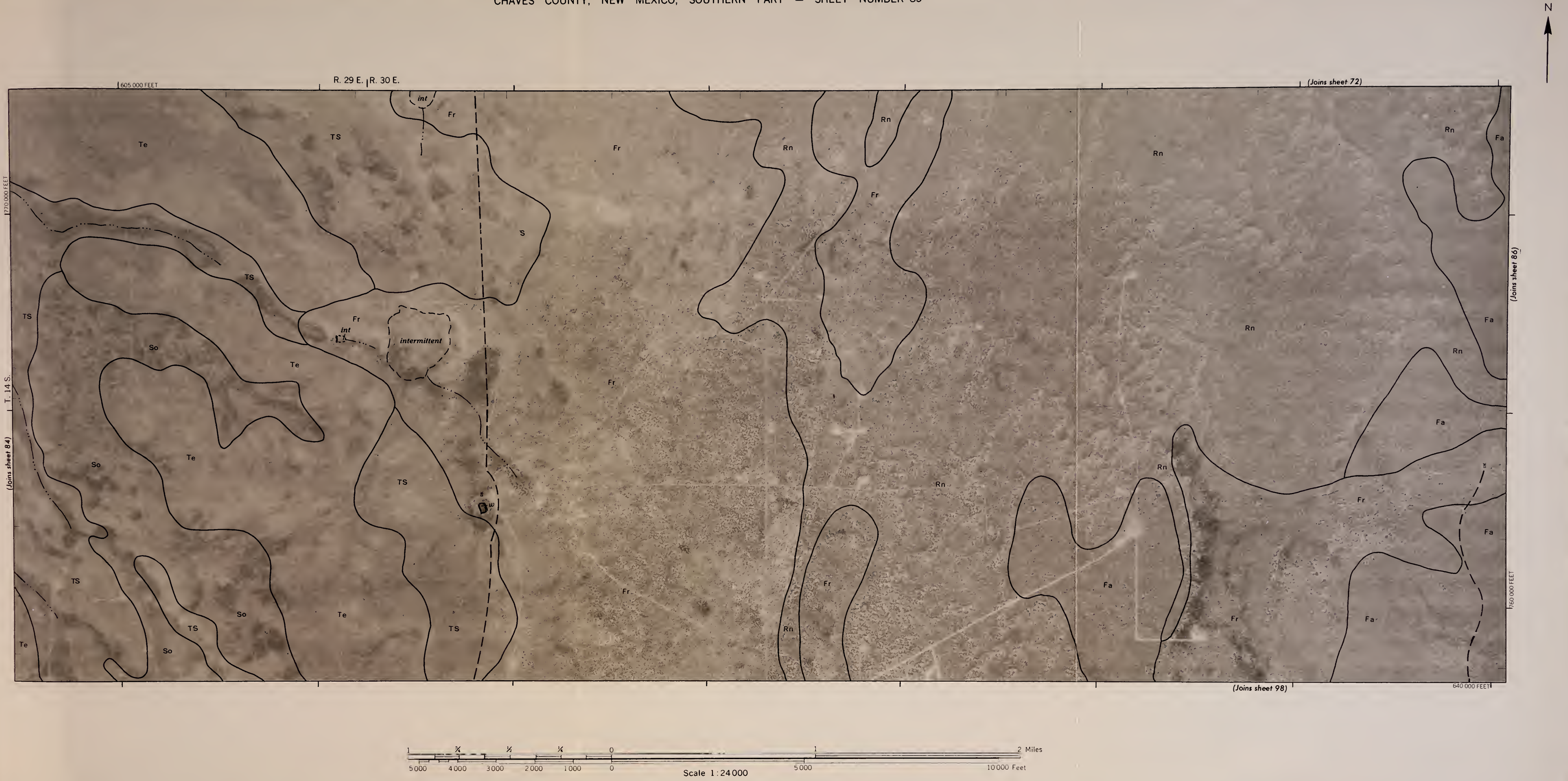
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 84

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

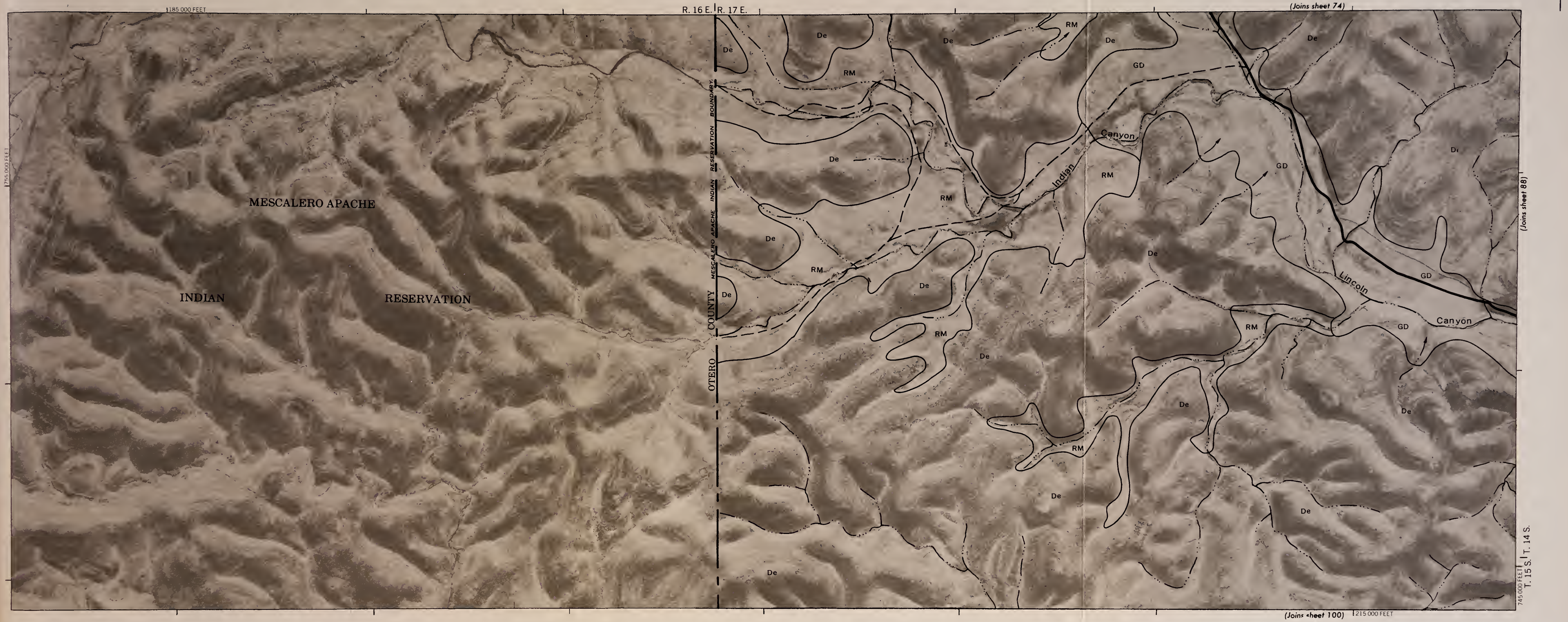
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 85



This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 86



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 88

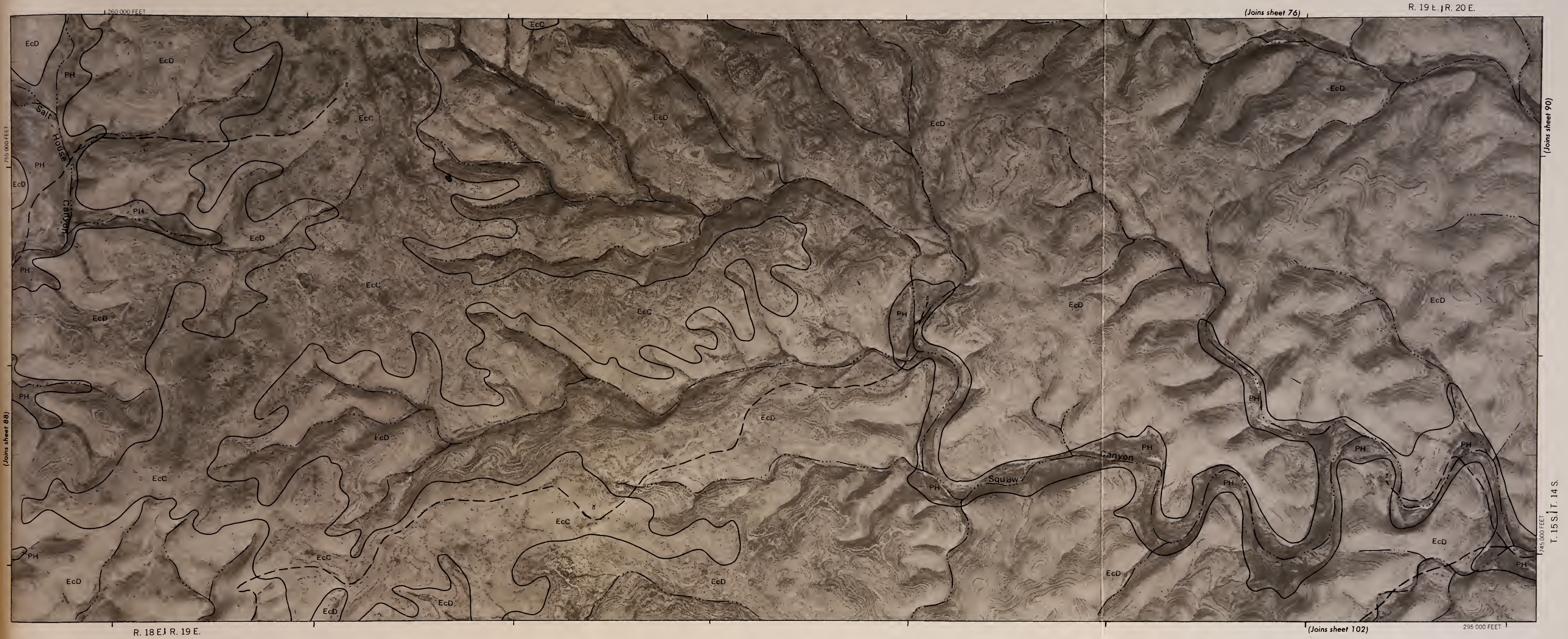
Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 89

N



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

5 000 foot grid ticks based on state coordinate system. Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 90

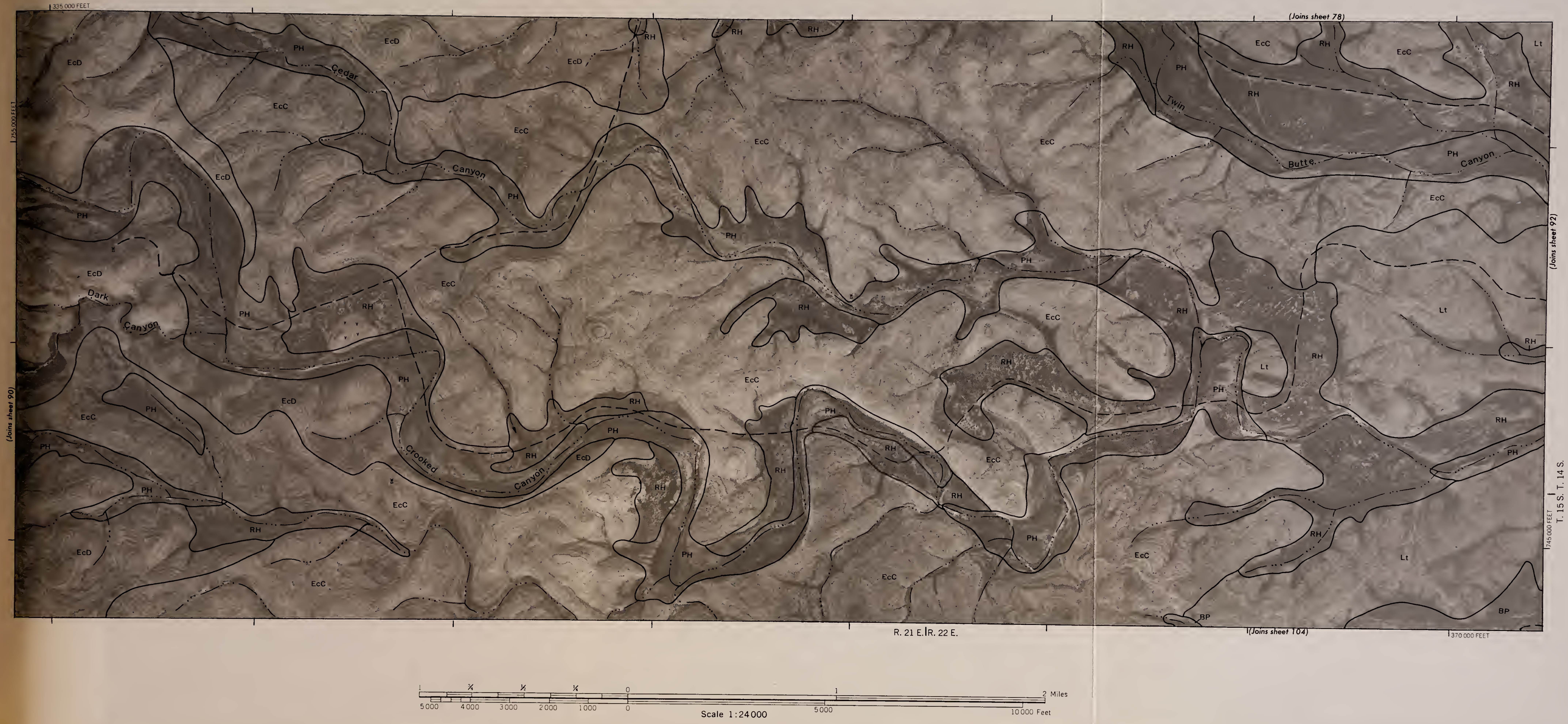
N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

N


335 000 FEET
(Joins sheet 78)
(Joins sheet 90)
(Joins sheet 92)
(Joins sheet 104)
265 000 FEET
745 000 FEET
370 000 FEET
Cedar Canyon
Dark Canyon
Crooked Canyon
Twin Butte Canyon
EcD
EcC
PH
RH
Lt
BP
R. 21 E. | R. 22 E.
T. 15 S. | T. 14 S.
2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10 000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 93

N

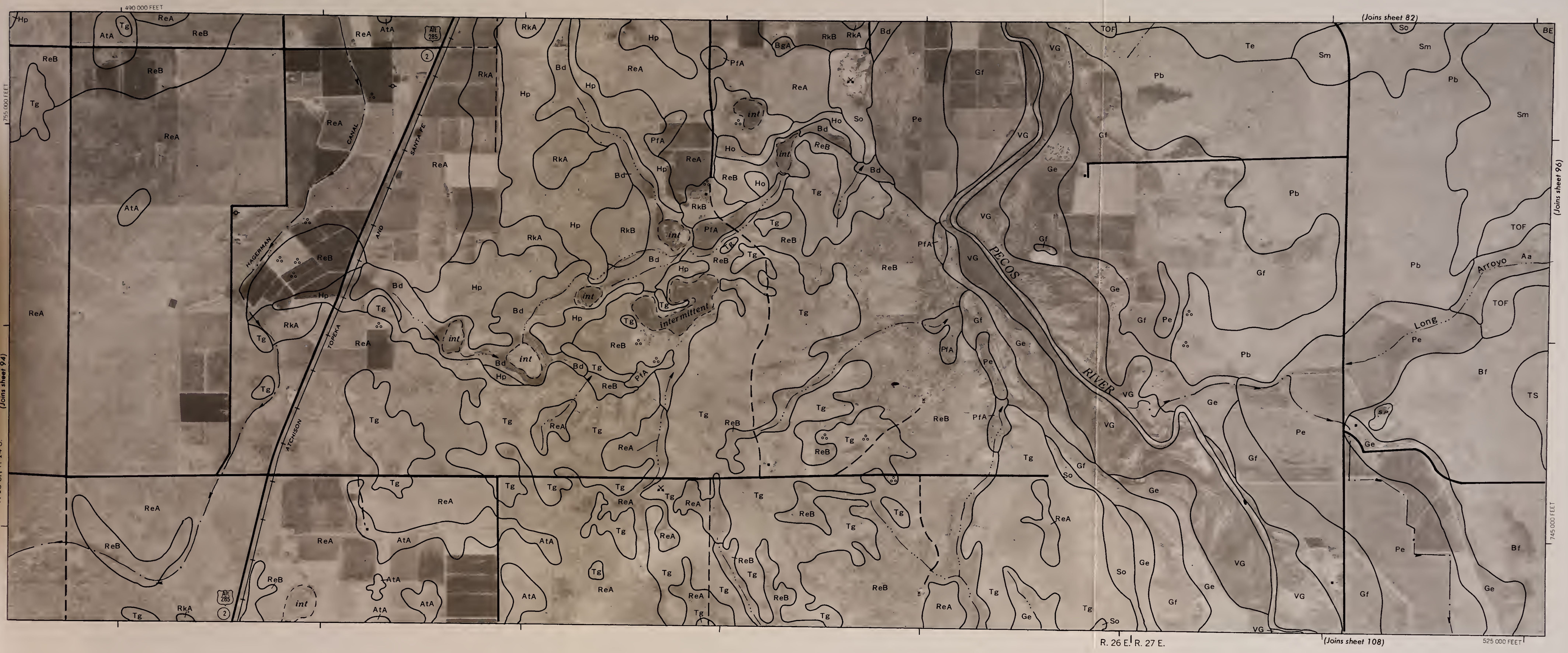
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 94

