Soil Survey of

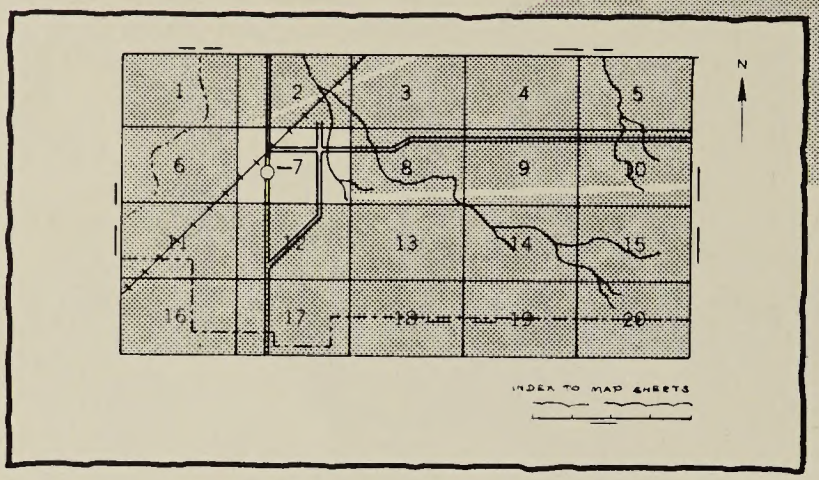
Gila-Duncan Area, Arizona

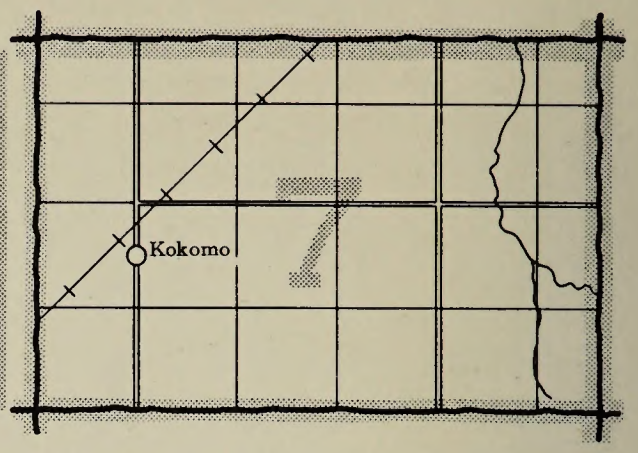
Parts of Graham and Greenlee Counties

United States Department of Agriculture, Soil Conservation Service and
United States Department of the Interior, Bureau of Land Management
in cooperation with
Arizona Agricultural Experiment Station

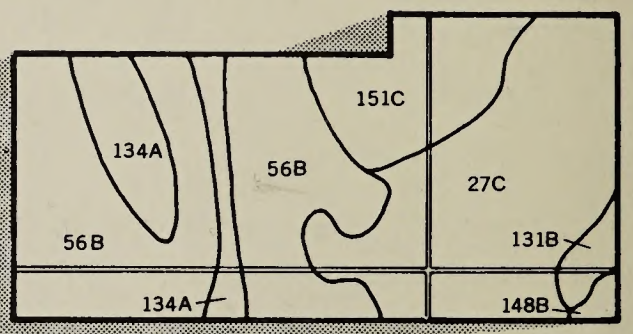
HOW TO USE

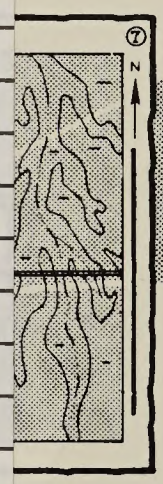
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

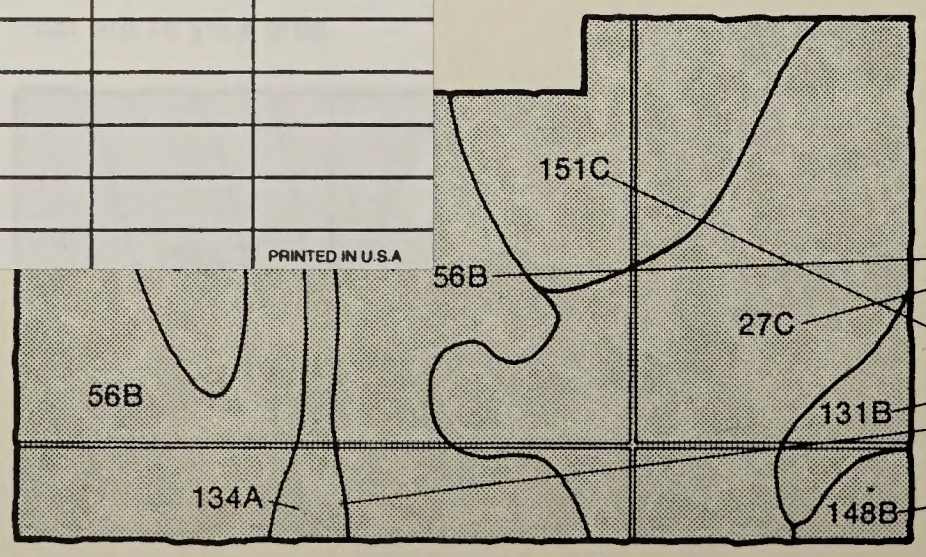




2. Note the number of the map sheet and turn to that sheet.







Symbols

27C
56B
131B
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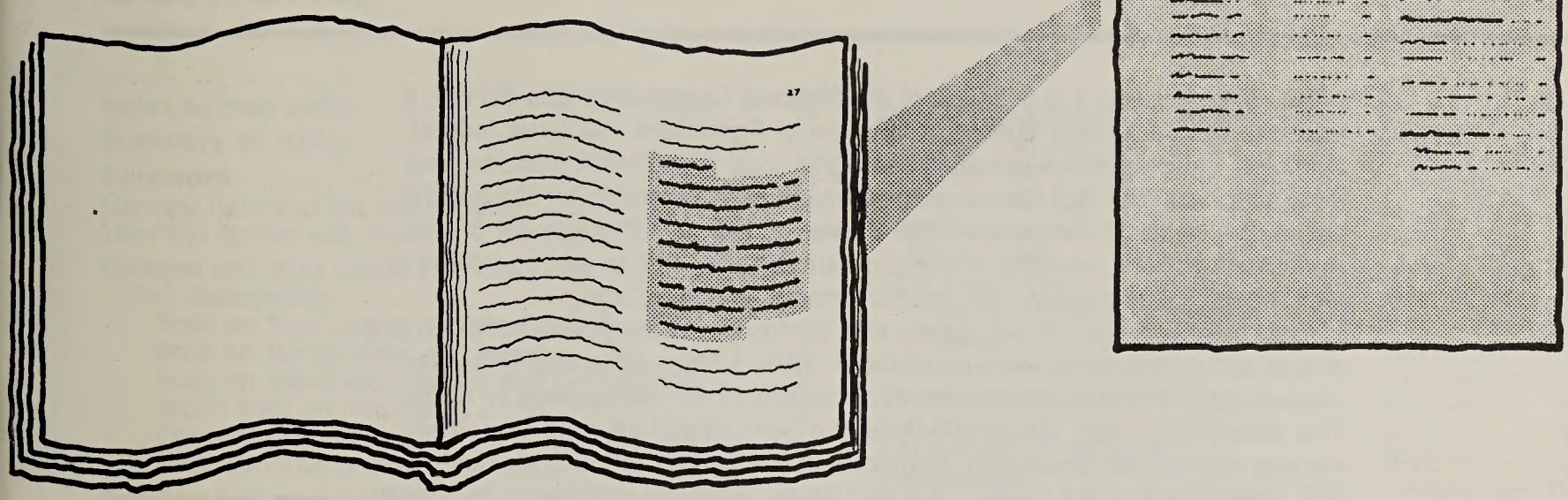
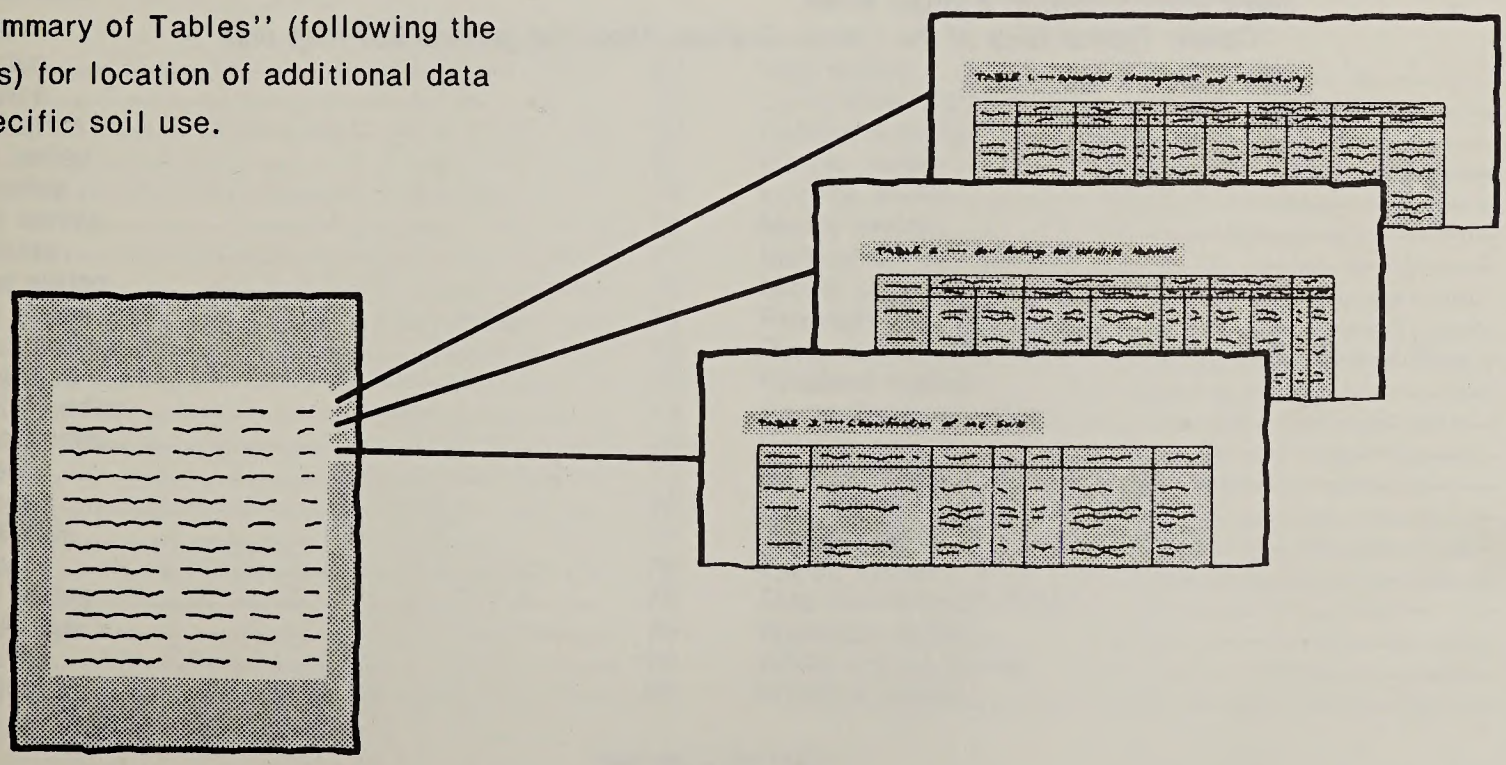
151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. 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, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1975-78. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service, the Arizona Agricultural Experiment Station, and the Bureau of Land Management, U.S. Department of the Interior. It is part of the technical assistance furnished to the Gila Valley Natural Resource Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Typical area of the Limpia-Graham-Atascosa general soil map unit.

contents

soil series

Issued July 1981

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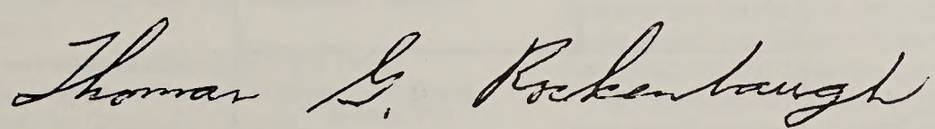
foreword

This soil survey contains information that can be used in land-planning programs in the Gila-Duncan Area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