Scale 1:24 000



Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet


N
(Joins sheet 83)
(Joins sheet 95)
(Joins sheet 97)
(Joins sheet 109)
560 000 FEET
755 000 FEET
530 000 FEET
745 000 FEET
T. 15 S | T. 14 S.
R. 27 E. | R. 28 E.
Long Arroyo
BE
TOF
Sm
Aa
Bf
So
Te
HrC
TS
HSE
RL
31
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 97

97

N

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

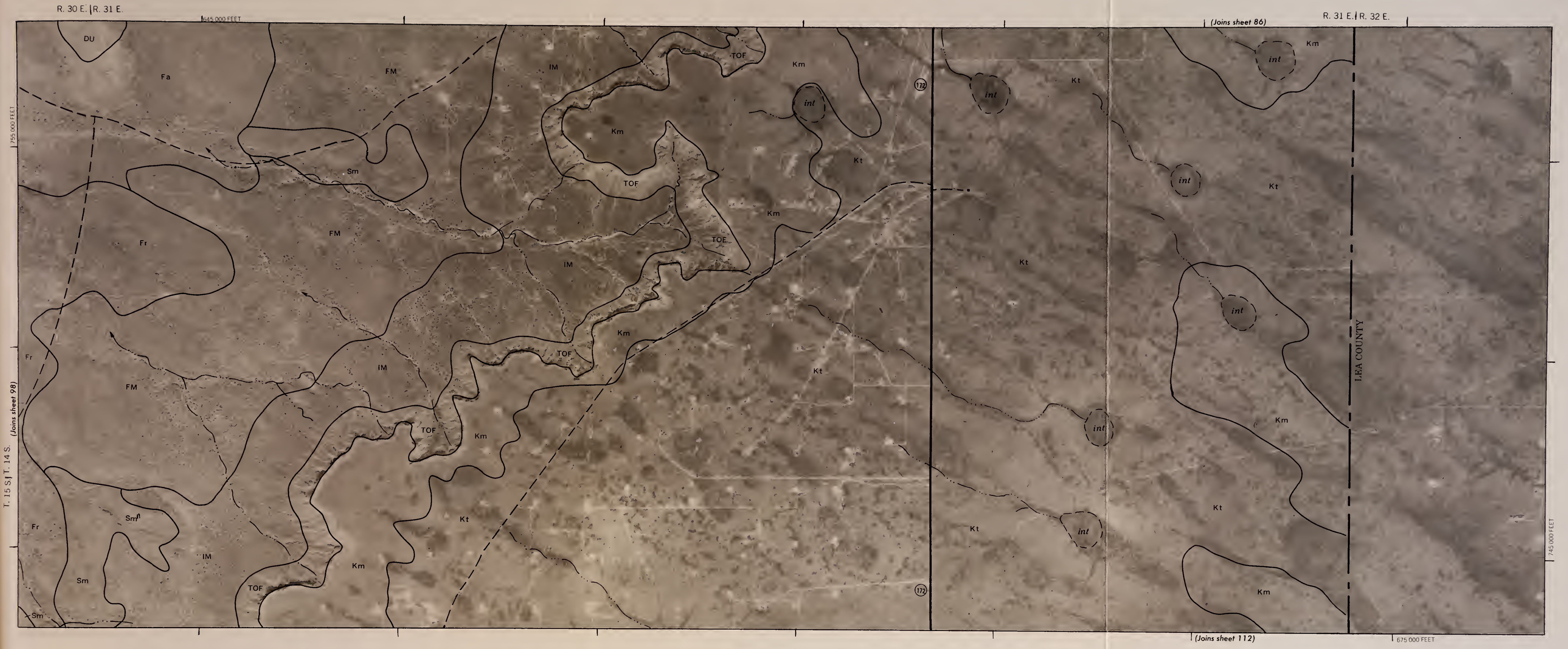
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 98

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 99

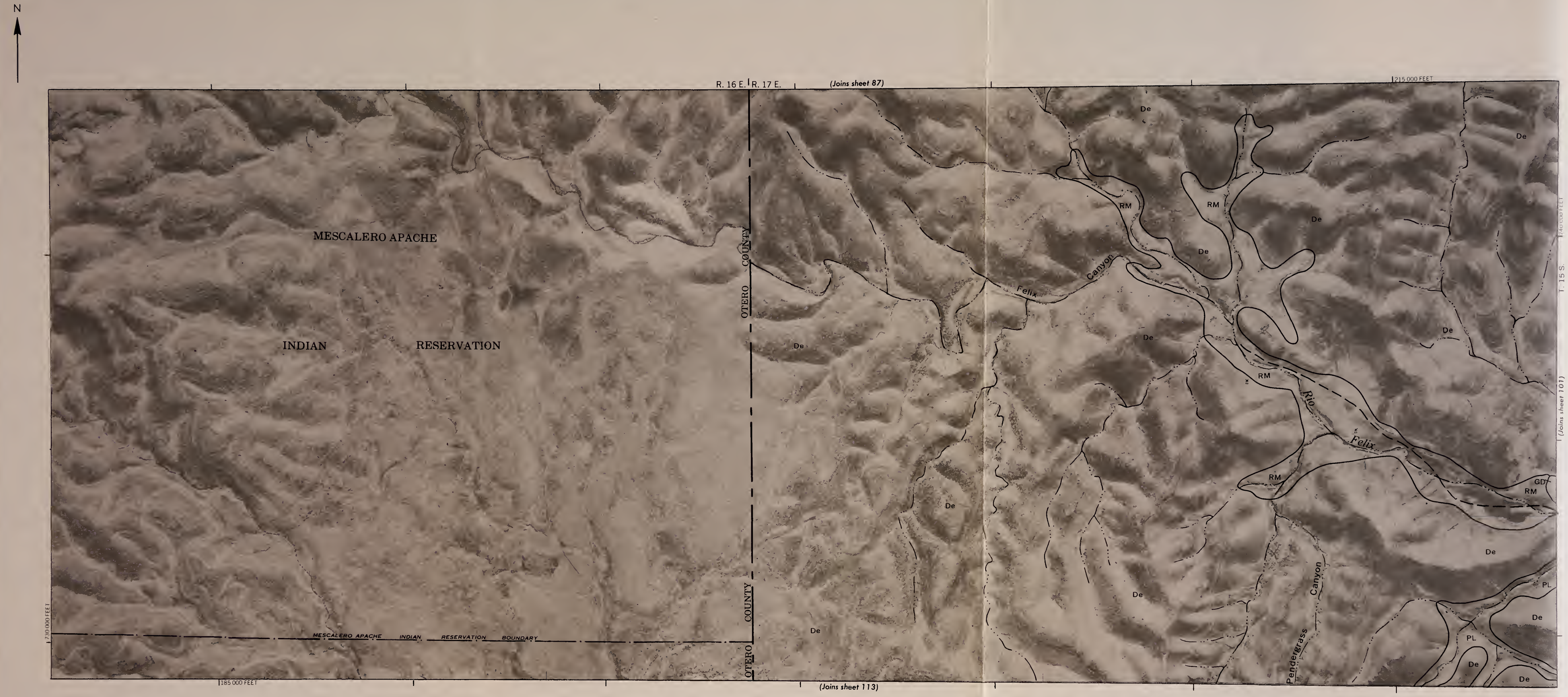


1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 100



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 101

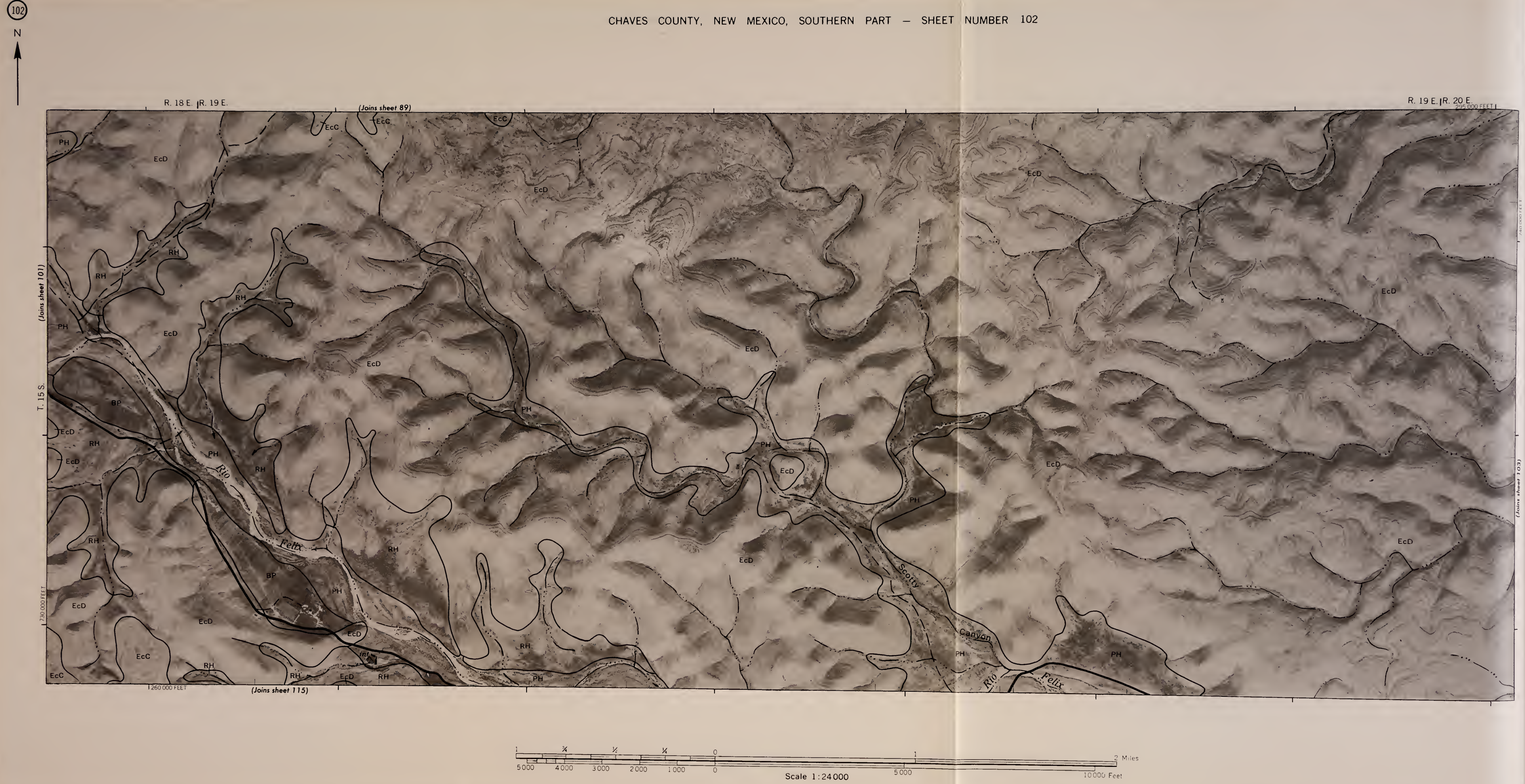
N

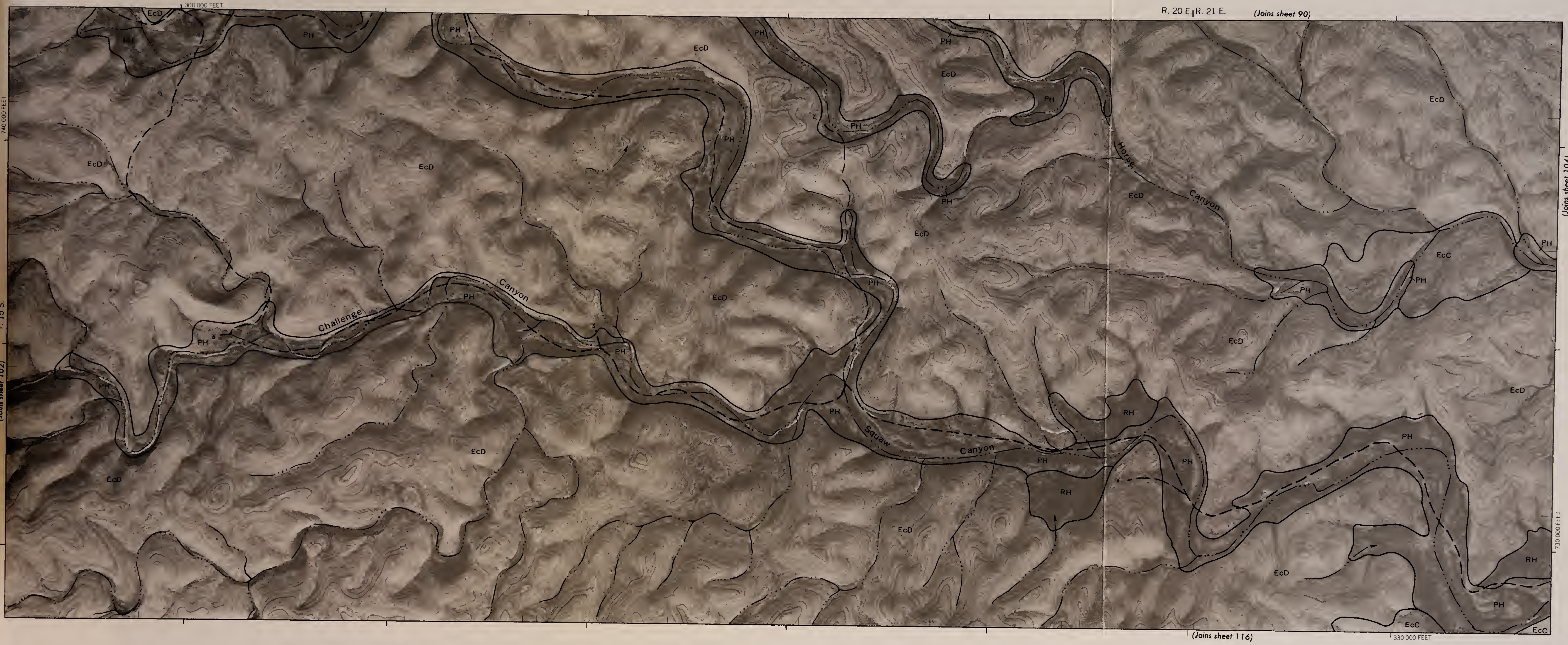
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 102



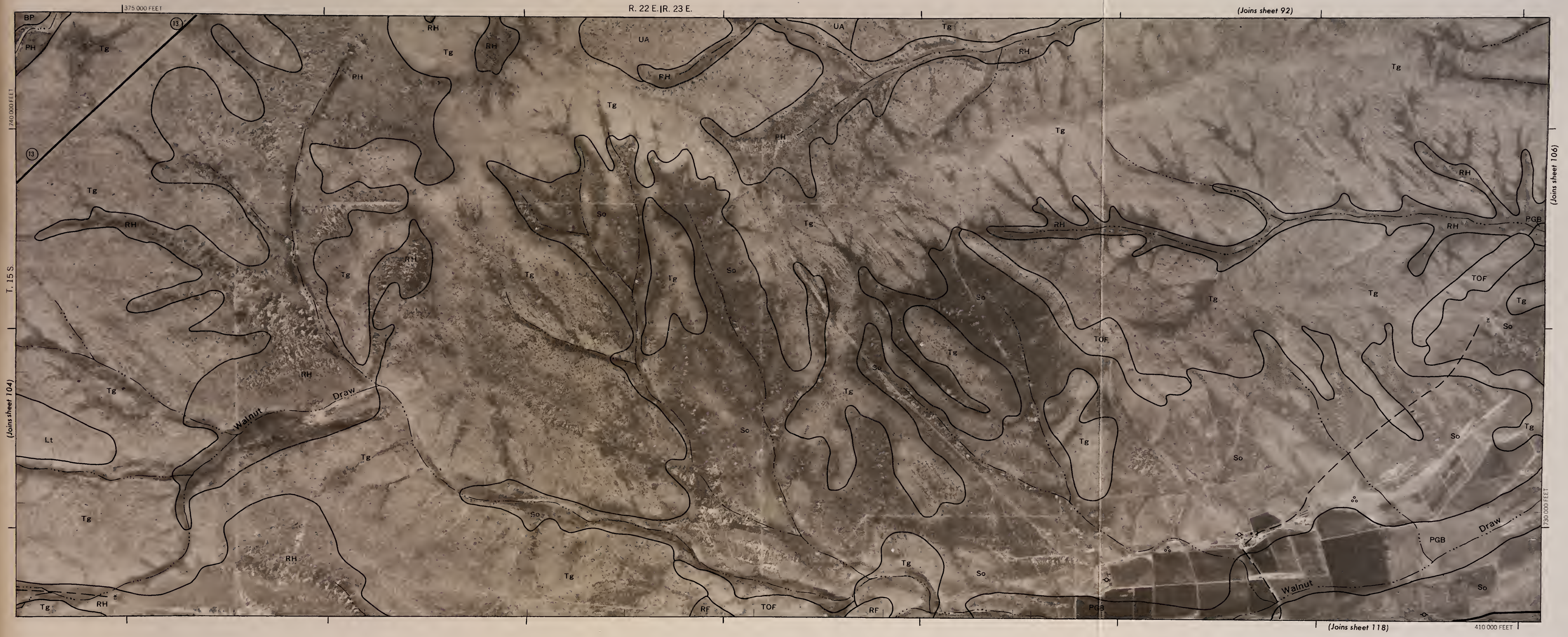

N
R. 20 E. | R. 21 E.
(Joins sheet 90)
(Joins sheet 104)
(Joins sheet 116)
(Joins sheet 102)
300 000 FEET
740 000 FEET
730 000 FEET
330 000 FEET
T. 15 S.
Challenge Canyon
Squaw Canyon
Horse Canyon
EcD
EcC
PH
RH
Scale 1:24000
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

1 ½ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N



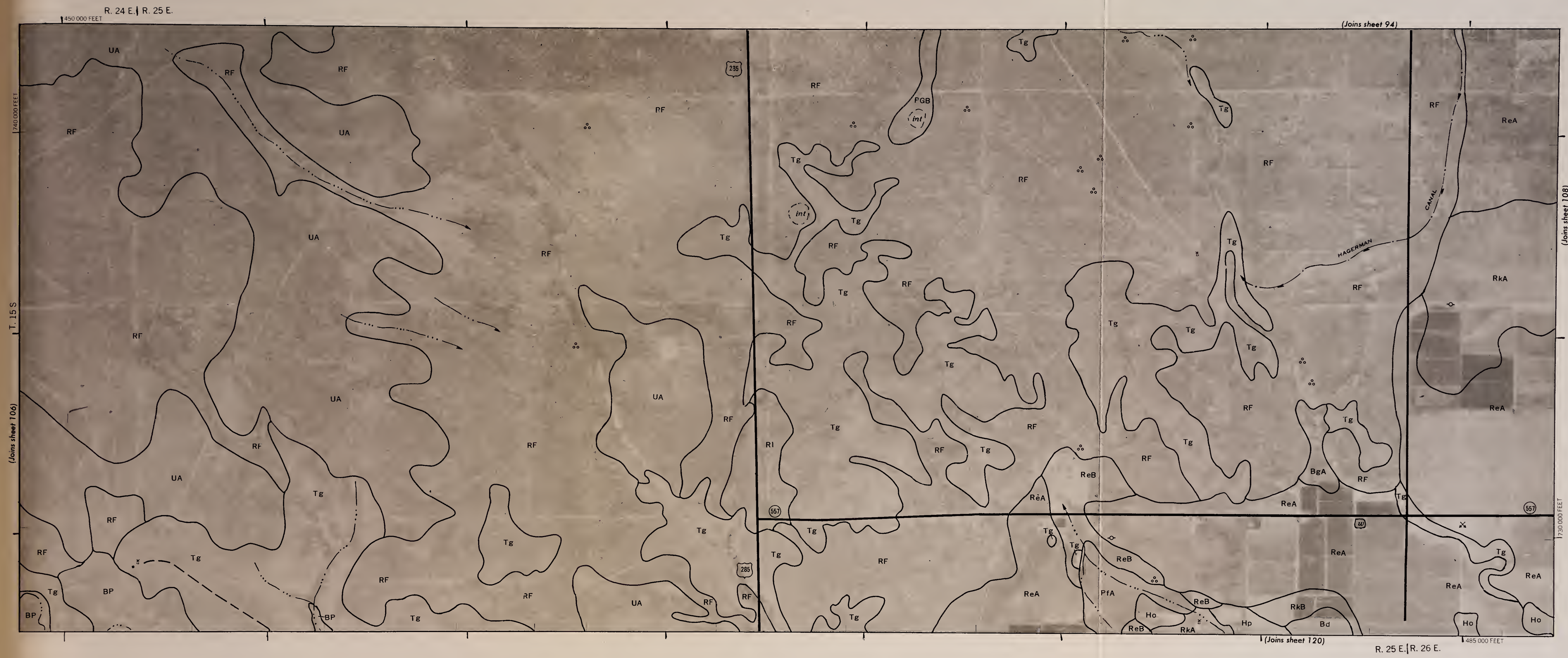
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000


N
(Joins sheet 93)
(Joins sheet 105)
(Joins sheet 107)
(Joins sheet 119)
445 000 FEET
415 000 FEET
730 000 FEET
T. 15 S.
R. 23 E. | R. 24 E.
Antelope
Draw
Walnut
Canyon
Walnut
Creek
Tg
RH
PGB
So
UA
RF
BP
RI
int
Scale 1:24000
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

N



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 109

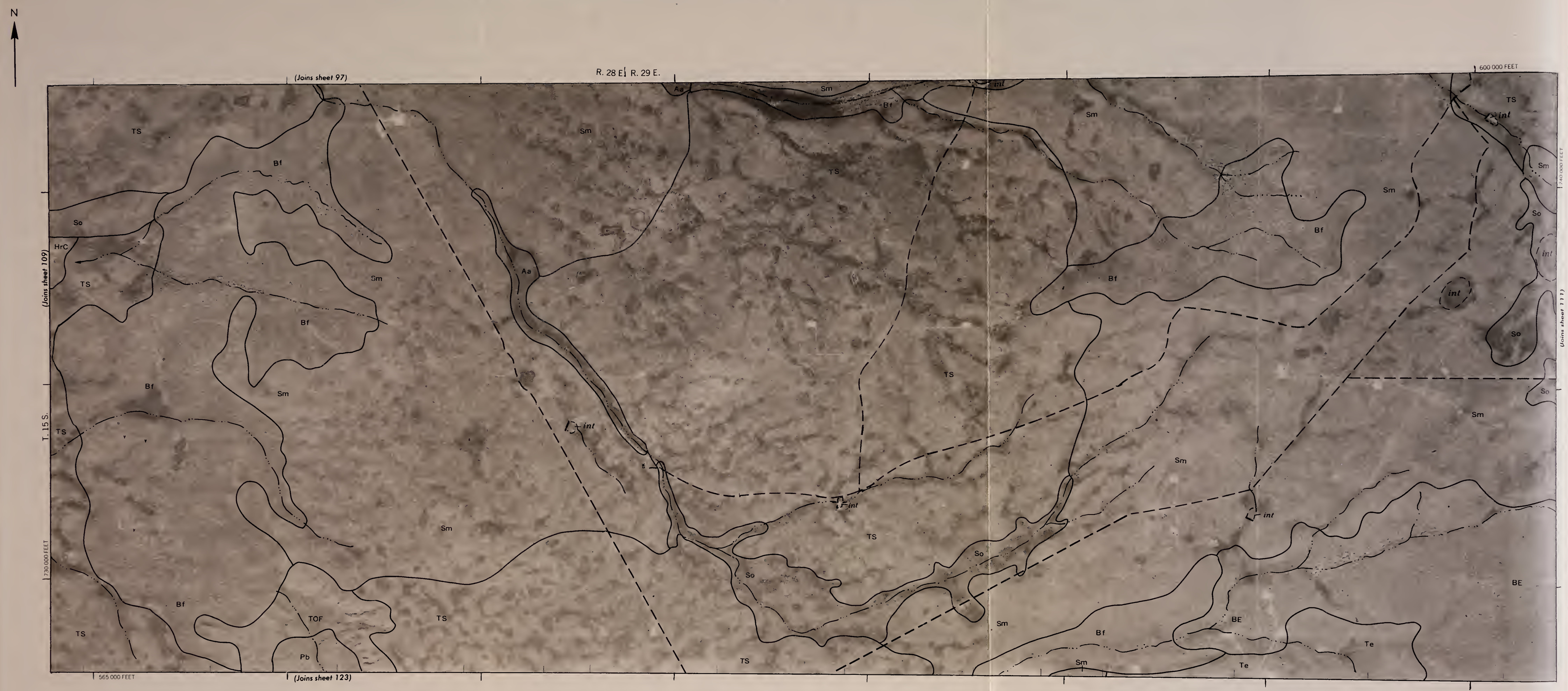
N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 110



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 111

111

N

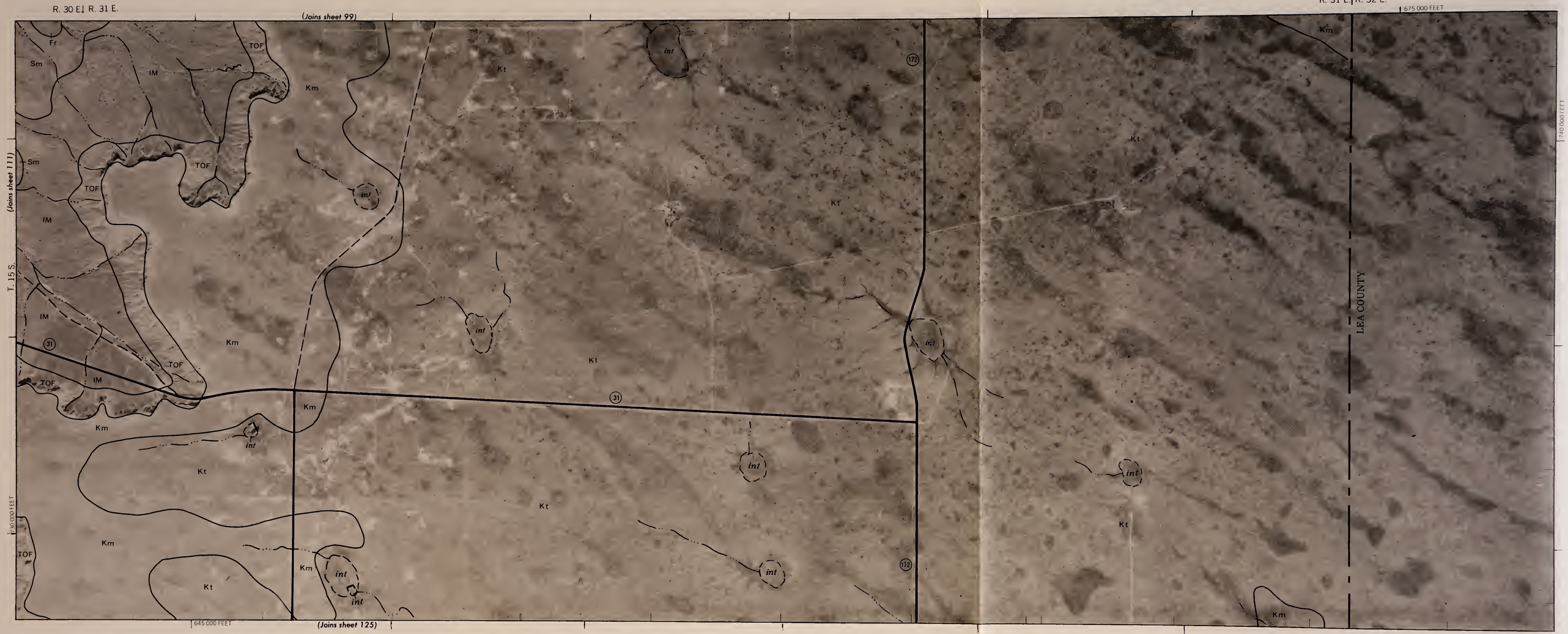
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24 000

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 112



1 ¾ ½ ¼ 0 1 2 Miles

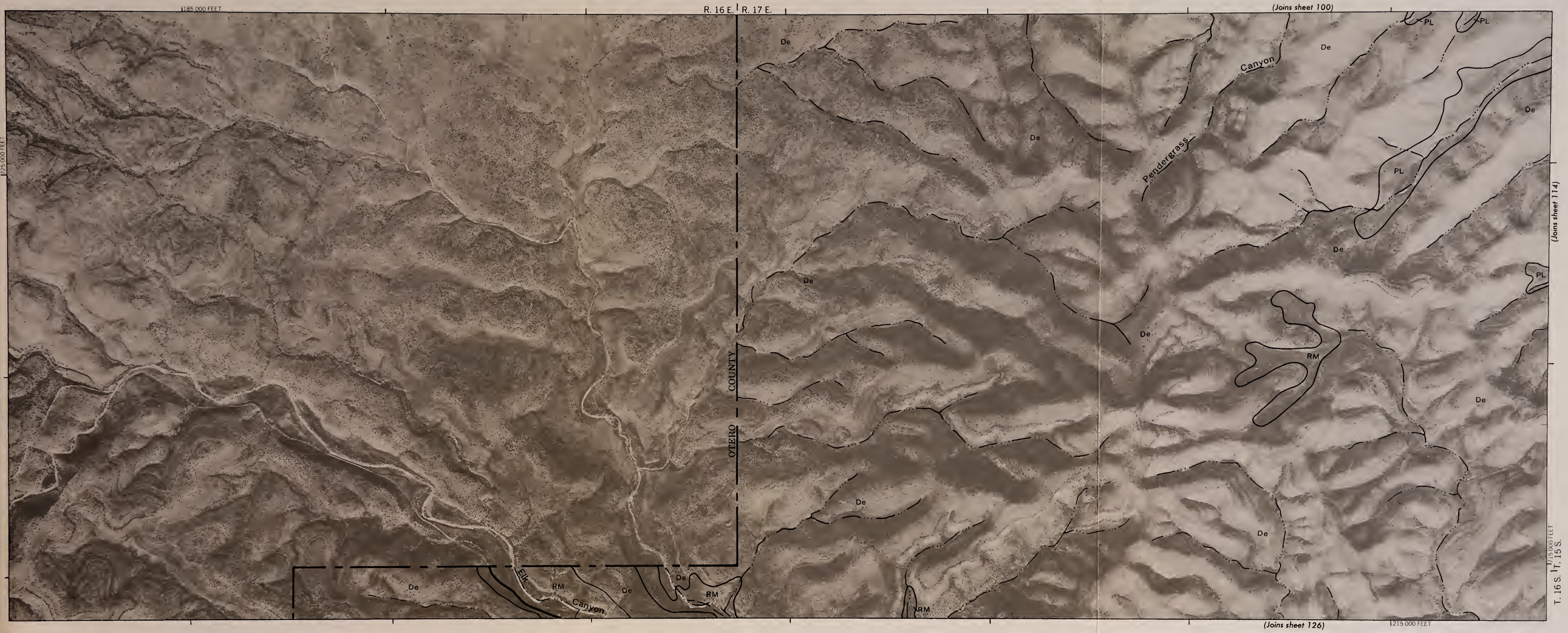
5000 4000 3000 2000 1000 0 5000 10 000 Feet

Scale 1:24 000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 113

113

N



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24 000

This map was compiled on 1974 and 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 114

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24 000

Department of the Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 116

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10 000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