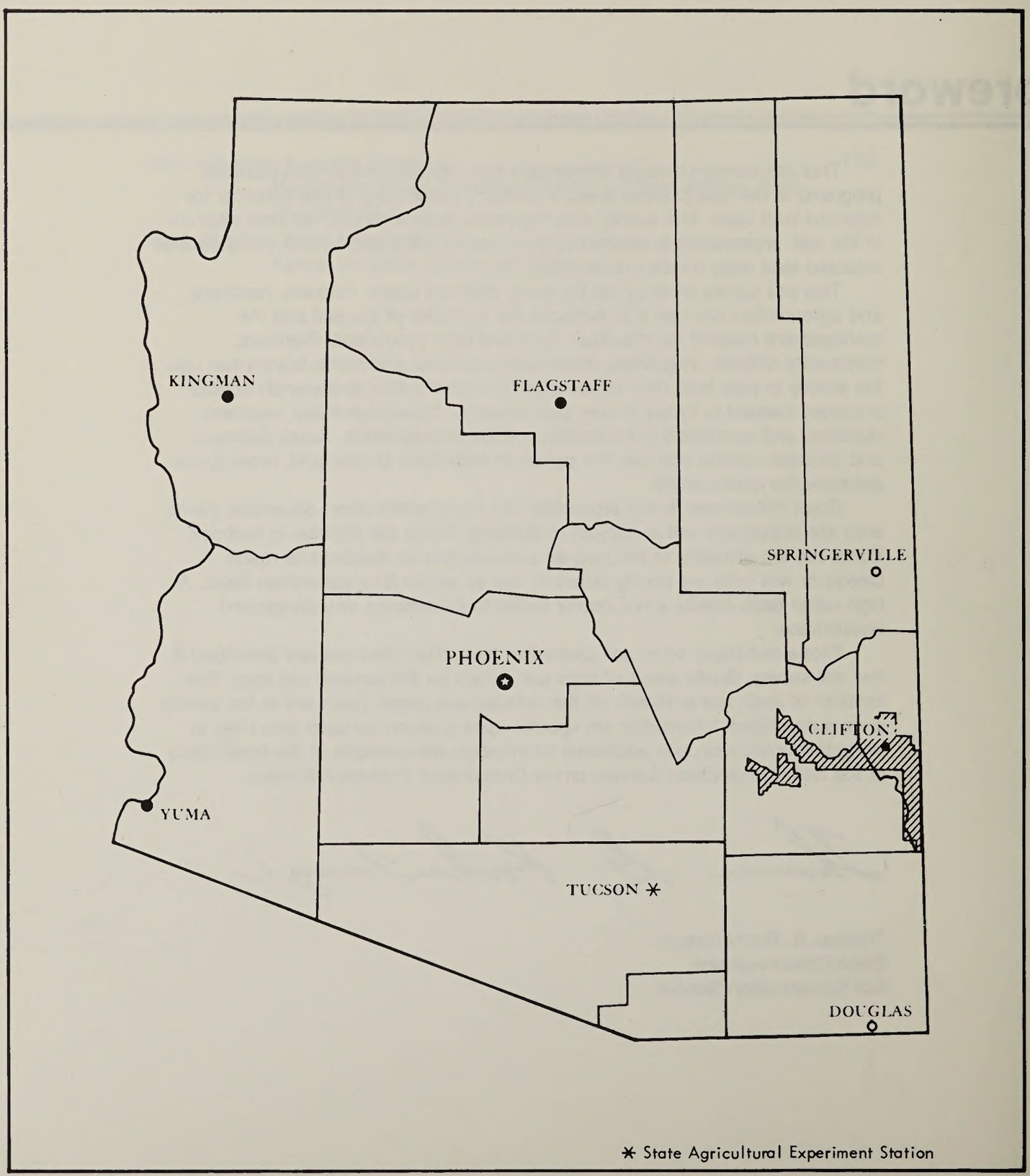
This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



Thomas G. Rockenbaugh
State Conservationist
Soil Conservation Service



Location of Gila-Duncan Area in Arizona

Soil Survey of

Gila-Duncan Area, Arizona

Parts of Graham and Greenlee Counties

By Alfred A. DeWall, Soil Conservation Service
Fieldwork by Alfred A. DeWall, Scott D. Hutchinson, and
William J. Westberg, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service and
United States Department of the Interior, Bureau of Land Management
in cooperation with
Arizona Agricultural Experiment Station

The GILA-DUNCAN AREA consists of the southern third of Greenlee County, south of the Apache National Forest, and the central part of Graham County, south of the San Carlos Indian Reservation. The survey area has a land area of 770,000 acres, of which 372,845 acres is in Graham County and 397,155 acres is in Greenlee County.

The survey area is complex, both in the variety of the terrain and the soils. Between the alluvial soils of the Gila Valley and the mountain soils are eroded surfaces consisting of old lake sediment capped with alluvial deposits from the surrounding mountains. The area is a typical basin and range region characterized by the downcutting of the Gila River and the headward erosion of intermittent streams.

Cattle ranching and copper mining are the most important industries. Irrigation farming is practiced along parts of the Gila River in Greenlee County.

An older survey of part of Greenlee County was published in 1950 (*9*). The present survey updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this survey do not fully agree with those on soil maps for adjacent soil survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

The flood plain of the Gila River is mapped in slightly greater detail than is the area outside the Gila River Valley.

general nature of the survey area

This section briefly discusses the settlement and development, transportation, and climate of the survey area.

settlement and development

Among the early inhabitants of the survey area were the Anasazi, whose cliff dwellings can still be seen in the upper reaches of Bonita Creek. Sightings of Zuni pueblos in northwestern New Mexico added new fuel to the legend of the Seven Cities of Cibola, and in 1540 Francisco Vasquez de Coronado led an expedition to conquer the territory in the name of Spain. Coronado never found the Seven Cities of Cibola, however, and the impact of the Spanish on the area remained minimal.

The Mexican-American War of 1846-48 and the Gadsden Purchase of 1853 secured this territory for the United States, greatly accelerating subsequent development. Trappers and prospectors came to the area in ever-increasing numbers. With the establishment of military posts at Fort Goodwin, Fort Grant, and Fort Thomas, the danger of attack from the Apaches was diminished and the settlement of the area began in earnest. The 1870's saw the influx of many farmers and ranchers into the Gila and Duncan Valleys.

Mining activity in the Clifton-Morenci area also dates back to the 1870's. Early claims by Jim Metcalf and Henry Lesinsly led to the establishment of the Longfellow Mine and the Detroit Copper Company. By the late 1870's a smelter was in operation at Clifton, and

by the 1880's copper production was in full swing. Improvements in technology have enabled the production of copper to increase despite a decrease in the quality of ore.

On March 10, 1881, Graham County was created from parts of Pima and Apache Counties. The original Graham County included what is now Greenlee County, which was formed on January 1, 1911.

Safford was the county seat until 1883, when the county seat was moved to Solomonville. In 1915 the county seat was returned to Safford.

The majority of the population in this survey area is in Greenlee County, in the communities of Clifton, Morenci, Duncan, Franklin, and York. The rest of the population is on widely scattered ranches in Graham and Greenlee Counties and on farms along the Gila River.

transportation

Two major federal highways and one state highway serve the area. They are U.S. Highway 70, which runs from east to west, U.S. Highway 666, which runs from north to south, and Arizona Highway 75, which runs from south to north on the eastern side of the survey area.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Summers are hot in the survey area, especially at lower elevations, and winters are cold. Precipitation is normally light at lower elevations during all months of the year. At higher elevations, precipitation is much greater and snow accumulates to a considerable depth.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Clifton in the period 1951 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 48 degrees F, and the average daily minimum temperature is 33 degrees. The lowest temperature on record, which occurred at Clifton on January 12, 1962, is 4 degrees. In summer, the average temperature is 84 degrees and the average daily maximum temperature is 100 degrees. The highest recorded temperature, which occurred at Clifton on June 19, 1960, is 113 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of crops between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 12.1 inches. Of this, 7 inches, or 55 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 5 inches. The heaviest 1-day rainfall during the period of record was 2.95 inches at Clifton on September 26, 1962. Thunderstorms occur on about 45 days each year, and most occur in summer.

Average seasonal snowfall is less than 1 inch. The greatest snow depth at any one time during the period of record was 6 inches. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 35 percent. Humidity is higher at night, and the average at dawn is about 65 percent. The sun shines 80 percent of the time possible in summer and 70 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 9 miles per hour, in spring.

Every few years a blizzard with high winds and much drifting snow strikes the survey area. Even at lower elevations, snow remains on the ground for many weeks and livestock suffer.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study 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, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas where the soils are suitable for a broad land use can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 12 map units in this survey have been grouped into five general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

soil descriptions

soils on flood plains and alluvial fans

This group consists of one map unit. It makes up about 5 percent of the survey area. The soils in this group are nearly level to gently sloping. The vegetation in areas not cultivated is mainly streamside trees and grasses. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free season is 180 to 250 days.

The soils in this group are deep and well drained. They formed in mixed alluvium derived dominantly from volcanic rock.

This group is used for irrigated crops, homesite development, rangeland, recreation, and wildlife habitat.

1. Guest-Gila-Glendale

Deep, well drained, nearly level to gently sloping, clayey, silty, and loamy soils; on flood plains and alluvial fans

This map unit is along the Gila River and the major intermittent streams that feed into the Gila River. Slopes range from 0 to 5 percent. The vegetation in areas not cultivated is dominantly riparian. Cottonwood and willow trees and an understory of bermudagrass, wolftail, hairy grama, and threeawn are typical plants along perennial streams. The alluvial fans adjacent to the flood plains support little vegetation because of gully erosion, strong alkalinity, and excess salts. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free season is 180 to 250 days.

This unit makes up about 5 percent of the survey area. It is about 32 percent Guest and similar soils, 24 percent Gila soils, and 22 percent Glendale soils. The remaining 22 percent is components of minor extent.

Guest and similar soils are on flood plains and alluvial fans. These soils are deep and well drained. They formed in alluvium derived from mixed rock. The soils are clayey throughout and extend to a depth of 60 inches or more.

Gila soils are on flood plains and alluvial fans. These soils are deep and well drained. They formed in alluvium derived from mixed rock. The soils are loamy throughout and extend to a depth of 60 inches or more.

Glendale soils are on flood plains and alluvial fans. These soils are deep and well drained. They formed in alluvium derived from mixed rock. The soils are silty throughout and extend to a depth of 60 inches or more.

Of minor extent in this unit are Pima, Hantz, Anthony, and Santo Tomas soils.

This unit is used mainly for irrigated cropland and homesite development. It is also used as rangeland and for recreation and wildlife habitat.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding. The risk of flooding can be reduced by the use of dikes, levees, and channels.

The main limitations of this unit for homesite development are the hazard of flooding, low soil strength, shrink-swell potential, and slow permeability.

soils on fan terraces and hillsides

This group consists of five map units. It makes up about 45 percent of the survey area. The soils in this group are gently sloping to steep. The native vegetation is mainly creosotebush, cacti, and grasses. Elevation is 3,000 to 5,200 feet. The average annual precipitation is about 9 to 14 inches, the average annual air temperature is 60 to 66 degrees F, and the average frost-free season is 170 to 250 days.

The soils in this group are very shallow to deep and well drained. They formed in mixed alluvium and colluvium derived dominantly from volcanic rock.

This group is used mainly as rangeland. It is also used for homesite development, recreation, and wildlife habitat.

2. Hap-Continental-Sonoita

Deep, well drained, gently sloping, loamy and clayey soils; on fan terraces

This map unit is mainly east of the Santa Teresa Mountains in the southwestern part of the survey area. Small isolated areas occur along the east side of the area. The unit is mainly on fan terraces bordering flood plains. Slopes are dominantly 2 to 15 percent. The vegetation on the Hap and Sonoita soils is mainly Mormon-tea, range ratany, soaptree yucca, and an understory of black grama, bush muhly, plains bristlegrass, and hairy grama. The vegetation on the Continental soils is mainly black grama, bush muhly, sideoats grama, and tobosa. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free season is 180 to 250 days.

This unit makes up about 5 percent of the survey area. It is about 31 percent Hap soils, 24 percent Continental soils, and 17 percent Sonoita soils. The remaining 28 percent is components of minor extent.

Hap soils are in gently sloping areas on fan terraces. These soils are deep and well drained. They formed in alluvium derived dominantly from granite, gneiss, and schist. The soils are loamy throughout and extend to a depth of 60 inches or more.

Continental soils are in stable, gently sloping areas on fan terraces. These soils are deep and well drained. They formed in alluvium derived dominantly from granite, gneiss, and schist. About 30 to 60 percent of the surface is covered with gravel and cobbles. The subsoil is clayey.

Sonoita soils are in gently sloping areas on fan terraces. These soils are deep and well drained. They formed in alluvium derived dominantly from granite, gneiss, and schist. The soils are loamy throughout and extend to a depth of 60 inches or more.

Of minor extent in this unit are Bucklebar, Pinaleno, and Dona Ana soils. The minor soils are in the more sloping areas of the unit.