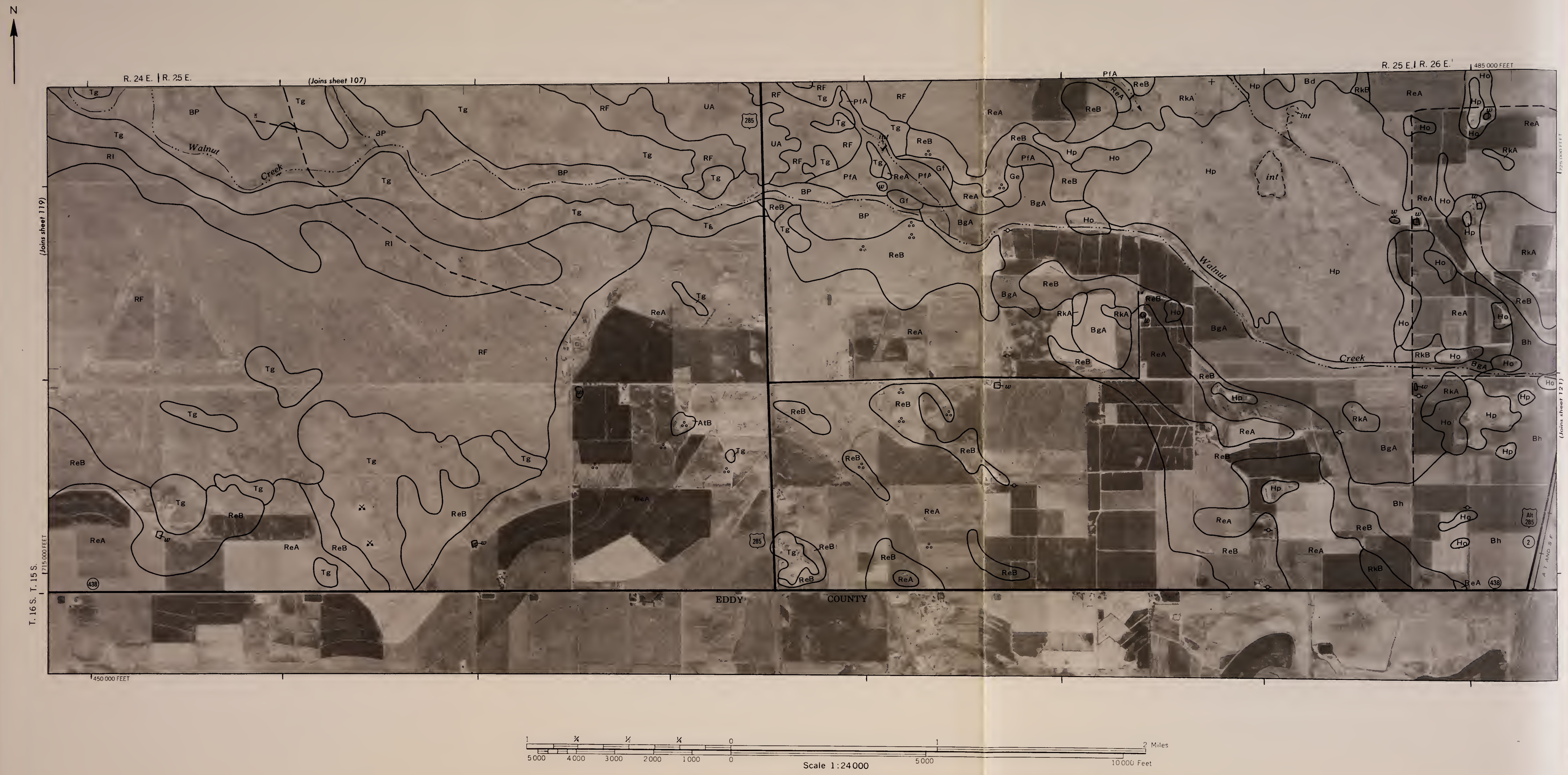

N
(Joins sheet 105)
R. 22 E. | R. 23 E.
410 000 FEET
(Joins sheet 117)
(Joins sheet 119)
T. 16 S | T. 15 S.
375 000 FEET
Earl Draw
Cottonwood Creek
EDDY COUNTY
Tg
RI
RH
RF
So
UA
TOF
TfD
EcC
HSE
BP
int
1 ¼ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10 000 Feet
Scale 1:24 000

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000


N
R. 24 E. | R. 25 E.
(Joins sheet 107)
R. 25 E. | R. 26 E.
485 000 FEET
(Joins sheet 119)
(Joins sheet 121)
T. 16 S. T. 15 S.
1 715 000 FEET
450 000 FEET
Walnut Creek
EDDY COUNTY
285
438
Alt 285
Tg
BP
RF
UA
Rl
ReA
ReB
AtB
PfA
Gf
Ge
BgA
RkA
RkB
Hp
Ho
Bd
Bh
int
w
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

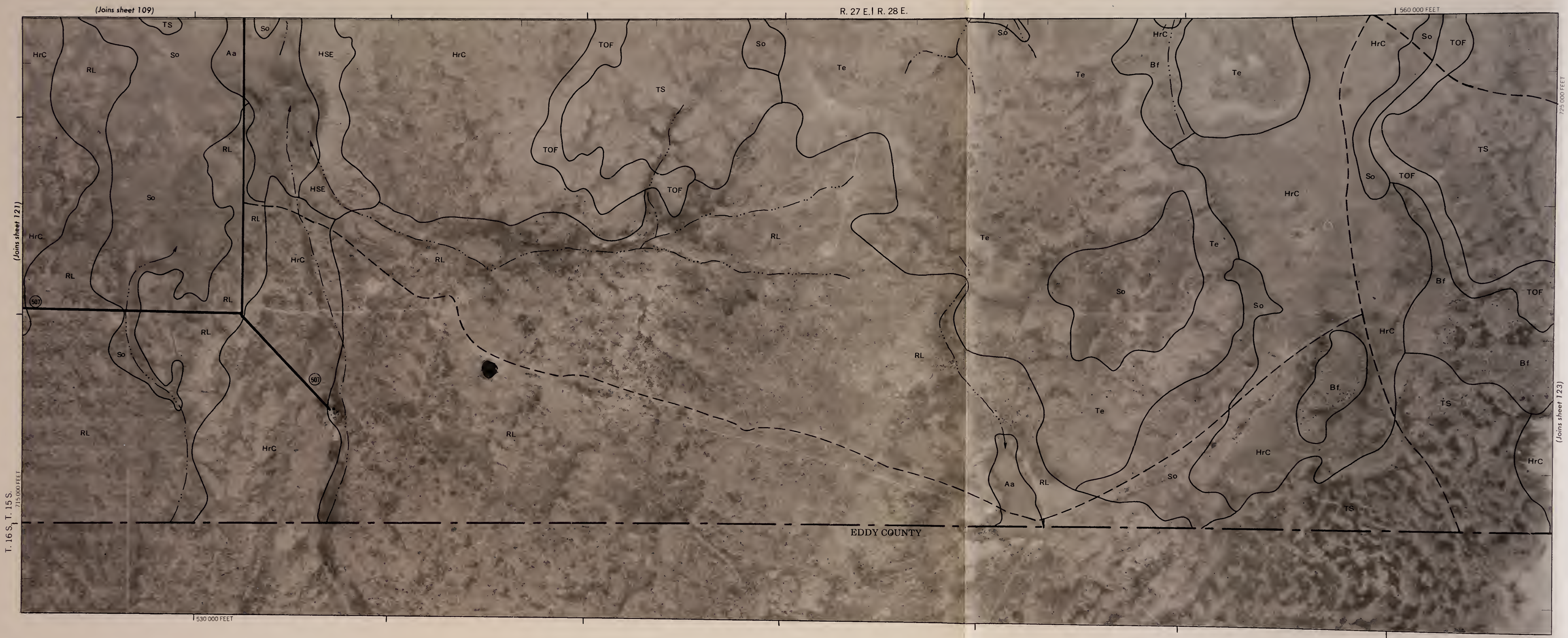
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

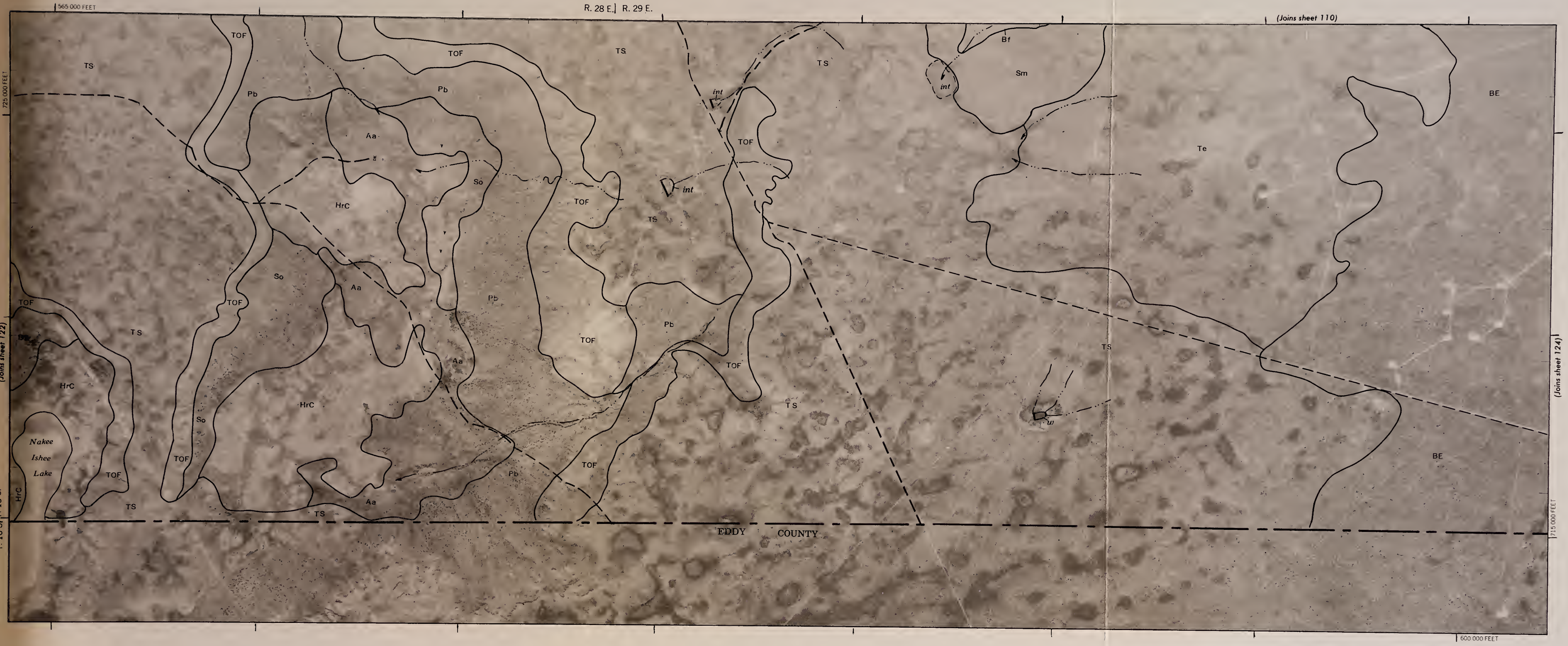
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

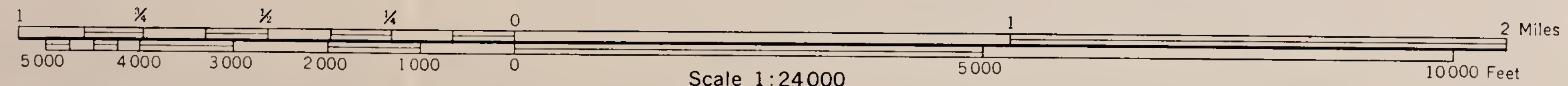
N



Scale 1:24000
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 123





Scale 1:24000

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

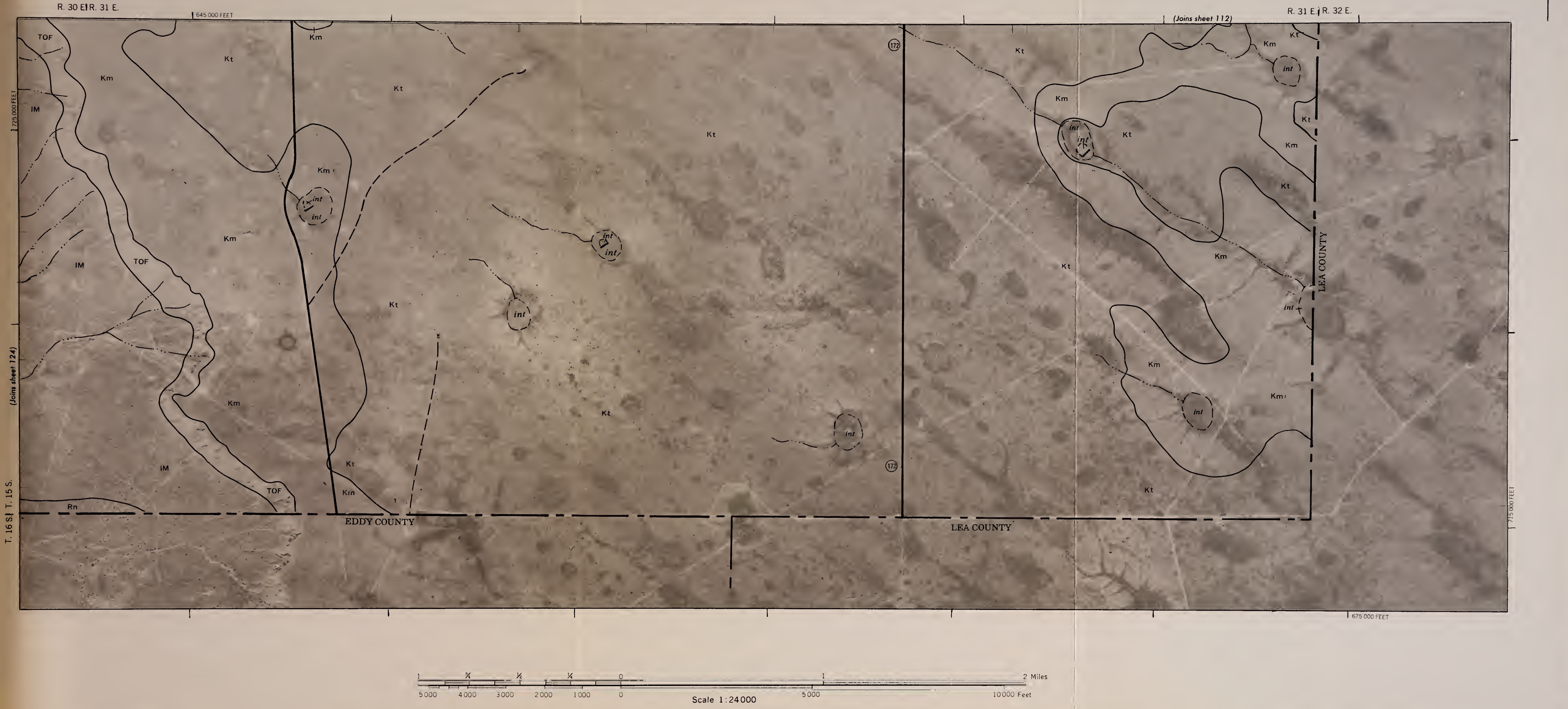
N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 124

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



This map was compiled on 1974 and 1975 U S Department of The Interior, Geological Survey orthophotography by the U S Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

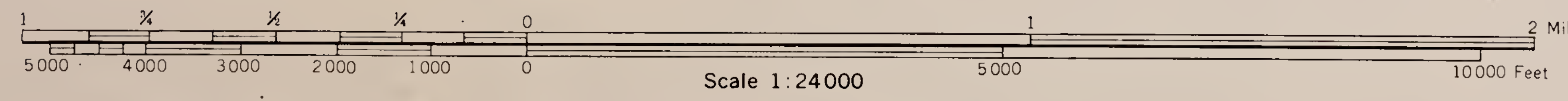
N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10 000 Feet

Scale 1:24 000

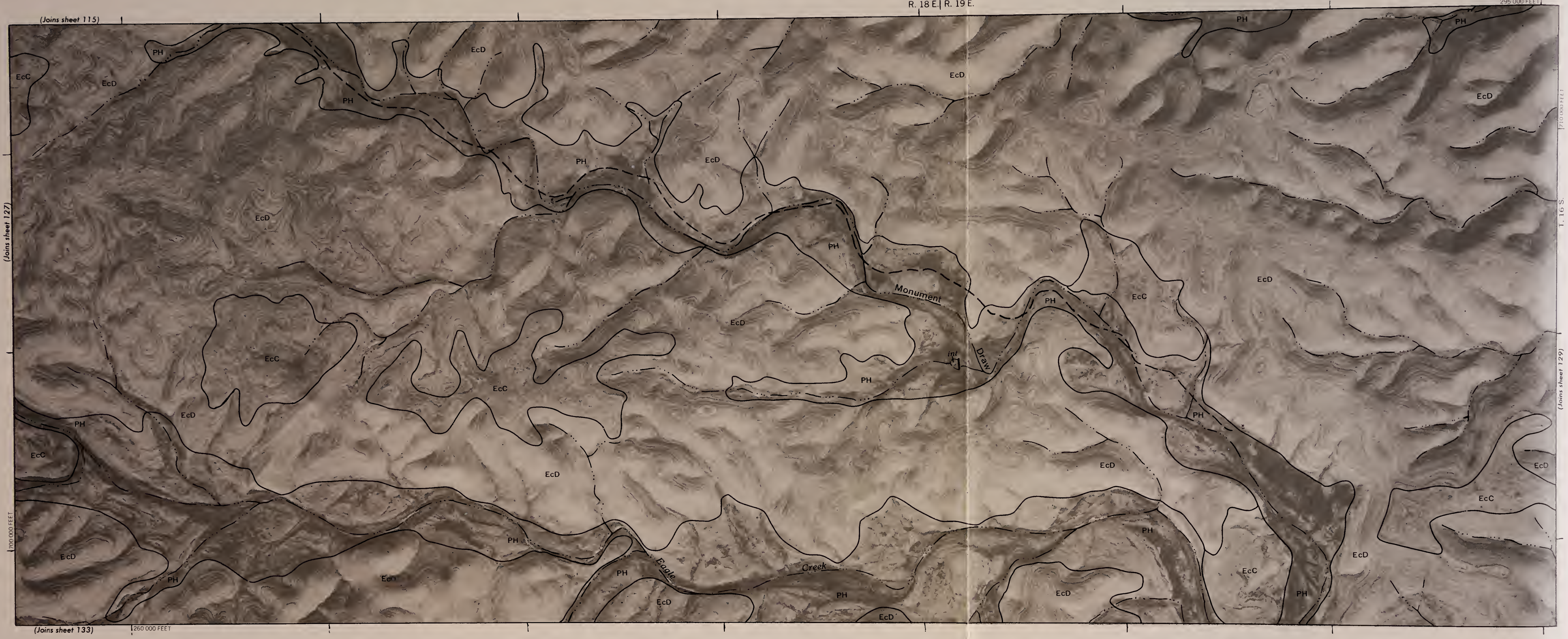
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 127