This unit is used mainly as rangeland and for wildlife habitat. It is also used for recreation and homesite development.

This unit is well suited to use as rangeland and for wildlife habitat. It has few limitations. With proper management of the unit, forage production is high.

3. Haplargids-Calciorthids-Torriorthents

Deep, well drained, moderately sloping to very steep, loamy to clayey soils; on highly dissected hills

This map unit is dominantly in the eastern part of the survey area, from Franklin to Three Way. Smaller areas are in the western part of the area. The unit is characterized by steep slopes formed by headward erosion, undercutting, and slumping and by exposed lacustrine deposits of soft shale, mudstone, and strongly lime-cemented layers. Slopes range from 5 to 90 percent. The vegetation on the Haplargids is mainly tobosa, bush muhly, threeawn, and range ratany; on the Calciorthids it is mainly scattered creosotebush; and on the Torriorthents it is mainly sideoats grama, bush muhly, black grama, and tobosa. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free season is 180 to 250 days.

This unit makes up about 7 percent of the survey area. It is about 41 percent Haplargids, 37 percent Calciorthids, and 6 percent Torriorthents. The remaining 16 percent is components of minor extent.

Haplargids are in moderately sloping to very steep areas on hillsides. These soils are deep and well drained. They formed in old lacustrine deposits derived dominantly from acid and basic igneous rock. About 40 to 90 percent of the surface is covered with gravel and a few cobbles. The soils are loamy to clayey throughout. They vary considerably throughout the area.

Calciorthids are on moderately sloping hilltops and on steep to very steep hillsides in areas of dissected lacustrine deposits. These soils are shallow to deep and are well drained. They formed in limy lacustrine deposits derived dominantly from acid and basic igneous rock. The soils are loamy throughout and in places have a duripan or a petrocalcic horizon at a shallow to moderate depth.

Torriorthents are in moderately sloping areas on the lower part of the hillsides between Haplargids and Calciorthids. They formed in mixed colluvium derived dominantly from lacustrine deposits. The soils are loamy throughout. Lime content varies from area to area, depending on whether Calciorthids or Haplargids occupy the adjacent hillsides.

Of minor extent in this unit are Torrifluvents in drainageways.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

The main limitations of this unit for use as rangeland are slope and low water supplying capacity.

The limitations of this unit for homesite development are slope, shrink-swell potential, slow permeability, and the hazard of erosion.

4. Tres Hermanos-Pinaleno-Whitlock

Deep, well drained, gently sloping to steep, very gravelly and loamy soils; on fan terraces and hillsides

This map unit is scattered throughout the survey area. It is mainly on fan terraces and hillsides. Slopes range

from 2 to 40 percent. The vegetation is mainly creosotebush, but a few grasses such as bush muhly, black grama, and annuals grow in protected areas. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free season is 180 to 250 days.

This unit makes up about 18 percent of the survey area. It is about 33 percent Tres Hermanos soils, 31 percent Pinaleno soils, and 5 percent Whitlock soils. The remaining 31 percent is components of minor extent.

Tres Hermanos soils are in gently sloping to moderately sloping areas on fan terraces. The soils formed in mixed alluvium derived from mixed rock. About 20 to 60 percent of the surface is covered with gravel and a few cobbles. The soils are loamy to a depth of 60 inches or more.

Pinaleno soils are in moderately sloping to steep areas on fan terraces and hillsides. These soils are deep and well drained. They formed in mixed alluvium and colluvium derived from mixed rock. About 20 to 80 percent of the surface is covered with cobbles and gravel. The soils are very gravelly and loamy to a depth of 60 inches or more.

Whitlock soils are in the lower, gently sloping areas on fan terraces. These soils are deep and well drained. They formed in mixed alluvium derived from mixed rock. The soils are loamy to a depth of 60 inches or more.

Of minor extent in this unit are Continental and Eba soils.

This unit is used mainly as rangeland and for wildlife habitat. It is also used for recreation and homesite development.

The main limitations of this unit for use as rangeland are the high lime content and low water supplying capacity of the soils.

If this unit is used for homesite development, the main limitations are low soil strength, hazard of erosion, and slope.

5. Peloncillo-Tapco-Artesia

Very shallow to moderately deep, well drained, gently sloping to steep, loamy, very gravelly, and clayey soils; on fan terraces

This map unit is scattered throughout the survey area. It is mainly on fan terraces that extend from the base of volcanic mountains. Slopes range from 2 to 15 percent. The vegetation on the Peloncillo soils is mainly creosotebush, but a few grasses such as bush muhly and black grama grow in protected areas. The vegetation on the Tapco and Artesia soils is mainly tobosa, sideoats grama, curly mesquite, vine-mesquite, and scattered mesquite trees and cacti. Elevation is 3,000 to 5,200 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free season is 170 to 250 days.

This unit makes up about 9 percent of the survey area. It is about 50 percent Peloncillo soils, 18 percent Tapco soils, and 12 percent Artesia soils. The remaining 20 percent is components of minor extent.

Peloncillo soils are in moderately sloping to steep areas on fan terraces. These soils are very shallow and shallow and are well drained. They formed in mixed alluvium derived dominantly from volcanic rock. About 20 to 60 percent of the surface is covered with cobbles and gravel. The soils are loamy and extend to a depth of about 12 inches. The subsoil is very gravelly. A pan that is very strongly cemented with silica and lime is at a depth of 12 inches.

Tapco soils are in gently sloping areas on fan terraces. These soils are very shallow and shallow and are well drained. They formed in mixed alluvium derived dominantly from volcanic rock. About 20 to 60 percent of the surface is covered with cobbles and gravel. The surface layer is loamy and is 20 to 50 percent cobbles and gravel. The subsoil is clayey and extends to an average depth of 10 inches. Below this is a pan that is very strongly cemented with silica and lime.

Artesia soils are in gently sloping areas on fan terraces. These soils are moderately deep and well drained. They formed in mixed alluvium derived dominantly from volcanic rock. About 30 to 60 percent of the surface is covered with cobbles and gravel. The surface layer is loamy and is 35 to 50 percent cobbles and gravel. The subsoil is clayey, is very gravelly, and extends to a depth of 24 inches. A pan that is strongly cemented with silica and lime is between depths of 24 and 25 inches. Below this to a depth of 60 inches or more the soils are loamy and sandy, are 45 to 75 percent cobbles and gravel, and are weakly to strongly cemented with silica and lime.

Of minor extent in this unit are Pinaleno soils.

This unit is used as rangeland and for wildlife habitat and recreation.

The main limitations of this unit for use as rangeland are the high lime content and low water supplying capacity of the Peloncillo soils and the low water supplying capacity of the Tapco and Artesia soils.

6. Signal-Bonita-Wampoo

Deep and moderately deep, well drained, gently sloping to steep, clayey and very gravelly soils; on fan terraces and hillsides

This map unit is throughout the survey area on fan terraces and hillsides along the Gila, Peloncillo, and Big Lue Mountains. Slopes range from 2 to 40 percent. The vegetation is mainly sideoats grama, Arizona cottontop, tobosa, and black grama. There is some scattered juniper. Elevation is 3,000 to 5,200 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 60 to 66 degrees F, and the average frost-free season is 170 to 250 days.

This unit makes up about 6 percent of the survey area. It is about 36 percent Signal soils, 29 percent Bonita

soils, and 29 percent Wampoo soils. The remaining 6 percent is components of minor extent.

Signal soils are on gently sloping to steep hillsides. These soils are deep and well drained. They formed in mixed colluvium and alluvium derived mainly from volcanic rock. About 30 to 70 percent of the surface is covered with cobbles and gravel. The subsoil is clayey, is very gravelly, and extends to a depth of about 40 inches. Below this to a depth of 60 inches or more the soils are weakly cemented with lime, are loamy, and are 35 to 60 percent cobbles and gravel.

Bonita soils are in gently sloping to sloping areas on fan terraces. These soils are deep and well drained. They formed in mixed alluvium derived from volcanic rock. About 30 to 60 percent of the surface is covered with basalt cobbles. The soils are clayey to a depth of about 30 inches. Below this to a depth of 60 inches or more the soils are weakly cemented with lime, are loamy, and are 15 to 60 percent cobbles and gravel.

Wampoo soils are in gently sloping to moderately sloping areas on fan terraces. These soils are moderately deep and well drained. They formed in mixed alluvium derived from volcanic rock. About 20 to 50 percent of the surface is covered with cobbles and gravel. The subsoil is clayey to a depth of about 21 inches. Below this is an indurated pan that is cemented with silica and lime.

Of minor extent in this unit are Continental, White House, and Peloncillo soils.

This unit is used as rangeland and for wildlife habitat and recreation. It is well suited to these uses.

soils on hillsides and fan terraces

This group consists of one map unit. It makes up about 3 percent of the survey area. The soils in this group are gently sloping to very steep. The native vegetation is grasses and a few scattered trees and shrubs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free season is 170 to 240 days.

The soils in this group are moderately deep and deep and are well drained. They formed in mixed colluvium and alluvium derived dominantly from granite and gneiss.

This group is used as rangeland and for wildlife habitat and recreation.

7. Eloma-Alsco-Selevin

Deep, well drained, gently sloping to very steep, extremely cobbly and very stony, clayey and loamy soils; on hillsides and fan terraces

This map unit is mainly in the southwestern part of the survey area, but a small area is along the San Francisco River in the northwestern part. It is mainly on hillsides and fan terraces that extend from granitic mountains. The unit is characterized by very steep hillsides approaching several hundred feet in height and by gently sloping to moderately sloping fan terraces. Slopes range from 2 to 10 percent on the fan terraces and from 40 to 90 percent on the hillsides. The vegetation on the Eloma and Selevin soils is mainly sideoats grama, tobosa, vine-mesquite, and black grama. The vegetation on the Alsco soils is mainly sideoats grama, black grama, threeawn, and tridens, but there is also a wide variety of shrubs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free season is 170 to 240 days.

This unit makes up about 3 percent of the survey area. It is about 41 percent Eloma soils, 22 percent Alsco soils, and 12 percent Selevin soils. The remaining 25 percent is components of minor extent.

Eloma soils are on steep and very steep hillsides. These soils are deep and well drained. They formed in colluvium and alluvium derived dominantly from granite and gneiss. About 30 to 80 percent of the surface is covered with cobbles and stones. The subsoil is clayey, is extremely cobbly, and extends to a depth of about 45 inches.

Alsco soils are on steep and very steep hillsides. These soils are deep and well drained. They formed in colluvium and alluvium derived dominantly from granite and gneiss. About 30 to 80 percent of the surface is covered with cobbles and stones. The subsoil is loamy, is extremely cobbly, and extends to a depth of about 15 inches. Below this, to a depth of 50 inches, the soils are weakly cemented with lime.

Selevin soils are in gently sloping to moderately sloping areas on fan terraces. These soils are moderately deep and well drained. They formed in alluvium derived dominantly from granite and gneiss. About 30 to 50 percent of the surface is covered with stones, and 10 to 30 percent is covered with cobbles and gravel. The subsoil is clayey and very stony.

Of minor extent in this unit are Maloy and White House soils.

This unit is used as rangeland and for wildlife habitat and recreation.

The main limitations of this unit for use as rangeland are slope and stones on the surface.

warm soils on mountains

This group consists of two map units. It makes up about 38 percent of the survey area. The soils in this group are moderately steep to very steep and are characterized by vertical exposures of rock. The native vegetation is mainly grasses with about a 15 percent canopy of trees and shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is about 60 to 66 degrees F, and the average frost-free season is 170 to 240 days.

The soils in this group are very shallow to moderately deep and well drained. They formed in colluvium derived dominantly from granite and volcanic rock.

This group is used as rangeland and for wildlife habitat and recreation.

8. Limpia-Graham-Atascosa

Very shallow, shallow, and deep, well drained, moderately sloping to very steep, clayey, loamy, and very gravelly soils; on mountains

This unit is throughout the survey area in the Gila, Peloncillo, and Big Lue Mountains. Slopes generally range from 5 to 90 percent but are nearly vertical or vertical in places. The vegetation on the Graham and Limpia soils is mainly tobosa, sideoats grama, Arizona cottontop, and cane bluestem. The vegetation on the Atascosa soils is mainly plains lovegrass, sideoats grama, cane bluestem, and black grama. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free season is 170 to 240 days.

This unit makes up about 36 percent of the survey area. It is about 24 percent Limpia soils, 18 percent Graham soils, and 11 percent Atascosa soils. The remaining 47 percent is components of minor extent.

Limpia soils are in moderately sloping to steep areas on mountainsides. These soils are deep and well drained. They formed in colluvium derived dominantly from volcanic rock. About 50 to 90 percent of the surface is covered with cobbles and a few stones. The soils are clayey and very gravelly throughout.

Graham soils are on moderately sloping to very steep mountainsides. These soils are very shallow and shallow and are well drained. They formed in colluvium derived dominantly from volcanic rock. About 30 to 80 percent of the surface is covered with cobbles and a few stones. The soils are clayey and are underlain by basalt at a depth of 8 to 20 inches.

Atascosa soils are in moderately sloping to steep areas on hills. These soils are very shallow and shallow and are well drained. They formed in colluvium derived dominantly from volcanic rock. About 30 to 80 percent of the surface is covered with cobbles and gravel. The soils are loamy and very gravelly and are underlain by andesite at a depth of 5 to 15 inches.

Of minor extent in this unit are Rock outcrop and Bonita, Lampshire, and Peloncillo soils.

This unit is used as rangeland and for wildlife habitat, recreation, and copper mining. It is well suited to these uses.

9. Aravaipa-Rock outcrop-Lampshire

Very shallow and shallow, well drained, moderately sloping to very steep, very gravelly and extremely gravelly, clayey and loamy soils, and Rock outcrop; on mountains

This map unit is mainly in the southwestern part of the survey area, but two small areas of the unit are near Clifton. Slopes generally range from 5 to 90 percent, but exposures of rock are nearly vertical to vertical. The vegetation on the Aravaipa soils is sideoats grama, cane bluestem, curly mesquite, and black grama. The vegetation on the Lampshire soils is sideoats grama, cane bluestem, Arizona cottontop, tanglehead, juniper, shrub live oak, and desert hackberry. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 60 to 66 degrees F, and the average frost-free season is 170 to 240 days.

This unit makes up about 2 percent of the survey area. It is about 49 percent Aravaipa soils, 21 percent Rock outcrop, and 16 percent Lampshire soils. The remaining 14 percent is components of minor extent.

Aravaipa soils are on low, rolling hills. About 75 to 95 percent of the surface is covered with fine angular gravel. The soils are clayey and very gravelly. Highly weathered granite is at a depth of 14 to 20 inches. Consolidated bedrock is at a depth of 40 to 60 inches.

Rock outcrop consists of exposed granitic rock and schist.

Lampshire soils are in moderately sloping to steep areas on mountainsides. About 30 to 80 percent of the surface is covered with cobbles and gravel and a few stones. The soils are loamy and extremely gravelly. Schist is at a depth of 6 to 15 inches.

Of minor extent in this unit are Eloma, Alsco, Santo Tomas, and Comoro soils.

This unit is used as rangeland and for wildlife habitat and recreation. The main limitation for these uses is slope.

cool soils on mountains

This group consists of two map units. It makes up about 8 percent of the survey area. The soils of this group are moderately sloping to very steeply sloping. Exposures of rock are nearly vertical to vertical. The vegetation is mainly grasses and a 10 to 25 percent canopy of trees and shrubs. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 12 to 18 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free season is 130 to 190 days.

The soils in this group are very shallow to deep and are well drained. They formed in colluvium derived dominantly from acid and basic igneous rock.

This group is used as rangeland and for wildlife habitat and recreation.

10. Rock outcrop-Fallsam-Luzena

Rock outcrop, and very shallow to deep, well drained, moderately sloping to very steep, extremely cobbly and clayey soils; on mountains

This map unit is in the northern part of the survey area. Slopes range from 9 to 70 percent. Exposures of rock are nearly vertical to vertical. The vegetation is

mainly sideoats grama, blue grama, tobosa, and black grama, with juniper, pinyon, and mountainmahogany giving it a brushy appearance. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free season is 130 to 190 days.

This unit makes up about 6 percent of the survey area. It is about 36 percent Rock outcrop, 27 percent Fallsam soils, and 17 percent Luzena soils. The remaining 20 percent is components of minor extent.

Rock outcrop occurs throughout the unit. It consists of areas of exposed basalt, andesite, rhyolite, and volcanic tuff.

Fallsam soils are in moderately sloping to steep areas on mountainsides. These soils are deep and well drained. They formed in colluvium derived dominantly from volcanic rock. About 60 to 90 percent of the surface is covered with basalt cobbles. The soils to a depth of 60 inches or more are clayey and extremely cobbly.

Luzena soils are on the upper part of moderately steep to very steep mountainsides. These soils are very shallow and shallow and are well drained. They formed in colluvium derived dominantly from volcanic rock. About 20 to 80 percent of the surface is covered with cobbles and gravel. The soils are clayey throughout. Volcanic rock is at a depth of 6 to 20 inches.

Of minor extent in this unit are talus slopes, Cabezon soils, and deep, very gravelly loamy soils along drainageways.

This unit is used as rangeland and for wildlife habitat and recreation. The main limitation for these uses is slope.

11. Rock outcrop-Mokiak

Rock outcrop, and moderately deep, well drained, steep to very steep, very gravelly loamy soils; on mountains

This map unit is on mountains north of Morenci. Slopes generally range from 20 to 90 percent, but exposures of granite are nearly vertical to vertical. The vegetation is mainly sideoats grama, black grama, wolftail, and cane bluestem, with juniper, pinyon, and manzanita giving it a brushy appearance. Elevation is 5,000 to 6,800 feet. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free season is 130 to 190 days.

This unit makes up about 2 percent of the survey area. It is about 51 percent Rock outcrop and 15 percent Mokiak soils. The remaining 34 percent is components of minor extent.

Rock outcrop consists of areas of exposed granite, gneiss, and schist.

Mokiak soils are in pockets of mountainsides. These soils are moderately deep and well drained. They formed in colluvium derived dominantly from granite. The soils are very gravelly and loamy. Highly weathered granite is at a depth of 20 to 50 inches. Consolidated rock is at a depth of 50 inches or more.

This unit is used as rangeland and for wildlife habitat and recreation. The main limitation for these uses is slope.

miscellaneous areas

This group consists of one map unit. It makes up about 1 percent of the survey area. The areas of this group are nearly level to very steep. Elevation is 3,400 to 5,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 56 to 66 degrees F, and the average frost-free season is 150 to 200 days.

Areas of this group are shallow to deep and well drained. They consist of mine wastes derived dominantly from copper ore.

This group is used for copper mining and community development.

12. Pits-Dumps

Open pit mine, sandy mine tailings, tailings ponds, extremely stony mine wastes, and other areas disturbed in mining

This map unit is in steep mountainsides and foothills in and around Morenci. The deposits of material have nearly level to gently sloping tops and very steep side slopes. They are deep and well drained. Elevation ranges from 3,400 to 5,500 feet. Revegetation attempts have been made with varied results. In areas of reclaimed tailings, topsoil has been hauled in to landscape yards and school grounds.

This unit makes up about 1 percent of the survey area. It is about 45 percent an open pit mine; 25 percent extremely stony, unprocessed overburden; 25 percent chemically treated mine tailings or slickens; and 5 percent slag dumps.

The open pit mine consists of a series of 50-foot-high benches in copper ore-producing rock. The mine extends to a depth of about 1,500 feet. It is approximately 2 miles across at the top. Areas of expansion of the mine extend up the sides of adjoining mountains. The extremely stony, unprocessed overburden is dumped in areas surrounding the pit. It consists of rock fragments blasted out to expose the copper-bearing ore. The chemically treated mine tailings or slickens are areas used as sedimentation ponds for smelter wastes that are easily moved by water. This material resembles yellow gravelly sandy loam. The slag dumps are areas where molten smelter refuse has been dumped. It has the appearance and characteristics of solid black rock.

This unit is used for mining and for urban development. Suitability for cultivated crops, rangeland, and wildlife habitat is very poor. The limited water supplying capacity of the material, very steep slopes, content of toxic chemicals, and mining activities restrict the use of this unit.

Mine tailings are suitable as sites for community development when measures are taken to buffer the effect of chemicals on buildings. The overburden material and crushed slag can be used to build up low areas for use as sites for homes, streets, railroads, and flood control dikes.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil. They can be used to plan management for food and fiber production; to plan land use; and to enhance, protect, and preserve the environment. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have about the same profile make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture, slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Gila fine sandy loam, 0 to 2 percent slopes, is one of several phases in the Gila series.

Some map units are made up of two or more major soils. These map units are called soil complexes and soil associations.

A *soil complex* consists of two or more major soils. Areas of these soils are so intricately intermingled or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Anthony-Gila complex, 0 to 5 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated. The soils are shown as one unit because similar interpretations can be made for use and management. A soil association has a regular geographic pattern. The extent of each soil can differ from one mapped area to another. Hap-Pinaleno association, 9 to 60 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ from those of the major soil or soils. Such differences could significantly affect use and management of the map unit. The included soils are identified in each map unit description. In some survey areas, a few included soils are identified on the soil maps by a spot symbol.

Many surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a spot symbol.

This survey was mapped at three levels of intensity. The more detailed part is described by narrowly defined units, and the less detailed part is described by broadly defined units. For the narrowly defined units, the soil delineation boundaries were plotted and verified at closely spaced intervals. For the broadly defined units, the soil delineation boundaries were plotted and verified by some observations. The intensity of mapping selected was based on the anticipated long term use of the survey, and the map units were designed to meet the needs for that use.

On the soil legend at the back of this survey, the names of narrowly defined units are identified by one asterisk and those of broadly defined units are identified by two asterisks. Soils mapped at intermediate intensity are not identified.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Akela-Lehmans-Rock outcrop complex, 9 to 60 percent slopes. This map unit is on foothills. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 40 percent Akela extremely gravelly sandy loam, 20 percent Lehmans extremely gravelly clay loam, and 20 percent Rock outcrop. The Akela soil is dominantly on the more strongly sloping hillsides, the Lehman soil is on the tops and upper part of the sides of the more rounded hills, and Rock outcrop is throughout

the unit. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Torrifluvents in drainageways, Graham very cobbly clay loam on gently sloping, north-facing hillsides, and Peloncillo very gravelly loam in small alluvial areas on the lower fan terraces. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Akela soil is very shallow and shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and agglomerate. Typically, 60 to 90 percent of the surface is covered with gravel and a few cobbles and stones. The surface layer is brown, moderately alkaline extremely gravelly sandy loam about 1 inch thick. The underlying material to a depth of 7 inches is brown, calcareous, moderately alkaline extremely gravelly loam. Andesite is at a depth of 7 inches. Depth to andesite ranges from 4 to 15 inches.

Permeability of the Akela soil is moderate. Available water capacity is very low. Water supplying capacity is 4 to 6 inches. Effective and observed rooting depth is 4 to 15 inches. Runoff is rapid, and the hazard of water erosion is slight.

The Lehmans soil is very shallow and shallow and is well drained. It formed in colluvium derived dominantly from volcanic rock. Typically, 50 to 75 percent of the surface is covered with gravel and a few cobbles. The surface layer is reddish brown, neutral extremely gravelly clay loam about 1 inch thick. The subsoil to a depth of 12 inches is reddish brown, moderately alkaline clay and gravelly clay loam. Andesite is at a depth of 12 inches. Depth to bedrock ranges from 9 to 20 inches.

Permeability of the Lehmans soil is slow. Available water capacity is very low. Water supplying capacity is 6 to 8 inches. Effective and observed rooting depth is 9 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

Rock outcrop consists of areas of exposed basalt, andesite, or tuff. Generally, the rock is very hard and requires blasting if removal is desired.

This unit is used as rangeland and for wildlife habitat, recreation, mining, and homesite development.

If the range vegetation on the Akela soil is in good or excellent condition the native grasses are mainly black grama, sideoats grama, bush muhly, and cane bluestem. The production of vegetation suitable for livestock grazing is limited by slope, depth to rock, very low available water capacity, and high content of lime.

If the range vegetation on the Lehmans soil is in good or excellent condition, the native grasses are mainly black grama, sideoats grama, tobosa, and Arizona cottontop. The production of vegetation suitable for livestock grazing is limited by slope, depth to rock, and very low available water capacity.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of species is maintained in the plant community. Range management practices suitable for use on this unit are fencing, implementing planned grazing systems, and developing livestock watering facilities. The presence of many cobbles on the surface limit grazing. This unit responds rapidly to the use of grazing management systems. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas.

Copper mining is becoming an important use of this unit. The unit has few limitations for this use. Special consideration must be given to providing areas for mine waste disposal and for the control of erosion in these areas.

If this unit is used for homesite development, the main limitations are slope and depth to rock. The deep cuts needed to provide essentially level building sites can expose bedrock. The hazard of erosion in the steep areas may be increased if the soils are disturbed. Only the part of the site that is used for construction should be disturbed. Access roads should be designed to provide adequate cut-slope grade, and drains should be used to control surface runoff and keep soil losses to a minimum. Special consideration must be given to sewage disposal.

The main limitations of this unit for septic tank absorption fields are slope and depth to rock. Other methods of waste disposal, such as central sewage systems or holding tanks, should be considered.