This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners, if shown, are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 128

N



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

129

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART 128

This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N

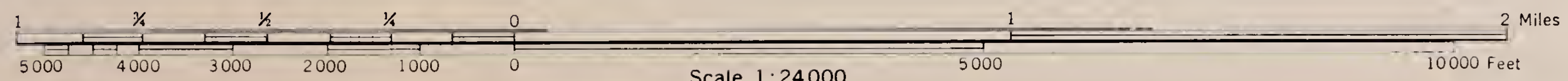
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 130

INSET A

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 132

N

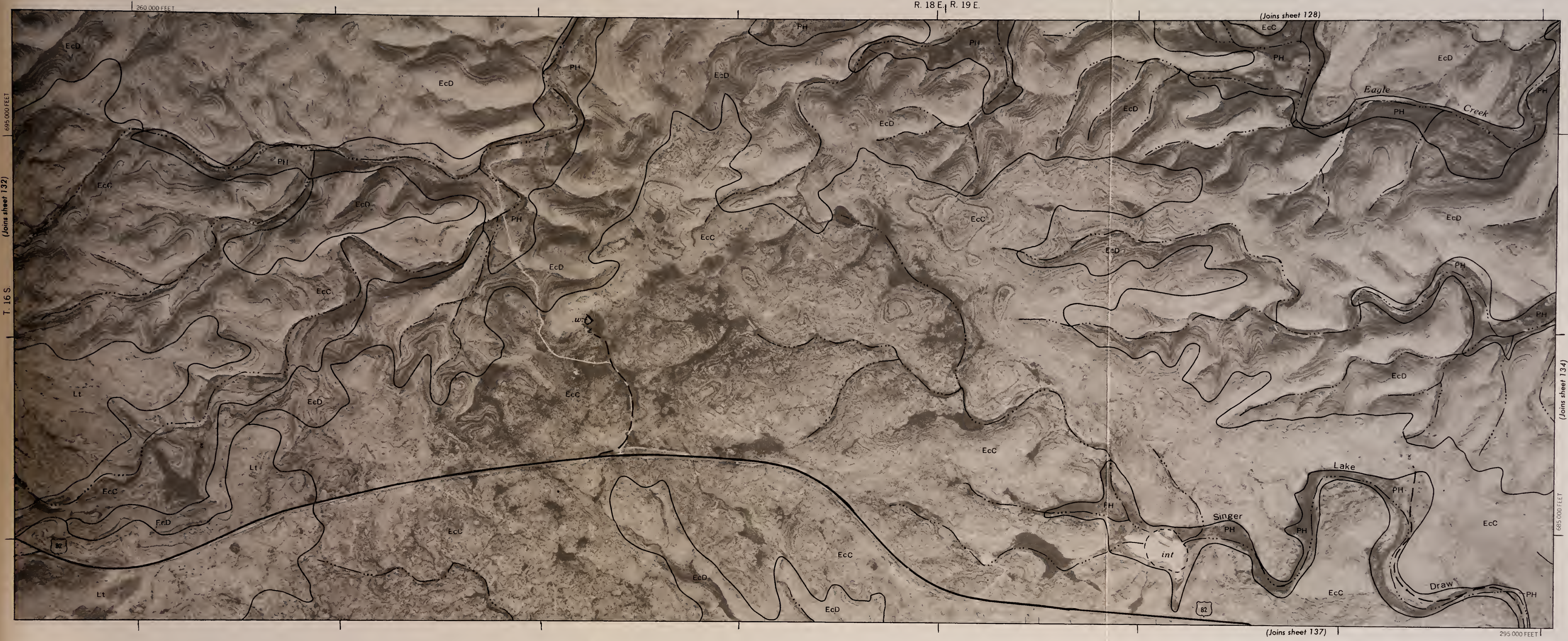
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 133

N



1 ½ ¼ ¼ 0 1 2 Miles

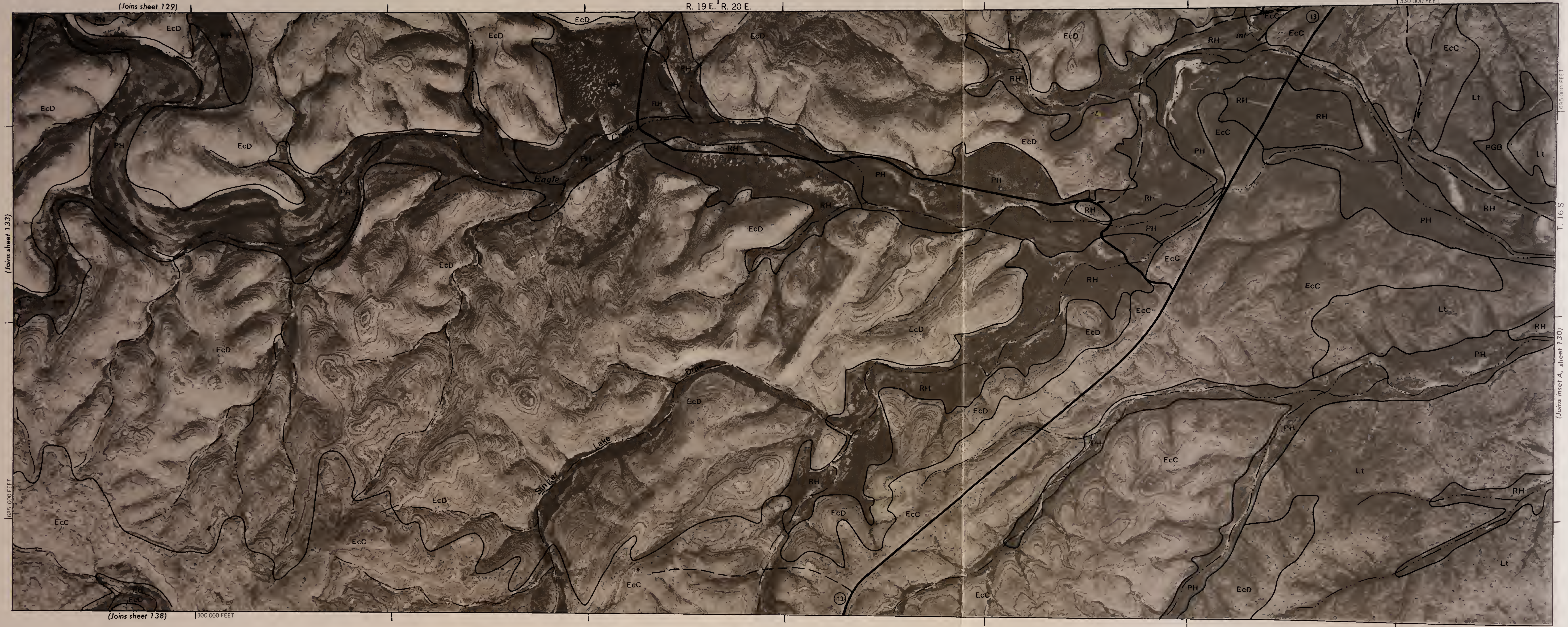
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 134

N

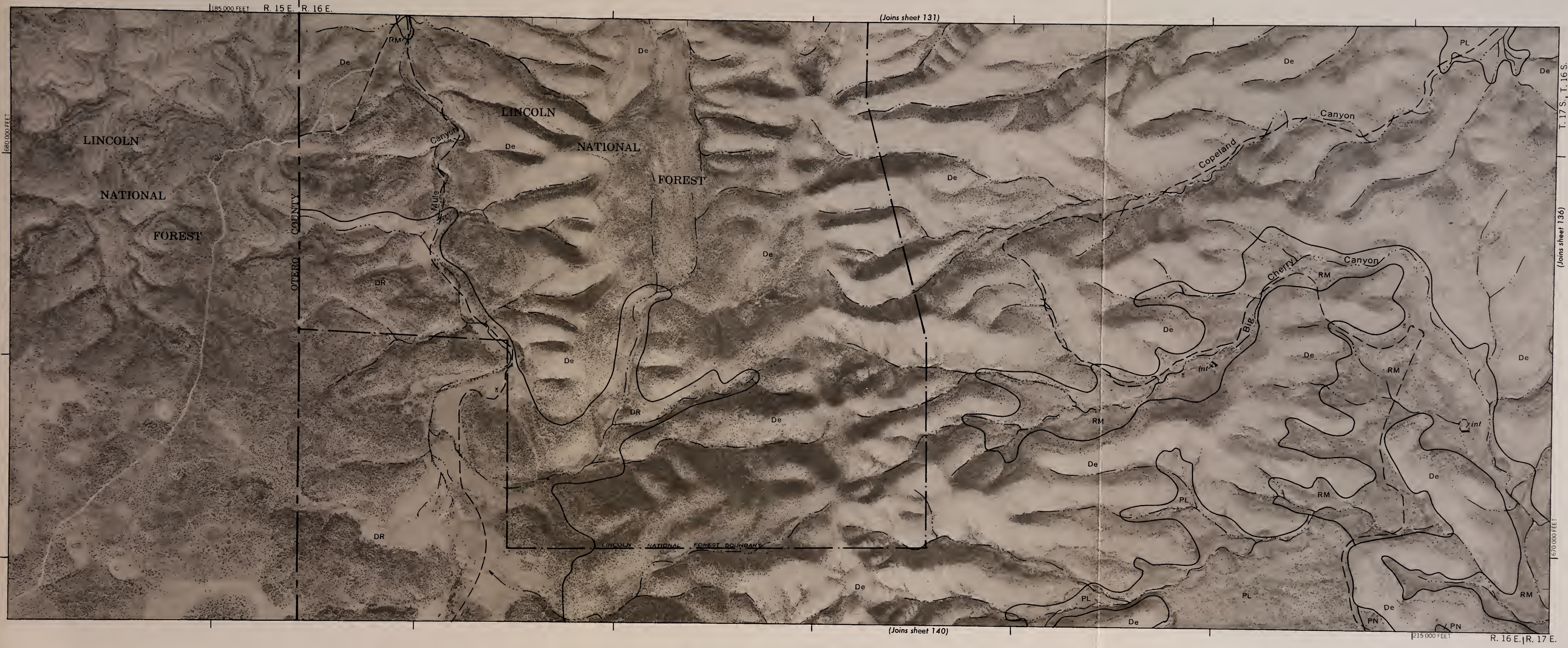


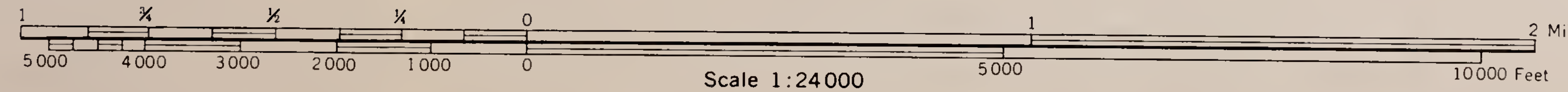
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

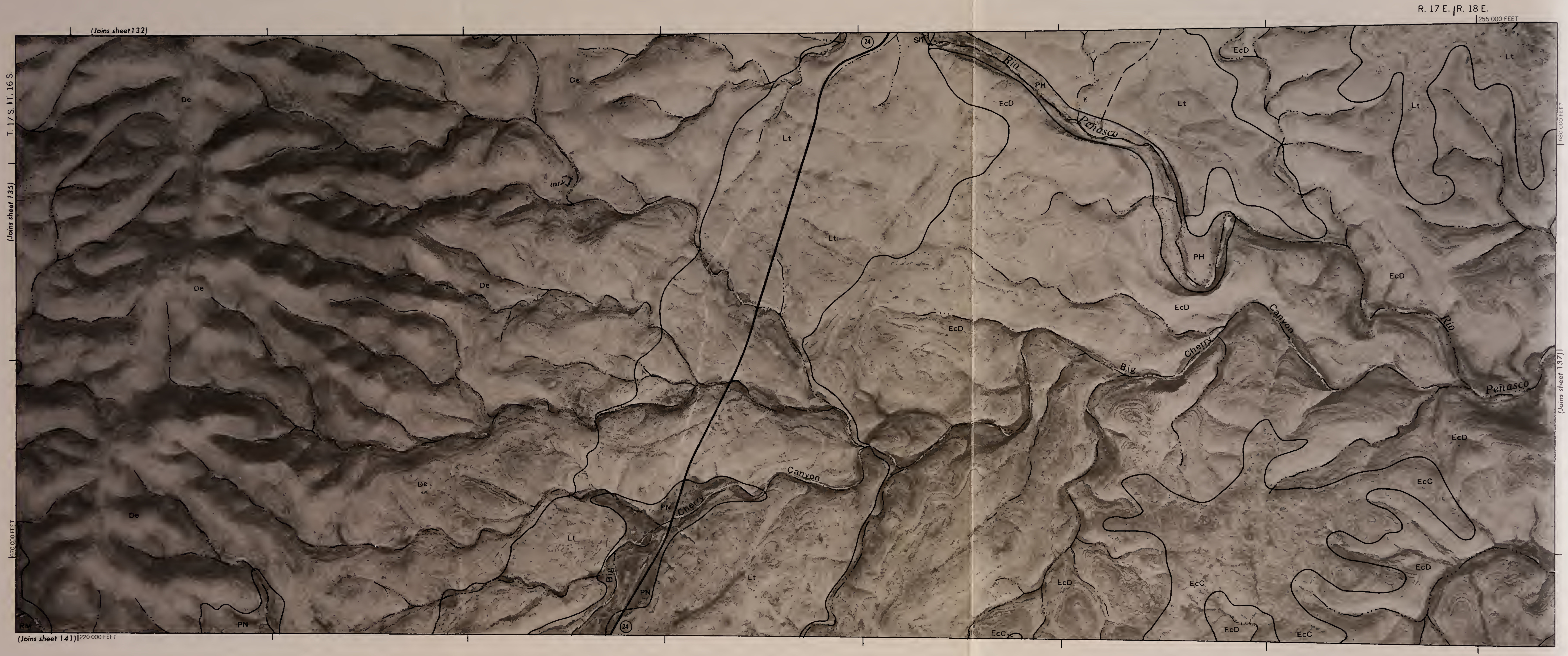




Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N



1 ½ ¼ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

138

N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 138

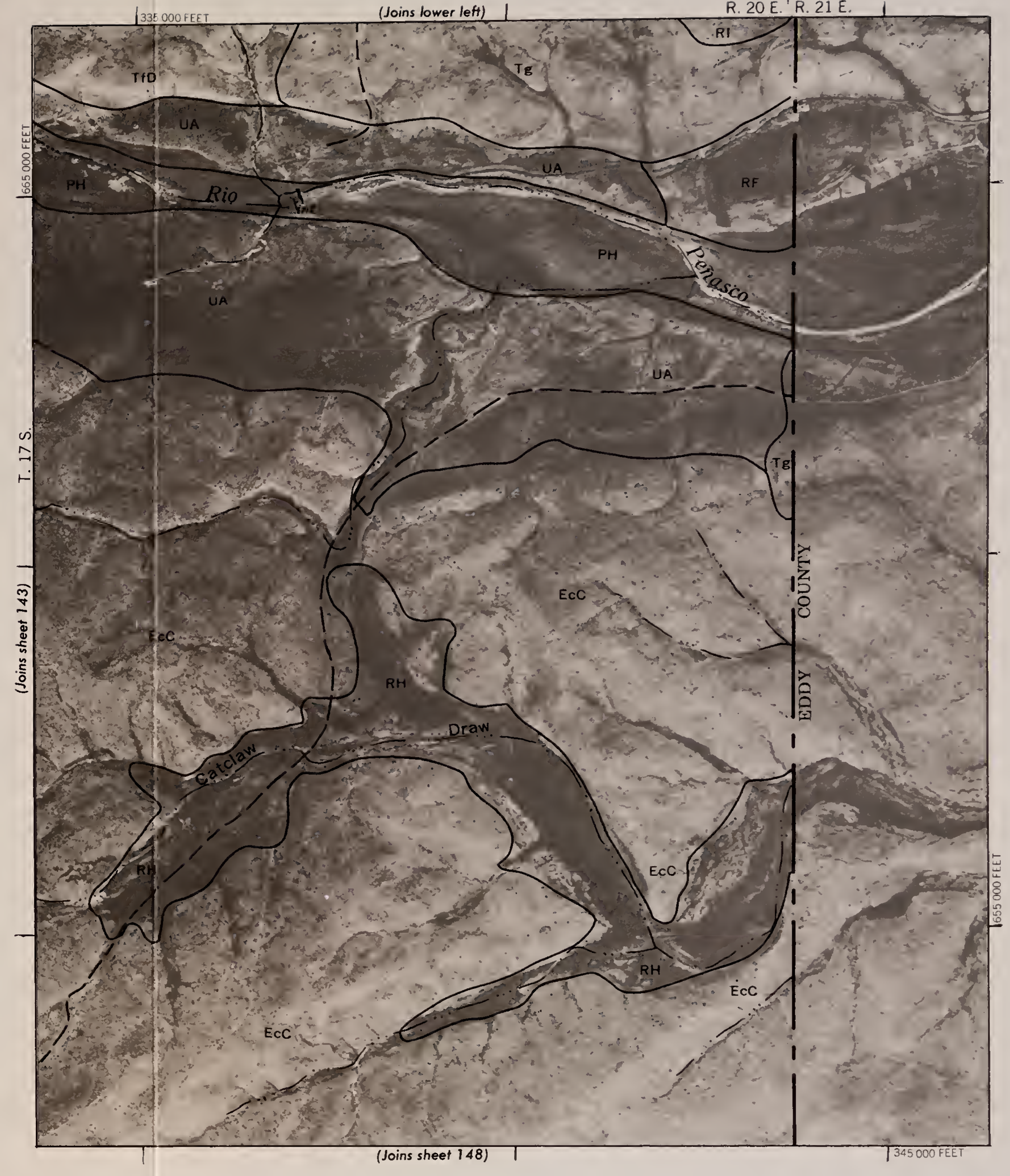
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10 000 Feet