If these soils are used for recreation, the main limitations are slope, gravel content of the soils, and depth to rock.

This map unit is in capability subclass VIIe.

2—Anthony-Gila complex, 0 to 5 percent slopes. This map unit is on flood plains and alluvial fans. Elevation is 3,000 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 45 percent Anthony sandy loam and 35 percent Gila fine sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Glendale soils, Torrifluvents, eroded Calciorthids, eroded Torriorthents, and saline-alkali soils. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Anthony soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is light brown, moderately alkaline sandy loam about 3 inches thick. The underlying material, to a depth of 45 inches, is light brown and light yellowish brown, moderately alkaline sandy loam. To a depth of 60 inches or more, it is yellowish brown gravelly loamy sand.

Permeability of the Anthony soil is moderately rapid. Available water capacity is moderate. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 40 to 45 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is subject to rare, brief periods of flooding from July through September and from February through April.

The Gila soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is pale brown, moderately alkaline fine sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is pale brown, moderately alkaline, stratified loam and fine sandy loam.

Permeability of the Gila soil is moderate. Available water capacity is high. Water supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 40 to 45 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is subject to rare, brief periods of flooding from July through September and from February through April.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for irrigated crops and homesite development.

The potential native plant community on this unit is mainly bush muhly, black grama, alkali sacaton, and Arizona cottontop. The present vegetation in most areas is mainly mesquite, creosotebush, bush muhly, and annual grasses and forbs.

Livestock prefer this unit to most others in the survey area because of its accessibility and the availability of water. This results in overgrazing and subsequent deterioration of the vegetation. Water-spreading dikes have been successfully installed, and with controlled grazing, this unit can be highly productive.

In some areas of this unit the soils are high in content of salts and are strongly alkaline. Forage production is very low. The dominant plants in these salt- and alkali-affected areas are fourwing saltbush and alkali sacaton.

If this unit is used for homesite development, the main limitation is the hazard of flooding. Flooding can be controlled only by the use of major flood control structures.

This unit is well suited to irrigated crops. It is limited mainly by rare, brief periods of flooding and the hazard of soil blowing. Slight droughtiness is an additional limitation on the Anthony soil. The risk of flooding can be reduced by the use of dikes, levees, and channels.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The system used generally is governed by the crop. To avoid overirrigating the soils and leaching plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Crops respond to nitrogen and phosphorus fertilizer.

If this unit is used for recreation, the main limitations are the hazard of flooding and slope.

This map unit is in capability subclasses IIs, irrigated, and VIIs, nonirrigated.

3—Aravaipa extremely gravelly loam, 5 to 40 percent slopes. This deep, well drained soil is on hills. It formed in alluvium derived dominantly from granite. Elevation is 3,500 to 5,000 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 170 to 220 days.

Typically, 75 to 95 percent of the surface is covered with fine angular gravel. The surface layer is brown, medium acid extremely gravelly loam about 1 inch thick. The subsoil is brown, neutral very gravelly clay loam and very gravelly clay about 12 inches thick. The substratum is highly weathered granite about 32 inches thick over consolidated, unweathered bedrock. Depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Comoro gravelly sandy loam and Santo Tomas very gravelly sandy loam in drainageways. Also included are areas of soils, on hillsides and in small pockets, that are similar to this Aravaipa soil but have gruss at a depth of more than 45 inches. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Aravaipa soil is slow to a depth of 13 inches and very slow below this depth. Available water capacity is low. Water supplying capacity is 8 to 12 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly as rangeland and for wildlife habitat and recreation. It is also used for homesite development.

The present vegetation in most areas is mainly scrub live oak, sotol, and juniper and an understory of threeawn, burroweed, and bush muhly. If the range vegetation is in good or excellent condition, the native grasses are mainly sideoats grama, blue grama, hairy grama, and black grama with a sparse overstory of Emory oak.

Good accessibility, a large variety of palatable plants, and availability of water encourage a constant grazing pressure on this unit. This results in overgrazing and subsequent deterioration of the vegetation. Proper grazing use, range seeding, and a planned system of grazing are needed to maintain or improve the production of forage. Areas where brush is managed by prescribing burning or by chemical or mechanical methods may initially be subject to a greater hazard of erosion. Control of runoff reduces erosion and increases the production of forage.

The use of this unit for recreation is limited mainly by slope, gravel on the surface, and depth to rock.

If this unit is used for homesite development, the main limitations are slope and depth to rock. Preserving the existing plant cover during construction helps to control erosion. Only the part of the site that is used for construction should be disturbed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for septic tank absorption fields, the main limitations are depth to rock, slope, and slow permeability.

This map unit is in capability subclass VIe.

4—Artesia extremely cobbly sandy clay loam, 0 to 8 percent slopes. This deep, well drained soil is on fan terraces. It formed in mixed alluvium. Elevation is 3,200 to 5,200 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, 30 to 60 percent of the surface is covered with cobbles and gravel. The surface layer is light brown, mildly alkaline extremely cobbly sandy clay loam about 1 inch thick. The subsoil is reddish brown, moderately alkaline very gravelly clay about 23 inches thick. The next layer is a light brown and pink, very strongly silica- and lime-cemented hardpan about 1 inch thick. The underlying material to a depth of 60 inches or more is weakly cemented very cobbly loamy sand. In some areas the surface layer is very gravelly sandy clay loam. Depth to the hardpan ranges from 20 to 40 inches.

Included in this unit are small areas of Tapco cobbly sandy clay loam on fan terraces near the base of hills, Peloncillo very cobbly clay loam in the steeper areas on fan terraces, Eba very gravelly clay loam along the valley border, and Torrifluvents in drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Artesia soil is slow. Available water capacity is low. Water supplying capacity is 7 to 9 inches. Effective rooting depth is 20 to 40 inches. Observed rooting depth is 20 to 30 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly as rangeland and for wildlife habitat and recreation. It is also used for homesite development and mine waste disposal.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly tobosa, Arizona cottontop, black grama, bush muhly, and sideoats grama.

Good accessibility, a large variety of palatable plants, and availability of water encourage a constant grazing pressure on this unit. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Control of runoff reduces erosion and increases the production of forage.

If this unit is used for homesite development, the main limitations are high shrink-swell potential and low soil strength. Excavation for roads and buildings increases the hazard of erosion. Structures to divert runoff are needed if buildings and roads are constructed. The hardpan is rippable and therefore is not a serious limitation for most engineering uses. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

If the unit is used for septic tank absorption fields, the depth to the hardpan and slow permeability are the main limitations. If the absorption lines are placed below the slowly permeable layer and hardpan, the limitation is slight. Increasing the size of the absorption area helps to compensate for the slow permeability of the subsoil.

Roads should be designed to offset the limited ability of the soil to support a load.

If this unit is used for recreation, the main limitation is the gravel and cobbles on the surface.

This map unit is in capability subclass VIIs.

5—Bonita very cobbly silty clay, 2 to 8 percent slopes. This deep, well drained soil is on fan terraces. It formed in mixed alluvium derived dominantly from volcanic rock. Elevation is 3,500 to 5,000 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 180 to 240 days.

Typically, 30 to 60 percent of the surface is covered with basalt cobbles. The upper part of the surface layer is brown, moderately alkaline very cobbly silty clay about 2 inches thick. The lower part is reddish brown, moderately alkaline clay and silty clay about 29 inches thick. The subsoil to a depth of 60 inches or more is yellowish red, moderately alkaline sandy clay loam 5 inches thick and is underlain by pink, moderately alkaline, weakly lime-cemented very cobbly sandy clay loam.

Included in this unit are small areas of Bonita very cobbly clay loam throughout the unit, Tapco cobbly clay loam on the sides and upper end of terraces, and Torrifluvents in drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Bonita soil is very slow. Available water capacity is high. Water supplying capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 30 to 35 inches. Runoff is slow when the soil is dry and medium when it is moist. The hazard of water erosion is slight.

This unit is used mainly as rangeland and for wildlife habitat. It is also used for homesite development and recreation.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly tobosa, sideoats grama, vine-mesquite, cane bluestem, and plains bristlegrass.

This unit can support large numbers of livestock during the months following the summer rains. When the plants go dormant, they deteriorate rapidly in palatability and food value. If the plants are used during this period, the livestock usually require a protein supplement.

Suitable range management practices on this unit are fencing, implementing planned grazing systems, and developing water for livestock. Because cobbles on the surface limit grazing, the unit responds readily to the use of grazing management stystems. Control of runoff reduces erosion and increases the production of forage.

If this unit is used for homesite development, the main limitations are high shrink-swell potential and low soil strength. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with a material that has low shrink-swell potential. Excavation for roads and buildings increases the hazard of erosion. Structures to divert runoff are needed if buildings and roads are constructed. Roads should be designed to offset the limited ability of the soil in this unit to support a load.

If this unit is used for septic tank absorption fields, the main limitation is the very slow permeability of the soil. This limitation can be partially overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIs.

6—Calciorthids and Torriorthents, 10 to 90 percent slopes. This map unit is in highly dissected areas on hills. Areas of this unit have been subject to stream entrenchment and headward erosion (fig. 1). The eroded condition of this unit is believed to be the result of normal geologic erosion, not accelerated erosion because of man's activities. This erosion would be very difficult to control. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Included in this unit are small areas of Tres Hermanos very gravelly loam, Anthony gravelly sandy loam, Gila loam, Continental very gravelly loam, Nickel very gravelly sandy loam, and Torrifluvents. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Calciorthids are moderately deep and deep and are well drained. They formed in lakebed sediment derived from mixed sources. Calciorthids are loamy and have layers of lime and silica accumulation that are weakly to strongly cemented in places.

Permeability of the Calciorthids is highly variable. Available water capacity is very low. Water supplying

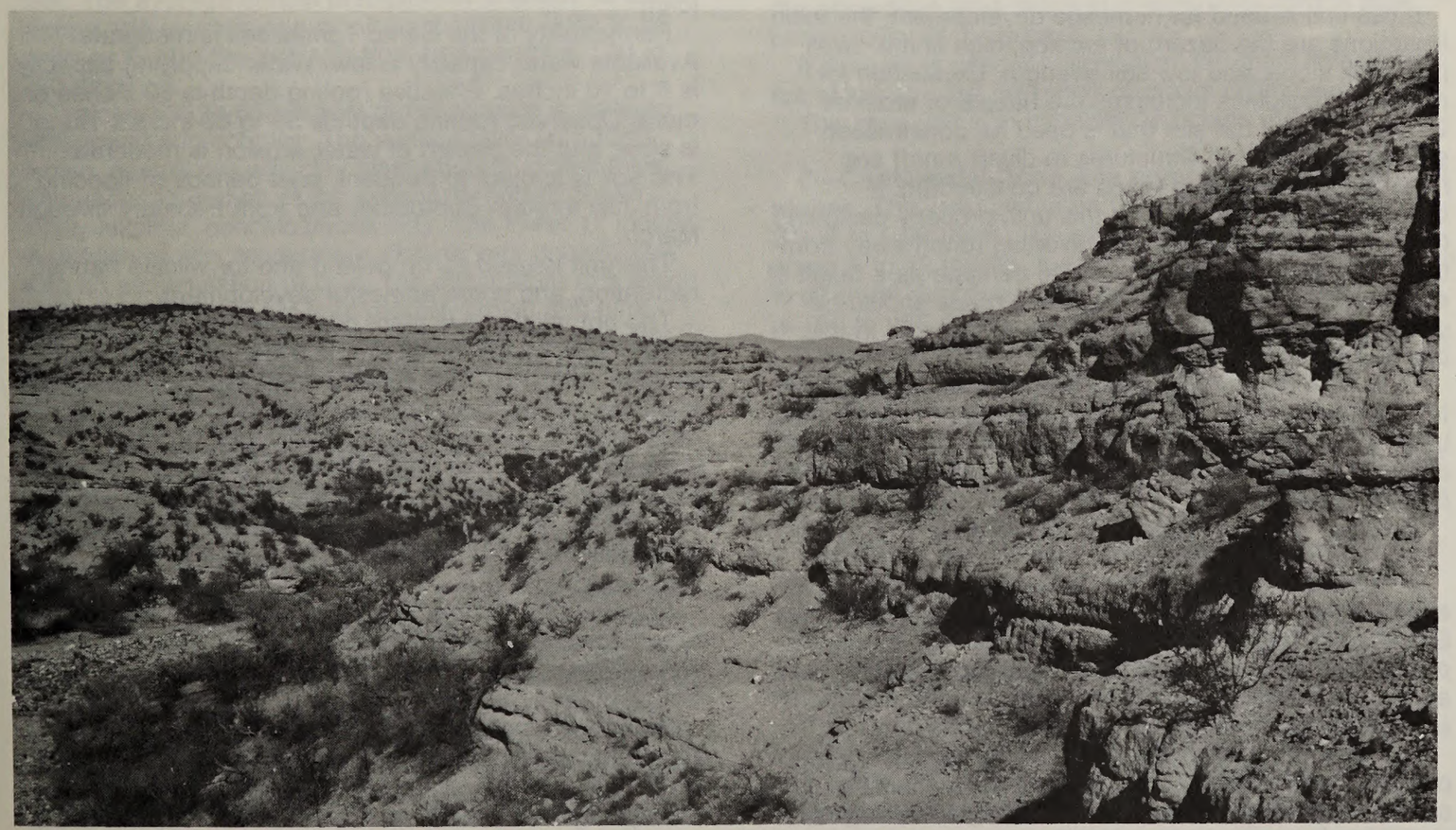


Figure 1.—Typical area of Calciorthids and Torriorthents, 10 to 90 percent slopes.

capacity is 3 to 4 inches. Effective rooting depth is 40 to 60 inches. Observed rooting depth is 6 to 25 inches. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

Torriorthents are deep and well drained. They formed in colluvium and alluvium derived dominantly from lakebed deposits. Torriorthents are stratified loamy sand to clay.

Permeability of the Torriorthents is variable. Available water capacity is low. Water supplying capacity is 3 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 6 to 25 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is slight.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development.

The potential native plant community on this unit is mainly bush muhly, black grama, fluffgrass, and creosotebush. The very steep to vertical side slopes are essentially barren. The production of vegetation for livestock grazing is low because of strong alkalinity, excess lime, very low available water capacity, and the high hazard of erosion.

Calciorthids and Torriorthents do not respond to grazing management. Livestock normally make little use of this unit except for those areas along major trails and drainageways.

If this unit is used for homesite development, the main limitations are the hazard of erosion, high shrink-swell potential, slope, and low soil strength. Excavation for roads and buildings increases the hazard of erosion. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load.

Slow permeability and slope are the main limitations of these soils for septic tank absorption fields. Using sandy backfill for the trench and increasing the length of the absorption lines help to compensate for the slow permeability.

This map unit is in capability subclass VIIe.

7—Comoro-Santo Tomas complex, 2 to 8 percent slopes. This map unit is on flood plains and alluvial fans. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 60 to 66 degrees F, and the average frost-free period is 190 to 240 days.

This unit is 50 percent Comoro sandy loam and 30 percent Santo Tomas very cobbly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Anthony gravelly sandy loam and other similar soils. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Comoro soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown, mildly alkaline sandy loam about 12 inches thick. The underlying material is stratified, grayish brown, moderately alkaline sandy loam about 29 inches thick. To a depth of 60 inches or more, it is light brown, moderately alkaline extremely cobbly loamy sand.

Permeability of the Comoro soil is moderately rapid. Available water capacity is moderate. Water supplying capacity is 6 to 10 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 40 to 50 inches. Runoff is slow, and the hazard of water erosion is moderate. This soil is subject to occasional, brief periods of flooding from July through September and from February through March.

The Santo Tomas soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, 50 to 80 percent of the surface is covered with cobbles and a few stones. The surface layer is dark brown, neutral very cobbly sandy loam about 6 inches thick. The underlying material to a depth of 60 inches of more is stratified, dark brown, neutral very gravelly sandy loam.

Permeability of the Santo Tomas soil is moderate. Available water capacity is low. Water supplying capacity is 6 to 10 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 50 to 60 inches. Runoff is slow, and the hazard of water erosion is moderate. This soil is subject to frequent, brief periods of flooding from July through September and from February through March.

This unit is used as rangeland and for wildlife habitat, recreation, and some homesite development.

The potential native plant community on this unit is mainly bush muhly, black grama, sideoats grama, and Arizona cottontop. The present vegetation in most areas is mainly mesquite and catclaw acacia with an understory of threeawn, bush muhly, and broom snakeweed. This unit produces year-round browse for wildife and livestock. The diversity of vegetation, which includes an abundance of streamside plant species, and availability of water encourage a constant grazing pressure on this unit.

Livestock prefer this unit to most others in the survey area because of its accessibility and the availability of water. This results in overgrazing and subsequent deterioration of the vegetation.

Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. If the shrubs are managed to create open areas, this unit produces a good stand of desirable grasses and forbs. Areas where brush is managed by prescribing burning or by chemical

or mechanical methods may be initially subject to a greater hazard of erosion.

Planned grazing systems are essential to maintain plant vigor and forage production on this unit. Fencing and deferred grazing are important in planned grazing systems. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential of the soils.

If this unit is used for homesite development, the main limitation is the hazard of flooding. Flooding can be controlled only by use of major flood control structures. Excavation for houses and access roads in places exposes material that is highly susceptible to soil blowing. Cutbanks are not stable and are subject to slumping.

Flooding is the main limitation of this unit for septic tank absorption fields. Effluent from absorption fields can surface in downslope areas and create a hazard to health.

If this unit is used for recreation, the main limitations are the hazard of flooding and the presence of stones and cobbles on the surface.

This map unit is in capability subclass VIw.

8—Continental gravelly clay loam, 2 to 15 percent slopes. This deep, well drained soil is on fan terraces. It formed in mixed alluvium. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, 35 to 65 percent of the surface is covered with gravel and cobbles. The surface layer is reddish brown, neutral gravelly clay loam about 2 inches thick. The upper 15 inches of the subsoil is reddish brown, mildly alkaline, noncalcareous clay. The lower 17 inches is reddish brown, moderately alkaline very gravelly clay with an accumulation of lime. The substratum to a depth of 70 inches or more is light reddish brown and pink, moderately alkaline very gravelly loamy sand and very cobbly loamy sand that is weakly to moderately cemented with lime.

Included in this unit are small areas of Pinaleno cobbly and very cobbly loam on hillsides, Eba cobbly and very cobbly clay loam on the steeper part of the terraces, and stony soils near the mountain front. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Continental soil is slow to a depth of 34 inches and rapid below this depth. Available water capacity is high. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 30 to 40 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly as rangeland and for wildlife habitat and recreation. It is also used for homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly black grama, bush muhly, tobosa, and sideoats grama. Good accessibility, a large variety of palatable plants, and availability of water encourage a constant grazing pressure on this unit. Suitable range management practices are fencing, implementing planned grazing systems, and developing water for livestock.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of species is maintained in the plant community.

If this unit is used for homesite development, the main limitations are shrink-swell potential and low soil strength. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Structures to divert runoff are needed if buildings and roads are constructed. Roads should be designed to offset the limited ability of the soil to support a load. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for septic tank absorption fields, the main limitation is the slow permeability of the subsoil. Absorption lines should be placed below the slowly permeable layer for best results. Increasing the size of the absorption area helps to compensate for the slow permeability of the subsoil.

If this unit is used for recreation, the main limitations are slope and the presence of gravel on the surface.

This map unit is in capability subclass VIIe.

9—Continental-Dona Ana complex, 2 to 15 percent slopes. This map unit is on fan terraces. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 50 percent Continental gravelly sandy clay loam and 30 percent Dona Ana sandy loam. The Continental soil is on the central part of the terraces, and the Dona Ana soil is on the more sandy part of the lower ends of the terraces. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Pinaleno very cobbly loam in the less sloping areas on hillsides, Eba very cobbly sandy clay loam in the steeper areas on hillsides, and Torrifluvents in drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Continental soil is deep and well drained. It formed in mixed alluvium. Typically, 35 to 65 percent of the surface is covered with gravel and cobbles. The surface layer is reddish brown, mildly alkaline gravelly sandy clay loam about 6 inches thick. The subsoil, about 30 inches thick, is reddish brown, mildly alkaline clay that

has a layer of lime accumulation in the lower part. The substratum to a depth of 60 inches or more is reddish brown or pink, moderately alkaline and strongly alkaline, weakly to moderately lime-cemented gravelly sandy loam.

Permeability of the Continental soil is slow to a depth of 36 inches and moderately rapid below this depth. Available water capacity is high. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 30 to 40 inches. Runoff is medium, and the hazard of water erosion is slight.

The Dona Ana soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is light brown and brown, mildly alkaline sandy loam about 10 inches thick. The subsoil is brown, calcareous, moderately alkaline sandy clay loam and reddish brown, calcareous, moderately alkaline clay loam about 25 inches thick. The substratum to a depth of 60 inches or more is very pale brown, moderately alkaline clay loam and loam. Lime is present as thin veins, coatings, and soft masses below a depth of 15 inches.

Permeability of the Dona Ana soil is moderate. Available water capacity is high. Water supplying capacity is 6 to 8 inches. Effective and observed rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used mainly as rangeland and for wildlife habitat and recreation. It is also used for homesite development.

The potential plant community on the Continental soil is mainly black grama, bush muhly, tobosa, and sideoats grama. The present vegetation in most areas is mainly creosotebush, bush muhly, cacti, and mesquite.

The potential plant community on the Dona Ana soil is mainly black grama, bush muhly, plains bristlegrass, and creosotebush. The present vegetation in most areas is mainly creosotebush, bush muhly, cacti, and mesquite.

The production of vegetation suitable for livestock grazing on this unit is limited by the low available water capacity of the soils and competition from creosotebush for moisture. Suitable range management practices are fencing, implementing planned grazing systems, and developing water for livestock. Because of the lack of a seed source and the competition from creosotebush for moisture, desirable grasses are very slow to recover even with the best grazing management.

If the Continental soil is used for homesite development, the main limitations are shrink-swell potential and low soil strength. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

The slow permeability in the subsoil limits the use of this soil for septic tank absorption fields. Absorption lines should be placed below the slowly permeable layer. Increasing the size of the absorption area helps to compensate for the slow permeability of the subsoil.

Structures to divert runoff are needed if buildings and roads are constructed on this soil. Roads should be designed to offset the limited ability of the soil to support a load. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If the Dona Ana soil is used for homesite development, the main limitation is the hazard of erosion and shrink-swell potential. Preserving the existing plant cover during construction helps to control erosion. Excavation for houses and access roads in places exposes material that is highly susceptible to soil blowing. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

Septic tank absorption fields are moderately limited in this soil by the moderate permeability of the subsoil. This limitation can be overcome by increasing the size of the absorption field.

If this unit is used for recreation, the main limitations on the Continental soil are slope and gravel on the surface. The main limitation on the Dona Ana soil is slope.

This map unit is in capability subclass VIIe.

10—Eba-Pinaleno complex, 2 to 40 percent slopes. This map unit is on fan terraces and hillsides. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 50 percent Eba extremely cobbly sandy clay loam and 30 percent Pinaleno very cobbly loam. The Eba soil is on the fan terraces, and the Pinaleno soil is on the hillsides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Continental gravelly clay loam on the central part of the fan terraces, Tres Hermanos gravelly sandy clay loam on the hillsides, and Torrifluvents in drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Eba soil is deep and well drained. It formed in mixed alluvium. Typically, 50 to 80 percent of the surface is covered with cobbles and gravel. The surface layer is brown, moderately alkaline extremely cobbly sandy clay loam about 6 inches thick. The upper 11 inches of the subsoil is reddish brown, moderately alkaline very cobbly sandy clay that has a small amount of lime. The lower 15 inches is reddish brown, moderately alkaline very gravelly sandy clay and very gravelly sandy clay loam that is moderate in content of soft lime masses. The substratum to a depth of 60 inches or more is pink and pinkish white, moderately alkaline, and very weakly to strongly lime-cemented. It is extremely gravelly sandy

clay loam in the upper 16 inches and very cobbly loamy sand in the lower 12 inches or more.

Permeability of the Eba soil is slow. Available water capacity is moderate. Water supplying capacity is 5 to 8 inches. Effective rooting depth is 30 to 40 inches. Observed rooting depth is 15 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

The Pinaleno soil is deep and well drained. It formed in mixed alluvium. Typically, 50 to 80 percent of the surface is covered with cobbles and gravel. The surface layer is brown, moderately alkaline very cobbly loam about 2 inches thick. The upper 10 inches of the subsoil is reddish brown, moderately alkaline very gravelly clay loam that has a few small, soft lime masses. The lower 18 inches is light brown, moderately alkaline very gravelly clay loam that has a moderate content of soft lime masses. The substratum to a depth of 60 inches or more is reddish brown and pinkish gray, moderately alkaline and strongly alkaline, weakly to moderately lime-cemented gravelly sandy loam that is stratified with finer and coarser textured material.

Permeability of the Pinaleno soil is moderately slow. Available water capacity is moderate. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used as rangeland and for wildlife habitat, recreation, and homesites.