Scale 1:24000

N

INSET A



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U S Department of the Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 140

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 141

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

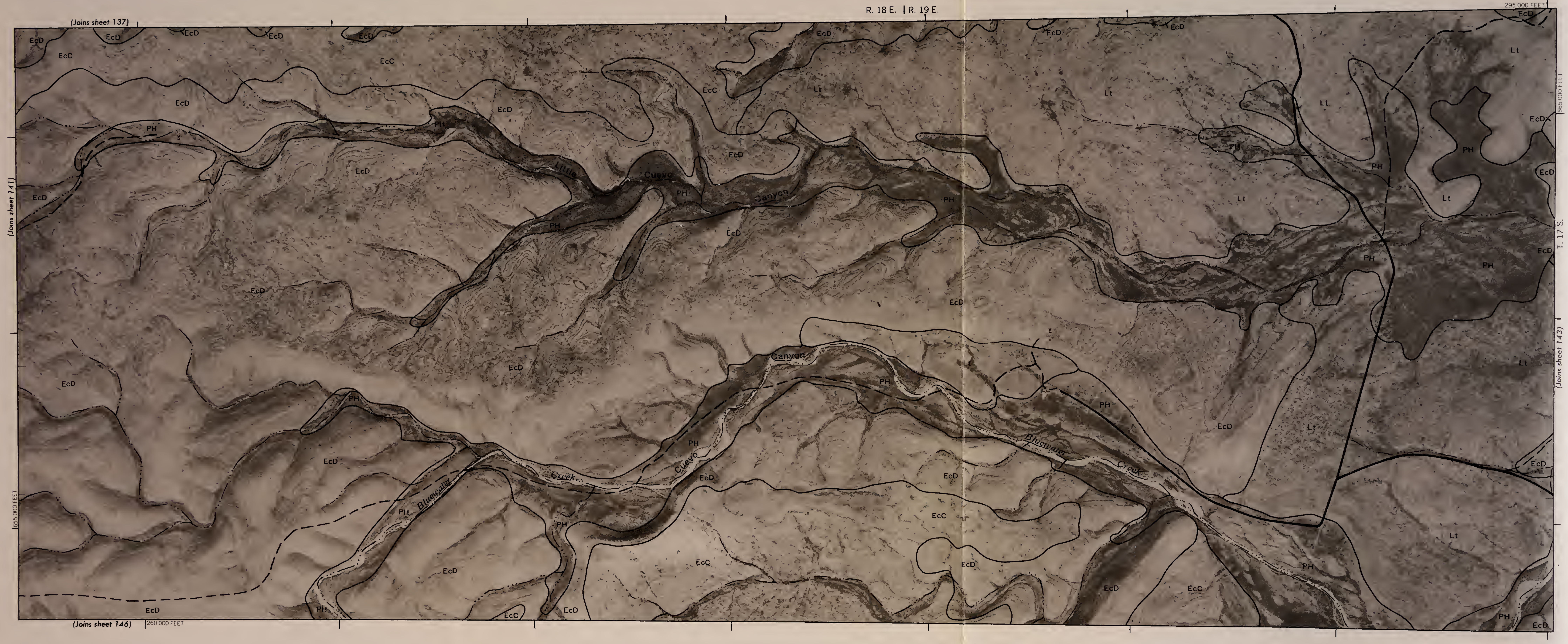
Scale 1:24000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 142

N



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

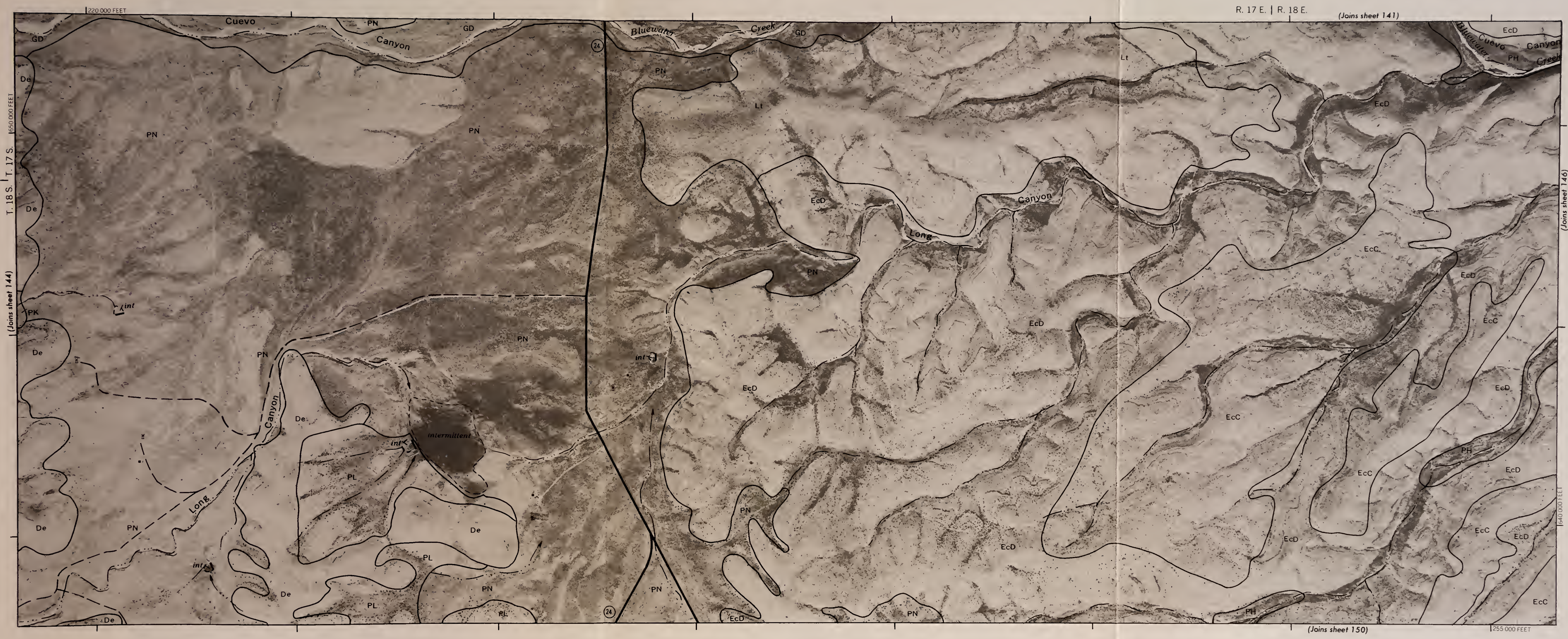
This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

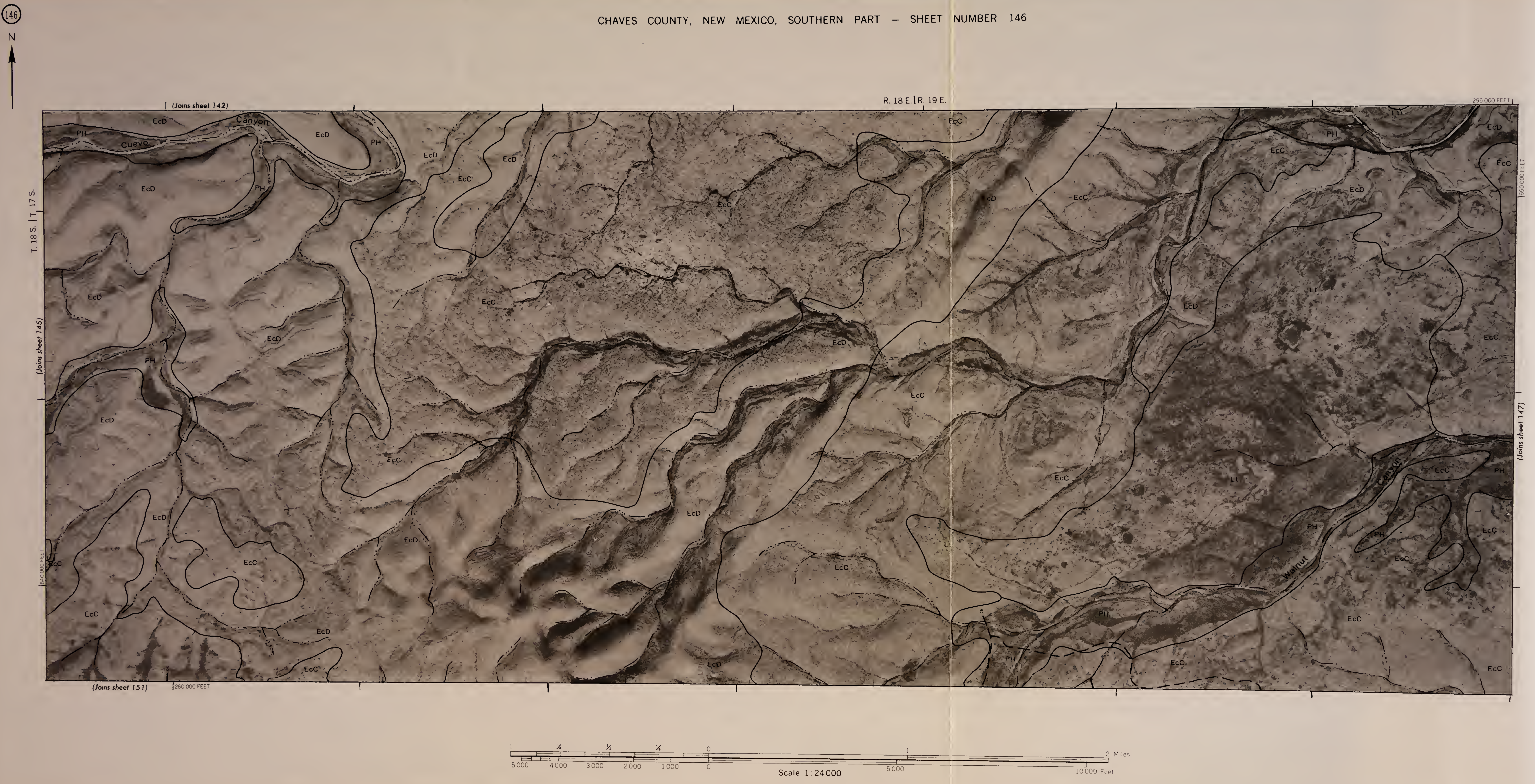
Scale 1:24000



1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 146



N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3000 2000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

This map was compiled on 1974 and 1975 U S Department of the Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

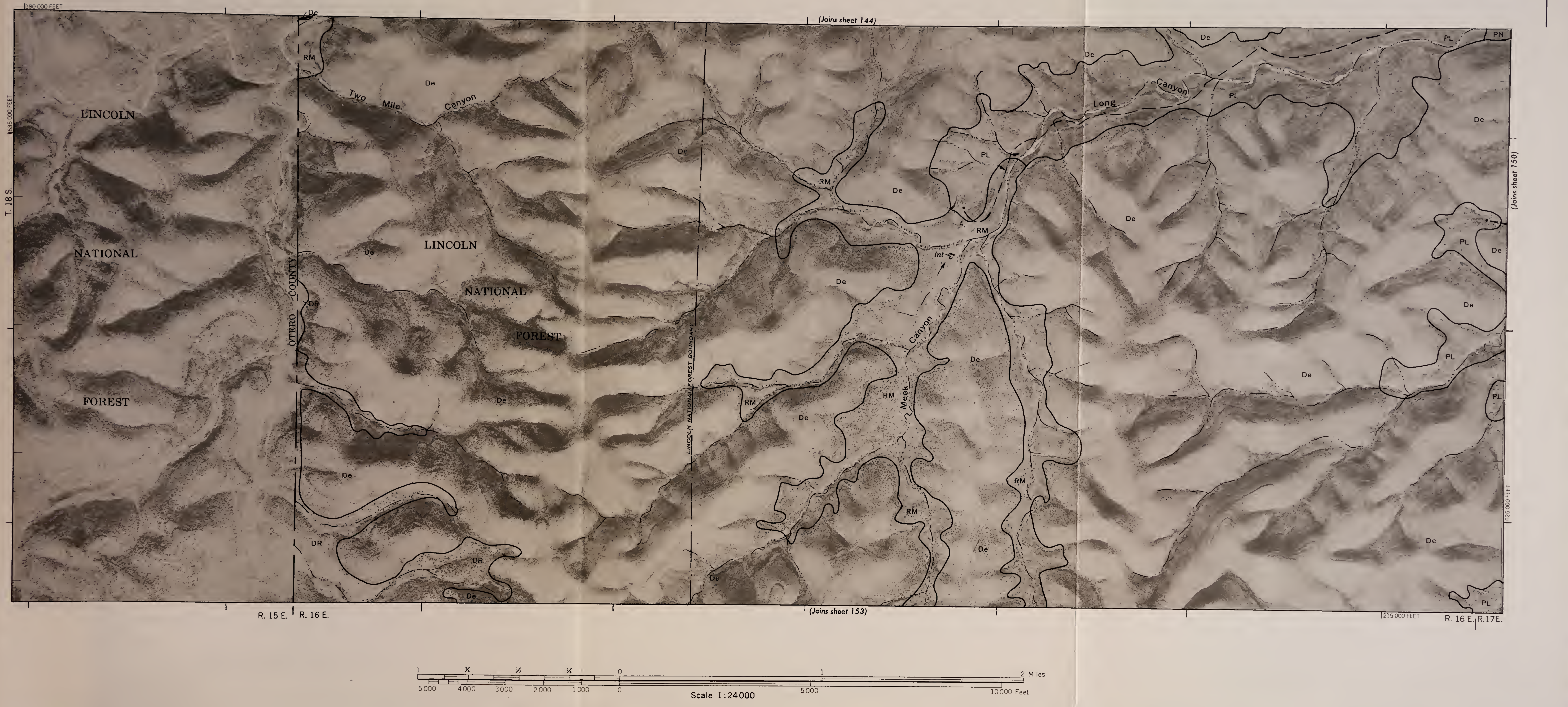
N

INSET A

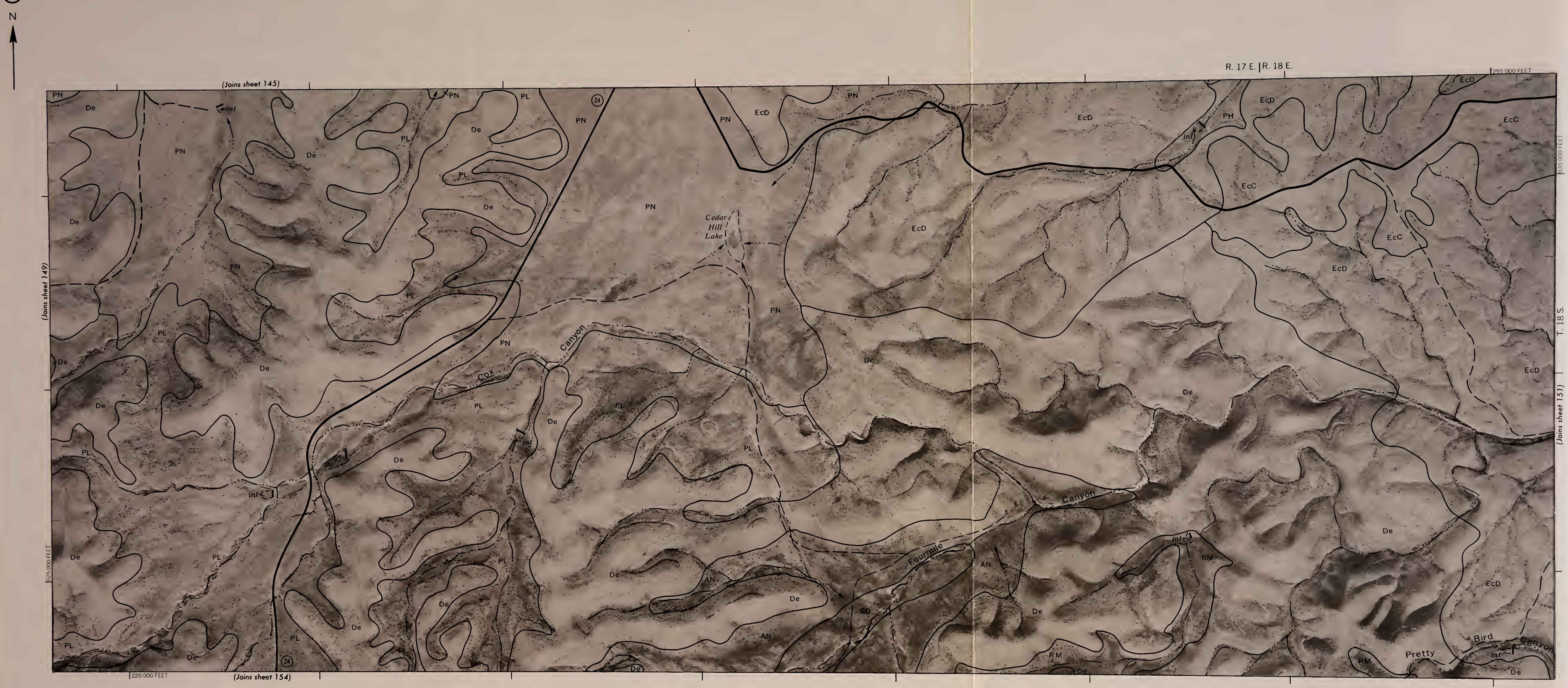
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 151