If the range vegetation on the Eba soil is in good or excellent condition, the native grasses are mainly tobosa, Arizona cottontop, bush muhly, and sideoats grama. The range vegetation on the Pinaleno soil is mainly bush muhly, black grama, sideoats grama, and Arizona cottontop.

Good accessibility, a large variety of palatable plants, and availability of water encourage a constant grazing pressure. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Because the presence of a large amount of cobbles on the surface of the soils limits accessibility for grazing, this unit responds rapidly to grazing management.

If the Eba soil is used for homesite development, the main limitation is slope. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Access roads must be designed to control surface runoff and help stabilize cut slopes. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

Slope and slow permeability in the subsoil limit the use of this soil for septic tank absorption fields. Absorption lines should be placed below the slowly permeable layer. Increasing the size of the absorption field also helps to compensate for the slow permeability of the subsoil.

If the Pinaleno soil is used for homesite development or for septic tank absorption fields, the main limitation is slope. Erosion is a moderate hazard in the steep areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for recreation, the main limitations are slope and the presence of gravel, cobbles, and stones on the surface.

This map unit is in capability subclass VIIe.

11—Eloma-Alsco complex, 15 to 70 percent slopes. This map unit is on hillsides. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

This unit is 45 percent Eloma very cobbly loam and 35 percent Alsco extremely cobbly sandy loam. The Eloma soil is mostly on the upper part of the hillsides, and the Alsco soil is on the lower part adjacent to drainageways. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to the Eloma and Alsco soils but have a thinner subsoil and are steeper. Also included are small areas of Santo Tomas very cobbly sandy loam near drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Eloma soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from granite and gneiss. Typically, 30 to 80 percent of the surface is covered with cobbles and some stones. The surface layer is brown, slightly acid very cobbly loam about 2 inches thick. The subsoil is neutral and mildly alkaline, dark brown very cobbly clay loam, dark reddish brown very gravelly clay and extremely cobbly clay, and reddish brown extremely cobbly clay and extremely cobbly sandy clay about 43 inches thick. The substratum to a depth of 60 inches or more is light brown, moderately alkaline, slightly calcareous extremely cobbly sandy loam. In some areas the surface layer is extremely cobbly or extremely stony.

Permeability of the Eloma soil is slow. Available water capacity is high. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate.

The Alsco soil is deep and well drained. It formed in alluvium derived dominantly from granite and gneiss. Typically, 30 to 80 percent of the surface is covered with cobbles and a few stones. The surface layer is dark yellowish brown, mildly alkaline extremely cobbly sandy loam about 2 inches thick. The upper 3 inches of the subsoil is brown, mildly alkaline extremely cobbly sandy

clay loam. The lower 11 inches is brown, moderately alkaline, calcareous very cobbly clay loam. The substratum to a depth of 60 inches or more is light brown and pinkish white, moderately alkaline, and calcareous. It is very gravelly loam in the upper 5 inches and extremely cobbly sandy loam in the lower 39 inches or more. In some areas the surface layer is very stony.

Permeability of the Alsco soil is moderately slow. Available water capacity is high. Water supplying capacity is 6 to 10 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 35 to 45 inches. Runoff is medium to rapid, and the hazard of water erosion is slight.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on the Eloma soil is in good or excellent condition, the native grasses are mainly sideoats grama, black grama, plains lovegrass, and hairy grama. If the range vegetation on the Alsco soil is in good or excellent condition, the native grasses are mainly creosotebush, bush muhly, black grama, and threeawn. If the range is overgrazed, the proportion of preferred forage plants decreases; therefore, livestock grazing should be managed so that the desired balance of species is maintained in the plant community.

Cattle usually avoid areas of this unit unless their movement is restricted by fences. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Because stones and cobbles on the surface limit access for grazing, this unit responds rapidly to the use of grazing management systems. Control of runoff reduces erosion and increases the production of forage. Trails or walkways can be constructed to encourage livestock grazing in areas where access is limited.

If this unit is used for homesite development, the main limitations are slope and stones and cobbles. Erosion is a moderate hazard on the Eloma soil. Preserving the existing plant cover during construction helps to control erosion. Only the part of the site that is used for construction should be disturbed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for septic tank absorption fields, the main limitations are slope, slow permeability, and cobbles and stones on the Eloma soil and slope, moderately slow permeability, and large stones on the Alsco soil.

If this unit is used for recreation, the main limitations are slope and cobbles and stones.

This map unit is in capability subclass VIe.

12—Eloma-White House association, 10 to 60 percent slopes. This map unit is on hillsides and fan terraces. Elevation is 3,500 to 5,000 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

This unit is 50 percent Eloma very cobbly loam and 30 percent White House gravelly loam. The Eloma soil is on the hillsides, and the White House soil is on the fan terraces.

Included in this unit are small areas of Alsco very cobbly loam on hillsides, Comoro sandy loam and Santo Tomas very cobbly sandy loam along drainageways, Aravaipa very gravelly loam on hillsides, and Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Eloma soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from granite and gneiss. Typically, 30 to 80 percent of the surface is covered with cobbles and gravel. The surface layer is brown, neutral very cobbly loam about 2 inches thick. The subsoil is dark brown and dark reddish brown, mildly alkaline to moderately alkaline extremely cobbly clay, extremely cobbly sandy clay, very cobbly clay loam, and very gravelly clay about 43 inches thick. The substratum to a depth of 60 inches or more is light brown, moderately alkaline extremely cobbly sandy loam that in some areas has a small amount of lime in the lower part.

Permeability of the Eloma soil is slow. Available water capacity is high. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate.

The White House soil is deep and well drained. It formed in mixed alluvium derived dominantly from granite and gneiss. Typically, 20 to 50 percent of the surface is covered with fine gravel. The surface layer is brown, neutral gravelly loam about 1 inch thick. The upper 24 inches of the subsoil is dark reddish brown, neutral to moderately alkaline clay loam and clay. The lower 21 inches is red and yellowish red, moderately alkaline sandy clay. The substratum to a depth of 65 inches is moderately alkaline, yellowish red sandy clay loam and light brown clay loam that has a few veins and soft masses of lime.

Permeability of the White House soil is slow. Available water capacity is high. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, black grama, blue grama, plains lovegrass, and cane bluestem. Livestock prefer this unit to most others in the survey area because of accessibility and the availability of a large variety of palatable plants. This results in overgrazing and subsequent deterioration of the vegetation.

Planned grazing systems are essential to maintain plant vigor and forage production. Fencing and deferred

grazing are important in planned grazing systems. Brush management, contour furrowing, and range seeding can be used to restore the production of forage on this unit. The unit is suited to the construction of livestock water impoundments.

If this unit is used for homesite development, the main limitations are slope and cobbles and stones on the Eloma soil and the slope and shrink-swell potential of the White House soil. Erosion is a moderate hazard in the steep areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

Slope and slow permeability limit the use of this unit for septic tank absorption fields. Use of sandy backfill for the trench and long absorption lines helps to compensate for the slow permeability.

If this unit is used for recreation, the main limitations are slope and cobbles and stones on the Eloma soil and slope on the White House soil.

This map unit is in capability subclass VIe.

13—Fallsam-Cabezon-Rock outcrop complex, 9 to 70 percent slopes. This map unit is on mountains. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 130 to 190 days.

This unit is 35 percent Fallsam extremely cobbly silty clay loam, 25 percent Cabezon very cobbly clay, and 25 percent Rock outcrop and talus material. The Fallsam soil is dominantly on the lower two-thirds of the mountainsides, and the Cabezon soil is dominantly on the upper one-third of the mountainsides. Rock outcrop, which occurs throughout the unit, is near the tops of mountains, and the talus material is in elongated, steep areas downslope from the areas of Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of moderately deep and deep soils along drainageways. These soils are very gravelly and very cobbly loam and clay loam to a depth of about 36 inches. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Fallsam soil is deep and well drained. It formed in colluvium derived dominantly from volcanic rock. Typically, 60 to 90 percent of the surface is covered with basalt cobbles. The surface layer is brown, slightly acid extremely cobbly silty clay loam about 2 inches thick. The subsoil to a depth of 60 inches or more is brown, neutral and moderately alkaline very gravelly clay and extremely cobbly clay. Bedrock in some areas is at a depth of as little as 45 inches.

Permeability of the Fallsam soil is slow. Available water capacity is moderate. Water supplying capacity is 10 to 12 inches. Effective rooting depth is 45 to 60 inches. Observed rooting depth is 30 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Cabezon soil is very shallow and shallow and is well drained. It formed in colluvium derived dominantly from basalt. Typically, 30 to 60 percent of the surface is covered with cobbles and gravel. The surface layer is dark grayish brown, slightly acid very cobbly clay about 2 inches thick. The subsoil is very dark grayish brown and dark brown, neutral and mildly alkaline gravelly clay about 12 inches thick over basalt. Depth to basalt ranges from 8 to 20 inches.

Permeability of the Cabezon soil is slow. Available water capacity is low. Water supplying capacity is 8 to 10 inches. Effective and observed rooting depth is 8 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop is areas of exposed basalt. In places it consists of vertical cliffs about 100 feet high.

This unit is used as rangeland and for wildlife habitat and recreation.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, tobosa, black grama, curlymesquite, and plains lovegrass.

Cattle usually avoid areas of this unit. If cattle are restricted to this unit by fences, they tend to graze the summits and less sloping areas, leaving the steeper areas essentially ungrazed. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

If this unit is used for recreation, the main limitations are slope and cobbles and stones on the surface. Depth to rock is also a limitation on the Cabezon soil.

If this unit is used for homesite development, the main limitations are slope, shrink-swell potential, and cobbles and stones. Depth to rock is also a limitation on the Cabezon soil. Erosion is a moderate hazard in the steeper areas. Excavation for roads and buildings increases the hazard of erosion. Only the part of the site that is used for construction should be disturbed. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Roads should be designed to offset the limited ability of the soils in this unit to support a load.

If this unit is used for septic tank absorption fields, the main limitations are slope, slow permeability, and depth to rock. The limitations of depth to rock and slow

permeability can be partially overcome by increasing the size of the absorption field and using fill to increase the depth of the soils. Tile lines should be placed on the contour. An alternative is to install holding tanks or to transport the effluent offsite to a more suitable soil.

This map unit is in capability subclass VIe.

14—Gila fine sandy loam, 0 to 2 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, the surface layer is light yellowish brown and brown moderately alkaline fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches or more is brown and pale brown, moderately alkaline loam that is stratified with silt loam and very fine sandy loam.

Included in this unit are small areas of Anthony sandy loam and Torrifluvents. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Gila soil is moderate. Available water capacity is high. Water supplying capacity is 8 to 10 inches. Effective and observed rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is subject to occasional, brief periods of flooding from July through September and from February through March.

Most areas of this unit are used for irrigated cropland. A few areas are used for homesite development, rangeland, wildlife habitat, and recreation.

This unit is well suited to hay and pasture. The main limitation is the hazard of flooding. Grasses and legumes grow well on this unit if adequate fertilizer is used. All adapted pasture plants can be grown, but bunch-type species planted alone generally are not suitable because of the hazard of erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

Irrigation water can be applied by the furrow, border, and sprinkler methods. Leveling helps to insure the uniform application of water.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding.

The risk of flooding can be reduced by the use of dikes, leeves, and channels. Under a good management program, the unit can produce the following yields per acre of the commonly grown crops: 1,000 pounds of cotton lint, 8 tons of alfalfa hay, 85 bushels of barley, 80 bushels of wheat, and 90 bushels of grain sorghum.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop. To avoid overirrigating the soil and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Crop residue left on or near the surface of the soil in this unit helps to conserve moisture, maintain tilth, and control erosion. Soil blowing can be reduced by keeping the soil rough and cloddy when it is not protected by vegetation. Crops respond to nitrogen and phosphorus fertilizer.

The potential native plant community on this unit is mainly giant sacaton, sideoats grama, tobosa, and vine-mesquite. The present vegetation in most areas is mainly mesquite, willow trees, and a few grasses, dominantly bermudagrass, bush muhly, threeawn, and annuals. This unit produces year-round browse for wildlife or livestock. The diversity of vegetation, which includes an abundance of streamside plant species, and availability of water encourage a constant grazing pressure.

Brush management improves deteriorated areas of range that are producing more woody shrubs than those in the potential plant community. If the shrubs are managed to create open areas, this unit produces a good stand of desirable grasses and forbs. Areas where brush is managed by prescribed burning or by chemical or mechanical methods may initially be subject to a greater hazard of erosion. Fencing and using planned grazing systems are other suitable management practices.

If this unit is used for homesite development, the main limitation is the hazard of flooding. Flooding can be controlled only by use of major flood control structures. Roads should be designed to offset the limited ability of the soil in this unit to support a load. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. The hazard of flooding limits the use of the soil for septic tank absorption fields.