151

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

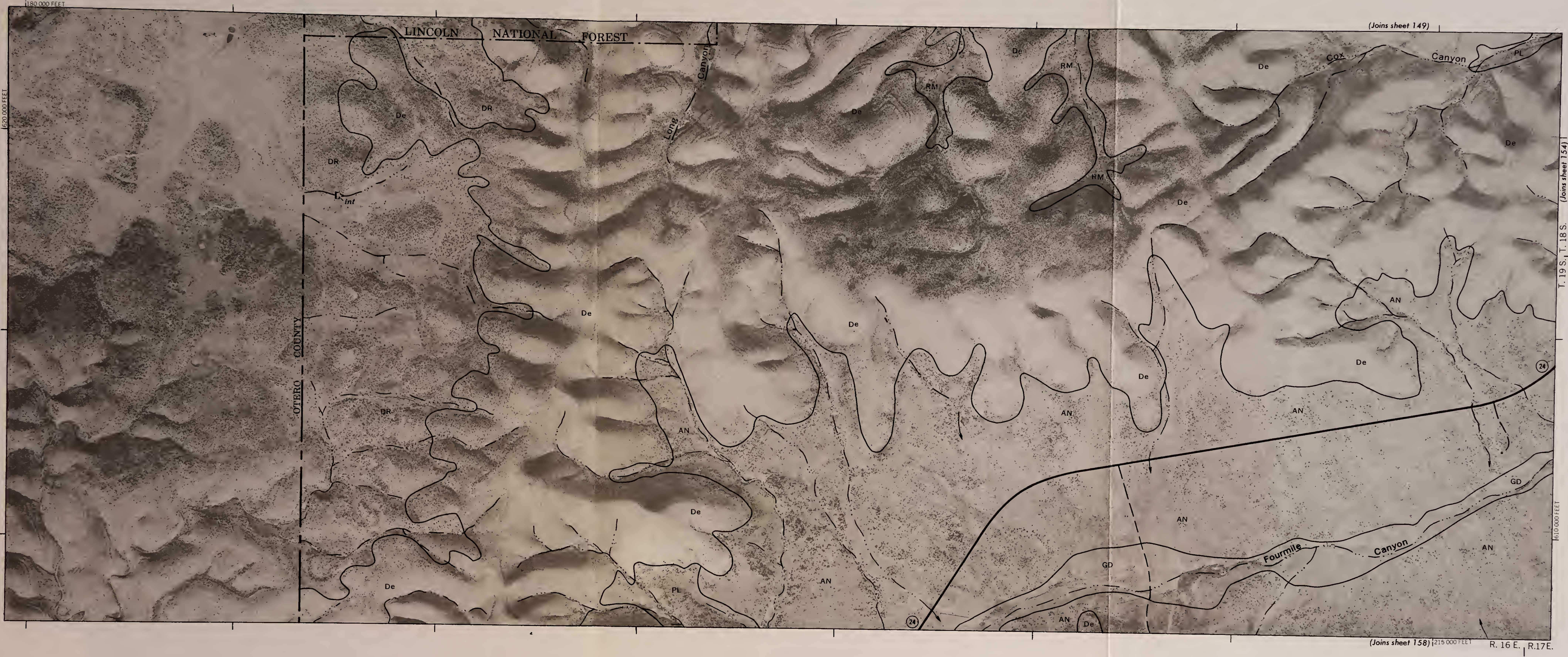
N

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 152

1 ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

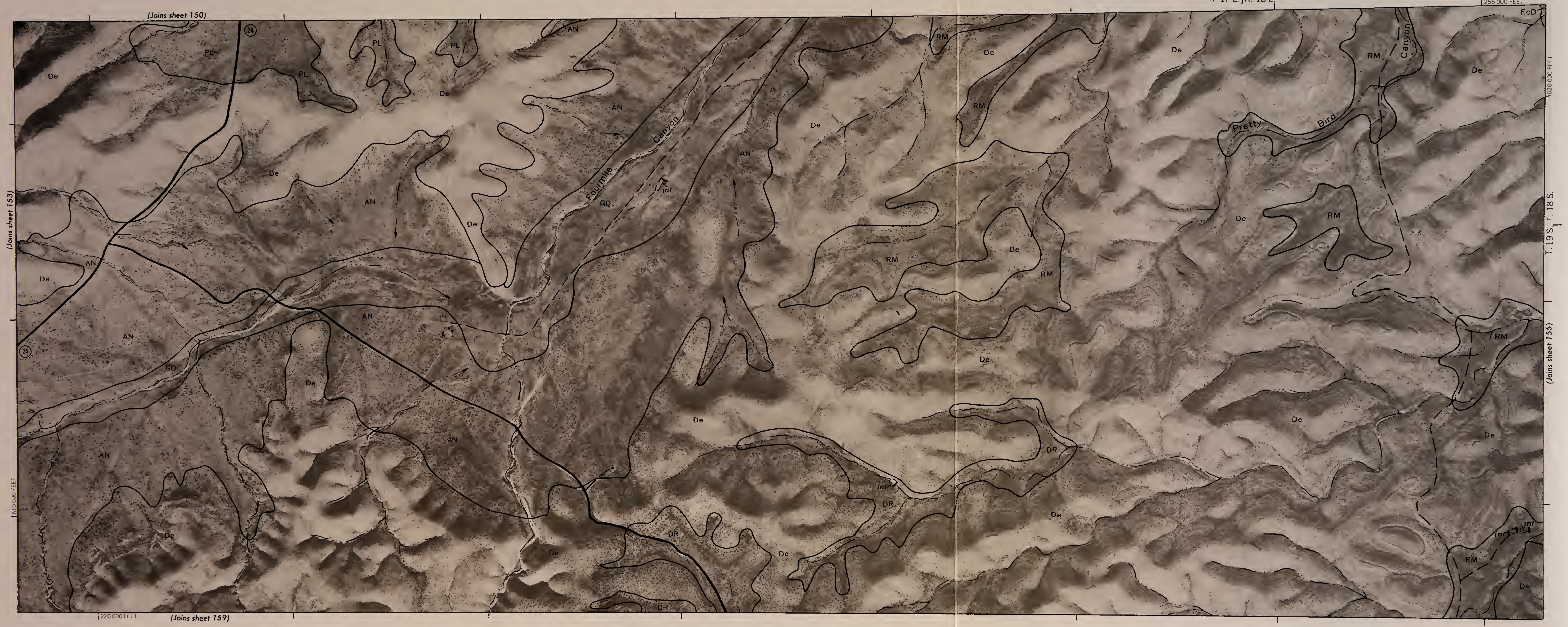
Scale 1:24000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 154

N



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

INSET A

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of the Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 158

N

R. 16 E. R. 17E.

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4000 3000 2000 1000 0 5 000 10 000 Feet

Scale 1:24 000

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

N

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet
Scale 1:24 000

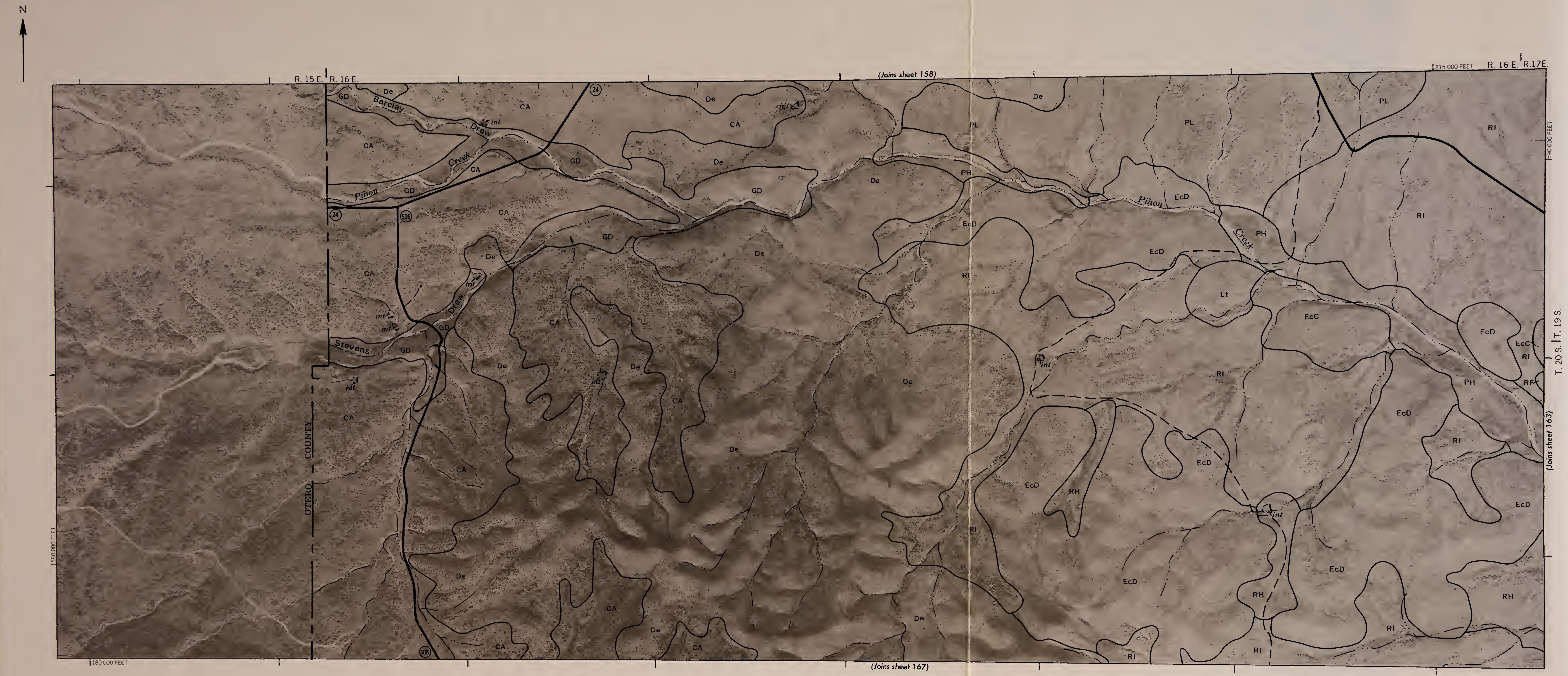
N

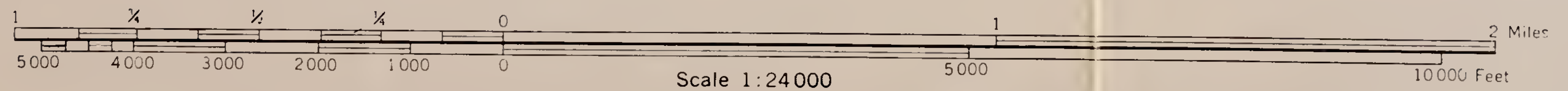
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.





Scale 1:24 000

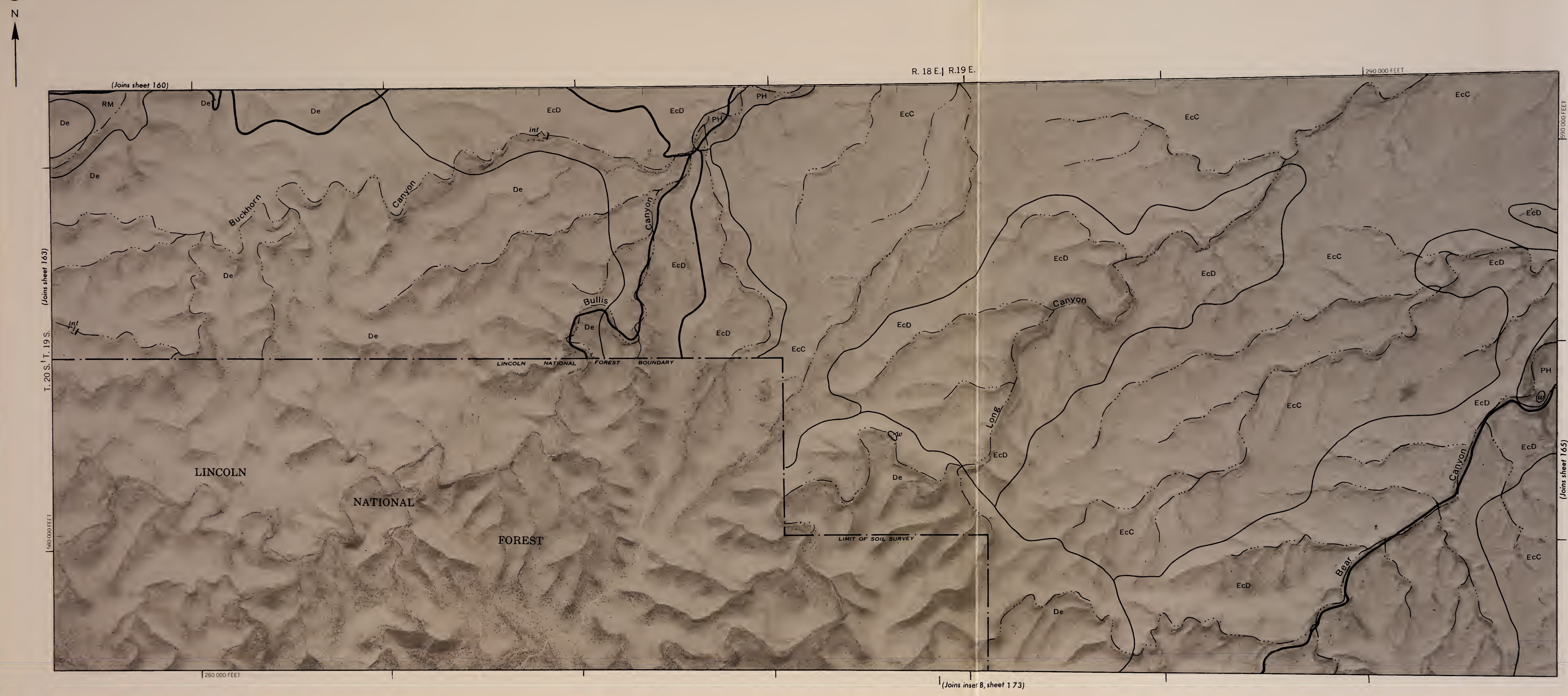
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of the Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 164



Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 165

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. 5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N

INSET A

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

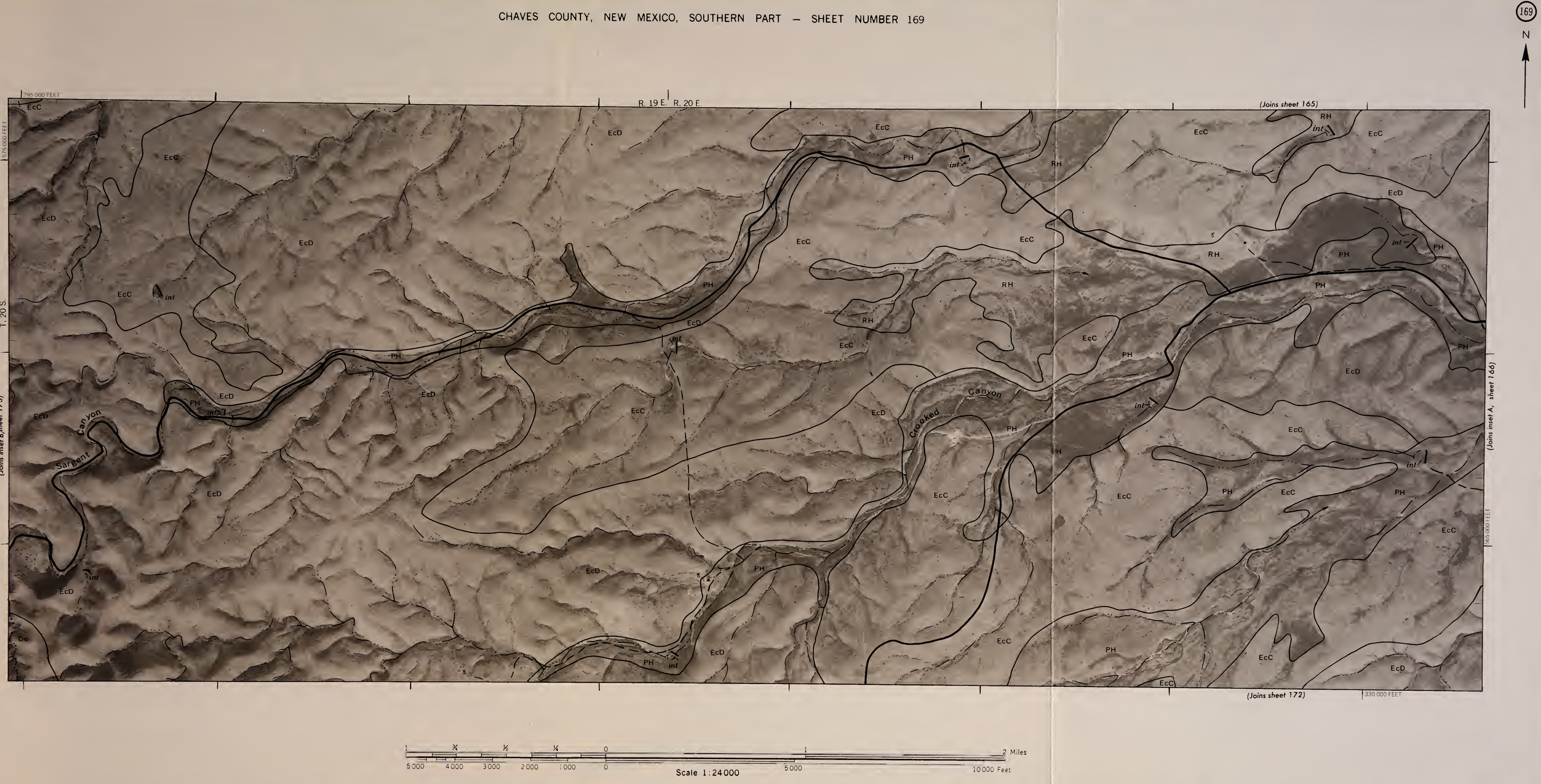
Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 168

5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.
This map was compiled on 1974 and 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

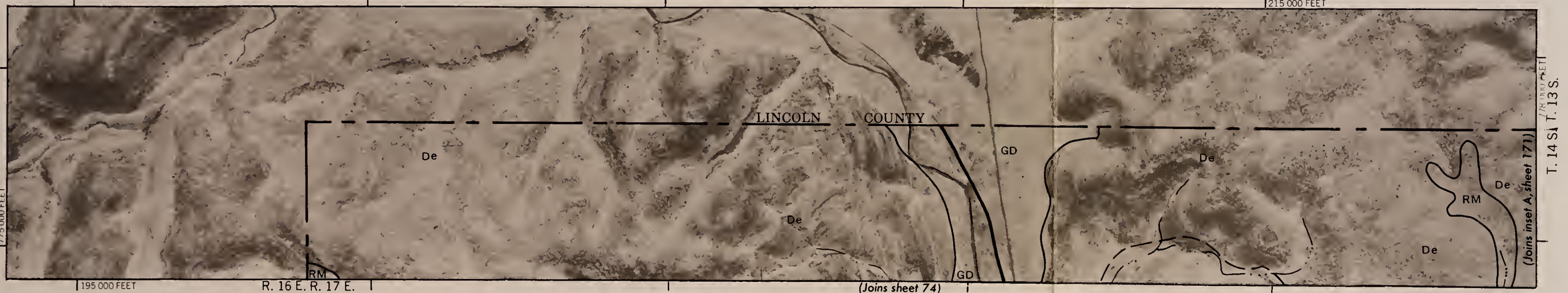
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 169



This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 170

INSET A



3000 AND 5000-FOOT GRID TICKS

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1974 and 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

N

3000 AND 5000-FOOT GRID TICKS

1 ¾ ½ ¼ 0 1 2 Miles

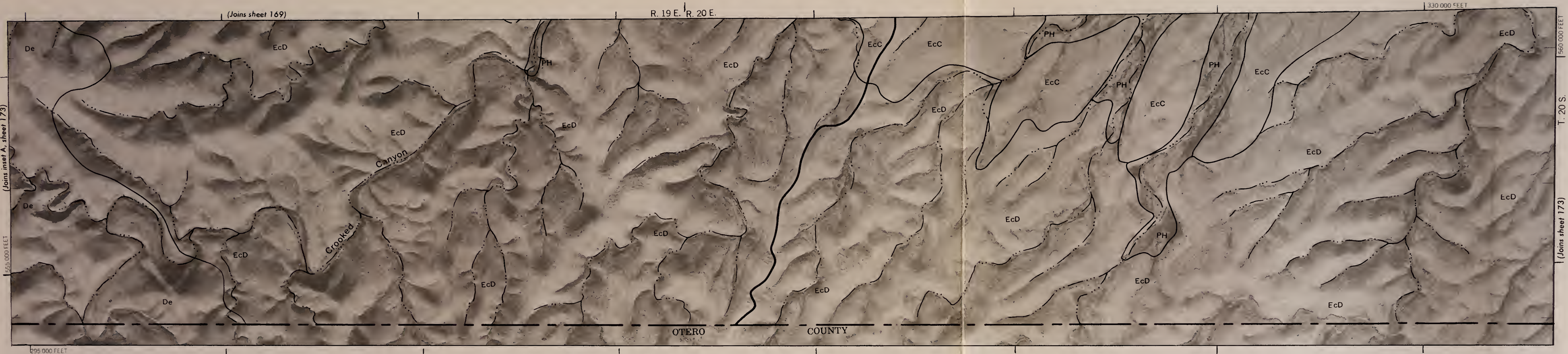
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

CHAVES COUNTY, NEW MEXICO, SOUTHERN PART — SHEET NUMBER 172

N



INSET A

4000 AND 5000-FOOT GRID TICKS

1 ¾ ½ ¼ 0 1 2 Miles

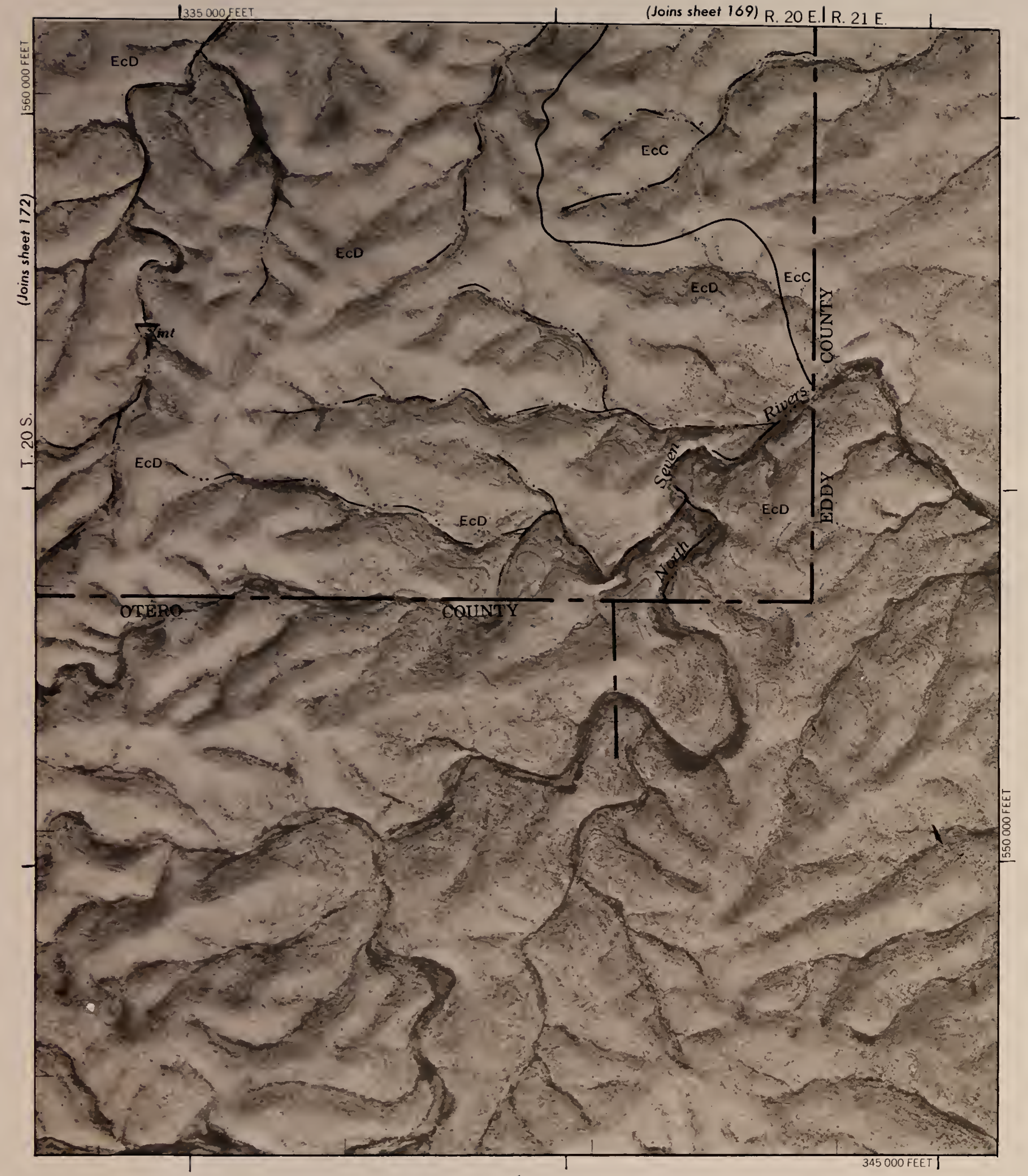
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

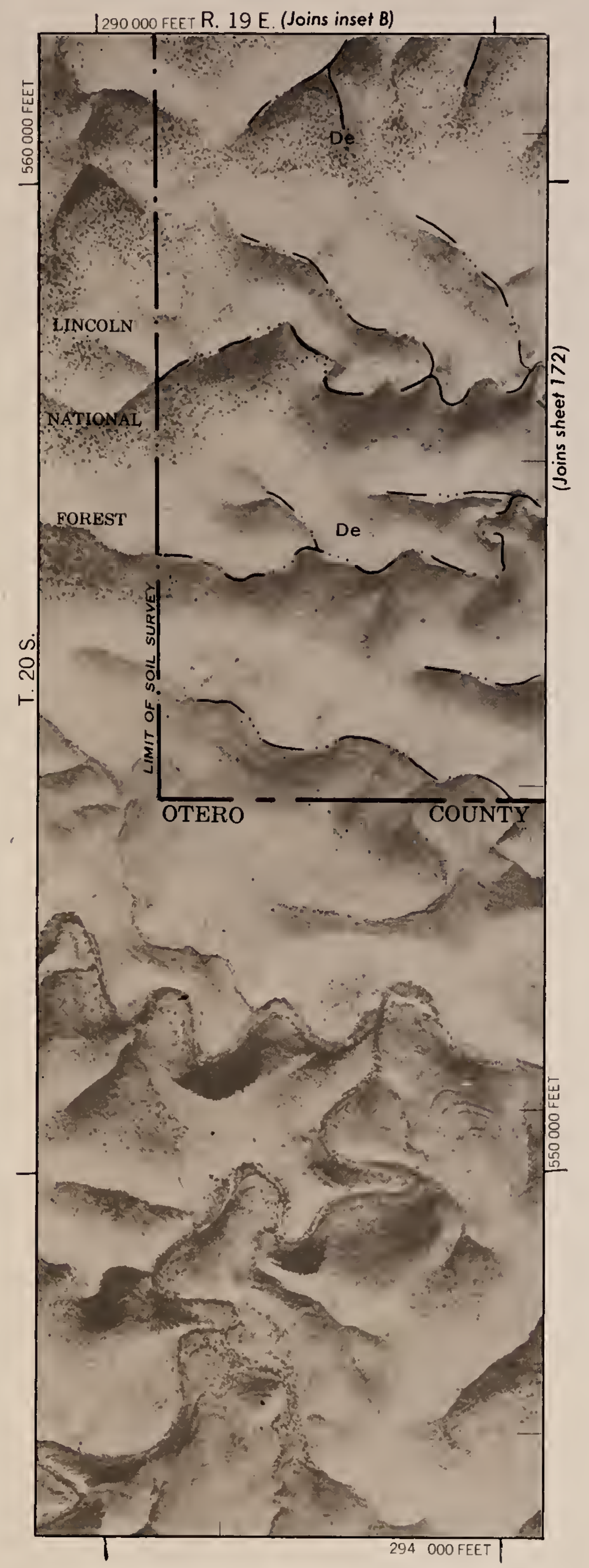
5 000 foot grid ticks based on state coordinate system Land division corners if shown are approximately positioned

This map was compiled on 1974 and 1975 U S Department of The Interior Geological Survey orthophotography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies

N



INSET A



4000 AND 5000-FOOT GRID TICKS

INSET B

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1974 and 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5 000 foot grid ticks based on state coordinate system. Land division corners if shown are approximately positioned.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Davis Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit — G.P.
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CeA, FoB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Borrow pit — B.P.
- Glacial till

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital if the map unit is broadly defined; otherwise, it is a lower case letter. A third letter, always a capital A, B, C, D, E or F shows the slope. Most symbols without slope letters are those of nearly level soils but some are for miscellaneous land types, soil associations or soil complexes with a considerable range of slope.

SYMBOL	NAME
Aa	Alama loam
AN	Ancho-Penasco association
AtA	Atoka loam, 0 to 1 percent slopes
AtB	Atoka loam, 1 to 3 percent slopes
Ba	Balmorhea loam
Bd	Balmorhea loam, drained
BE	Berino-Cacique association
Bf	Berino-Pintura complex
BgA	Bigetty loam, 0 to 1 percent slopes
BgB	Bigetty loam, 1 to 3 percent slopes
Bh	Bigetty loam, moderately saline
BP	Bigetty-Pecos association
CA	Cuevoland-Ancho association
De	Deama-Rock outcrop complex
DR	Deama-Remunda association
Du	Dune land
EcC	Ector-Rock outcrop complex, 0 to 9 percent slopes
EcD	Ector-Rock outcrop complex, 9 to 30 percent slopes
Fa	Faskin fine sand
FM	Faskin-Malstrom association
Fr	Faskin-Roswell complex
GD	Gabaldon-Dev association
Ge	Glendale fine sandy loam
Gf	Glendale loam
HO	Holloman loam, thick solum
Hp	Holloman-Gypsum land complex, 0 to 3 percent slopes
HrC	Holloman-Gypsum land complex, 3 to 5 percent slopes
HSE	Holloman-Gypsum land complex, 30 to 50 percent slopes
Im	Ima fine sandy loam
Ja	Jal fine sandy loam
Km	Kimbrough gravelly loam
Ks	Kimbrough-Sharvana complex
Kt	Kimbrough-Stegall-Slaughter complex
Lr	Lozier-Reakor complex
Lt	Lozier-Tencee complex
Pa	Pajarito loamy fine sand
Pb	Pajarito-Pintura complex
PeA	Pecos silty clay loam
PfA	Pecos silty clay loam, nonsaline, 0 to 1 percent slopes
PGB	Pecos silty clay loam, nonsaline, 0 to 3 percent slopes
PH	Pecos-Dev association
PK	Pena-Penasco association
PL	Penasco-Ancho association
PN	Penasco-Gabaldon association
Ra	Reakor sandy loam
ReA	Reakor loam, 0 to 1 percent slopes
ReB	Reakor loam, 1 to 3 percent slopes
RF	Reakor loam, 0 to 3 percent slopes
Rg	Reakor loam, gravelly subsoil variant
RH	Reakor-Pecos association
RI	Reakor-Tencee association
RkA	Reeves loam, 0 to 1 percent slopes
RkB	Reeves loam, 1 to 3 percent slopes
RL	Reeves-Holloman association
RM	Remunda-Penasco association
Rn	Roswell-Jalmar complex
Ru	Russler silty clay loam
Sh	Shanta silt loam
Sm	Simona fine sandy loam
So	Sotim fine sandy loam
Te	Tencee gravelly sandy loam
TfD	Tencee cobbly loam, 5 to 30 percent slopes
Tg	Tencee-Upton complex
TS	Tencee-Sotim association
TOF	Torriorthenta, very steep
UA	Upton-Atoka association
VG	Vinton-Glendale association

INDEX TO MAP SHEETS
CHAVES COUNTY, NEW MEXICO, SOUTHERN PART