If this unit is used for recreation, the main limitation is the hazard of flooding.

This map unit is in capability subclasses IIw, irrigated, and VIw, nonirrigated.

15—Glendale silty clay loam, 0 to 2 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, the surface layer is light brown, moderately alkaline silty clay loam about 10 inches thick. The underlying material is light brown and pink, moderately alkaline, stratified silty clay loam, silt loam, and loam to a depth of 50 inches. Below that, is pink, moderately alkaline silty clay to a depth of 63 inches.

Included in this unit are small areas of Pima silty clay loam, Hantz silty clay, and Guest silty clay. Included

areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Glendale soil is moderately slow to a depth of 50 inches and slow below this depth. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 40 to 60 inches. Runoff is slow to medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate. This soil is subject to occasional, brief periods of flooding from July through September and from February through March.

This unit is used mainly for irrigated cropland. It is also used for homesite development, rangeland, wildlife habitat, and recreation.

This unit is well suited to hay and pasture. The main limitation is the hazard of flooding. Grasses and legumes grow well if adequate fertilizer is used. All adapted pasture plants can be grown, but bunch-type species planted alone generally are not suitable because of the hazard of erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

Irrigation water can be applied by the furrow, border, and sprinkler methods. Leveling helps to insure the uniform application of water.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding. Flooding can be controlled only by the use of major flood control structures such as dikes, levees, diversions, or channels.

Under a good management program, the soil in this unit can produce the following yields per acre of the commonly grown crops: 1,000 pounds of cotton lint, 8 tons of alfalfa hay, 85 bushels of barley, 80 bushels of wheat, and 90 bushels of grain sorghum.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Crop residue left on or near the surface of the soil in this unit helps to conserve moisture, maintain tilth, and control erosion. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Crops respond to nitrogen and phosphorus fertilizer.

If this unit is used for homesite development, the main limitations are the hazard of flooding and shrink-swell potential. Flooding can be controlled only by use of major flood control structures. Excavation for houses and access roads in places exposes material that is highly susceptible to soil blowing. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If the unit is used for septic tank absorption fields, the main limitations are the hazard of flooding and moderately slow permeability.

The potential native plant community on the Glendale soil is mainly giant sacaton, sideoats grama, tobosa, and vine-mesquite. The present vegetation in most areas is mainly mesquite trees and fourwing saltbush with a few scattered perennial grasses. This soil produces year-round browse for wildlife or livestock.

Brush management improves deteriorated areas of range that are producing more woody shrubs than those in the potential plant community. If the shrubs are managed to create open areas, the soil in this unit produces a good stand of desirable grasses and forbs. Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be initially subject to a greater hazard of erosion. Fencing, deferred grazing, and brush control are other suitable management practices.

If this unit is used for recreation, the main limitations are the hazards of flooding and erosion.

This map unit is in capability subclasses IIw, irrigated, and VIw, nonirrigated.

16—Glendale-Gila complex, 0 to 5 percent slopes, severely eroded. This map unit is on alluvial fans (fig. 2). Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 55 percent Glendale silty clay loam and 35 percent Gila loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Pima silty clay loam and Hantz silty clay. Also included are small areas of saline soils scattered throughout the unit. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Glendale soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is light gray, moderately alkaline silty clay loam about 1 inch thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown, moderately alkaline silty clay loam stratified with finer and coarser textured material.

Permeability of the Glendale soil is moderately slow. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 30 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate. This soil is subject to rare, brief periods of flooding from

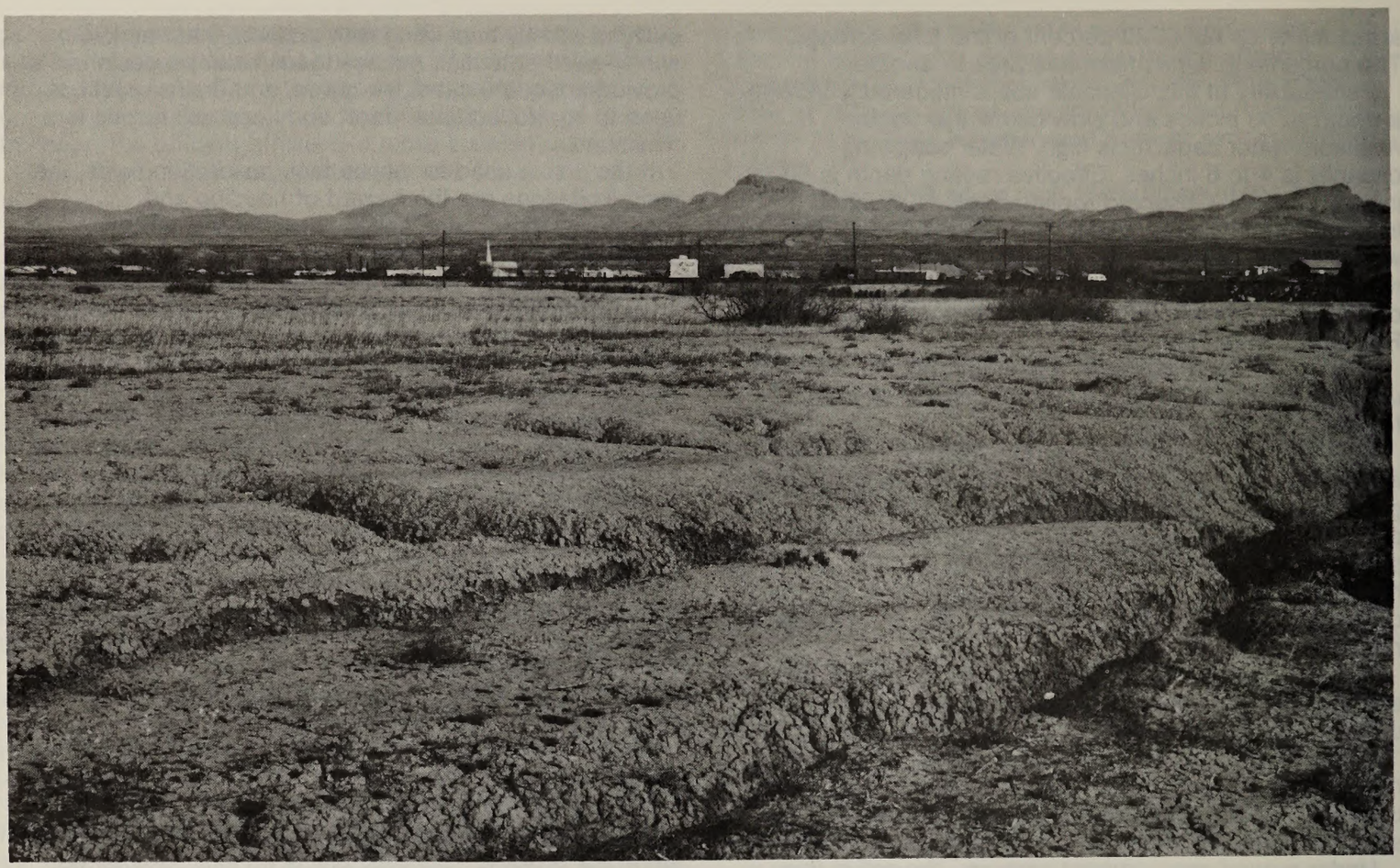


Figure 2.—Typical area of Glendale-Gila complex, 0 to 5 percent slopes, severely eroded.

July through September and from February through March.

The Gila soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is brown, moderately alkaline loam about 2 inches thick. The underlying material to a depth of 60 inches or more is brown or pale brown, moderately alkaline, stratified loam, silt loam, and very fine sandy loam.

Permeability of the Gila soil is moderate. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 30 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate. This soil is subject to rare, brief periods of flooding from July through September and from February through March.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development and irrigated cropland.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly bush muhly, giant sacaton, alkali sacaton, tobosa, Arizona cottontop, and creosotebush. The present vegetation in most areas is mainly scattered tobosa and alkali sacaton. Fourwing saltbush and mesquite are in some areas.

If water-spreading dikes are installed and controlled grazing is applied, this unit is highly productive. Planned grazing systems are essential to maintain plant vigor and forage production. Fencing and deferred grazing are important in planned grazing systems. Other suitable range management practices are fencing and developing water for livestock.

Control of runoff reduces erosion and increases the production of forage on this unit. Because of the lack of a seed source and the competition from creosotebush for moisture, desirable grasses are very slow to recover even with the best grazing management.

If this unit is used for homesite development, the main limitations are the hazard of flooding and the shrink-swell potential of the Glendale soil. Flooding can be controlled only by use of major flood control structures.

Excavation for roads and buildings increases the hazard of erosion. Structures to divert runoff are needed

if buildings and roads are constructed. Access roads must be designed to control surface runoff and help stabilize cut slopes. Buildings and roads can be designed to offset the effects of shrinking and swelling.

If this unit is used for septic tank absorption fields, the main limitations are the hazard of flooding and the moderately slow permeability of the Glendale soil. The limitation of the moderately slow permeability of the Glendale soil can be overcome by increasing the size of the absorption field.

If this unit is used for recreation, the main limitations are the hazard of flooding and slope.

If this unit is used for hay and pasture, the main limitation is the hazard of flooding. All adapted pasture plants can be grown on this unit, but bunch-type species planted alone generally are not suitable because of the hazard of erosion.

Irrigation water can be applied by the furrow, border, and sprinkler methods. Leveling helps to insure the uniform application of water.

Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Grasses and legumes grow well if adequate fertilizer is used.

This unit is well suited to irrigated crops. The main limitation is the hazard of flooding.

Under a good management program, the soils in this unit can produce the following yields per acre of the commonly grown crops: 1,000 pounds of cotton lint, 8 tons of alfalfa hay, 85 bushels of barley, 80 bushels of wheat, and 90 bushels of grain sorghum.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

This map unit is in capability subclass VIIc.

17—Guest silty clay, 0 to 2 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, the surface layer is grayish brown, moderately alkaline silty clay about 9 inches thick. The underlying material to a depth of 72 inches is grayish brown and brown moderately alkaline clay.

Included in this unit are small areas of Pima silty clay loam, Glendale silty clay loam, and Hantz silty clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Guest soil is slow. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective and observed rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to occasional, brief periods of flooding from July through September and from February through March.

This unit is used mainly for irrigated crops. It is also used as rangeland and for wildlife habitat, recreation, and homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding, a slow water intake rate, and slow permeability. The risk of flooding can be reduced by the use of dikes, levees, and diversions.

Under a good management program, the soil in this unit can produce the following yields per acre of the commonly grown crops: 900 pounds of cotton lint, 6.5 tons of alfalfa hay, 100 bushels of barley, 95 bushels of wheat, and 105 bushels of grain sorghum.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. To avoid overirrigating the soil and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Tillage should be kept to a minimum.

If this unit is used for hay and pasture, the main limitations are the hazard of flooding, a slow water intake rate, and slow permeability. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation water can be applied by the furrow, border, and sprinkler methods. Leveling helps to insure the uniform application of water. Grasses and legumes grow well if adequate fertilizer is used.

If this unit is used for homesite development, the main limitations are the hazard of flooding, shrink-swell potential, and low soil strength. Flooding can be controlled only by use of major flood control structures. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Excavation for roads and buildings increases the hazard of erosion. Roads should be designed to offset the limited ability of the soil in this unit to support a load. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for septic tank absorption fields, the main limitations are the hazard of flooding and slow

permeability. Use of sandy backfill for the trench and long absorption lines helps to compensate for the slow permeability.

If this unit is used for recreation, the main limitations are the hazard of flooding and the clayey texture of the soil, which is sticky when wet and has large cracks when dry.

The potential native plant community on the Guest soil is mainly tobosa, vine-mesquite, and some cane bluestem and twoflower trichloris. The present vegetaion in most areas is mainly mesquite and saltcedar with scattered perennial grasses. This soil produces year-round browse for wildlife or livestock.

Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. If the shrubs are managed to create open areas, this soil produces a good stand of desirable grasses and forbs. When the plants go dormant, they deteriorate rapidly in palatability and value as food. If they are used during the dormant period, the livestock usually require a protein supplement. If the plant cover is disturbed, protection from flooding is needed to control gullying, streambank cutting, and sheet erosion. Fencing, deferred grazing, and brush control are suitable management practices.

This map unit is in capability subclasses IIIw, irrigated, and VIw, nonirrigated.

18—Guest-Hantz complex, 0 to 5 percent slopes, severely eroded. This map unit is on alluvial fans (fig. 3). Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 55 percent Guest silty clay and 35 percent Hantz silty clay. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Glendale silty clay loam, Pima silty clay loam, and Gila silt loam.

Figure 3.—Headcutting and gullying on Guest-Hantz complex, 0 to 5 percent slopes, severely eroded.

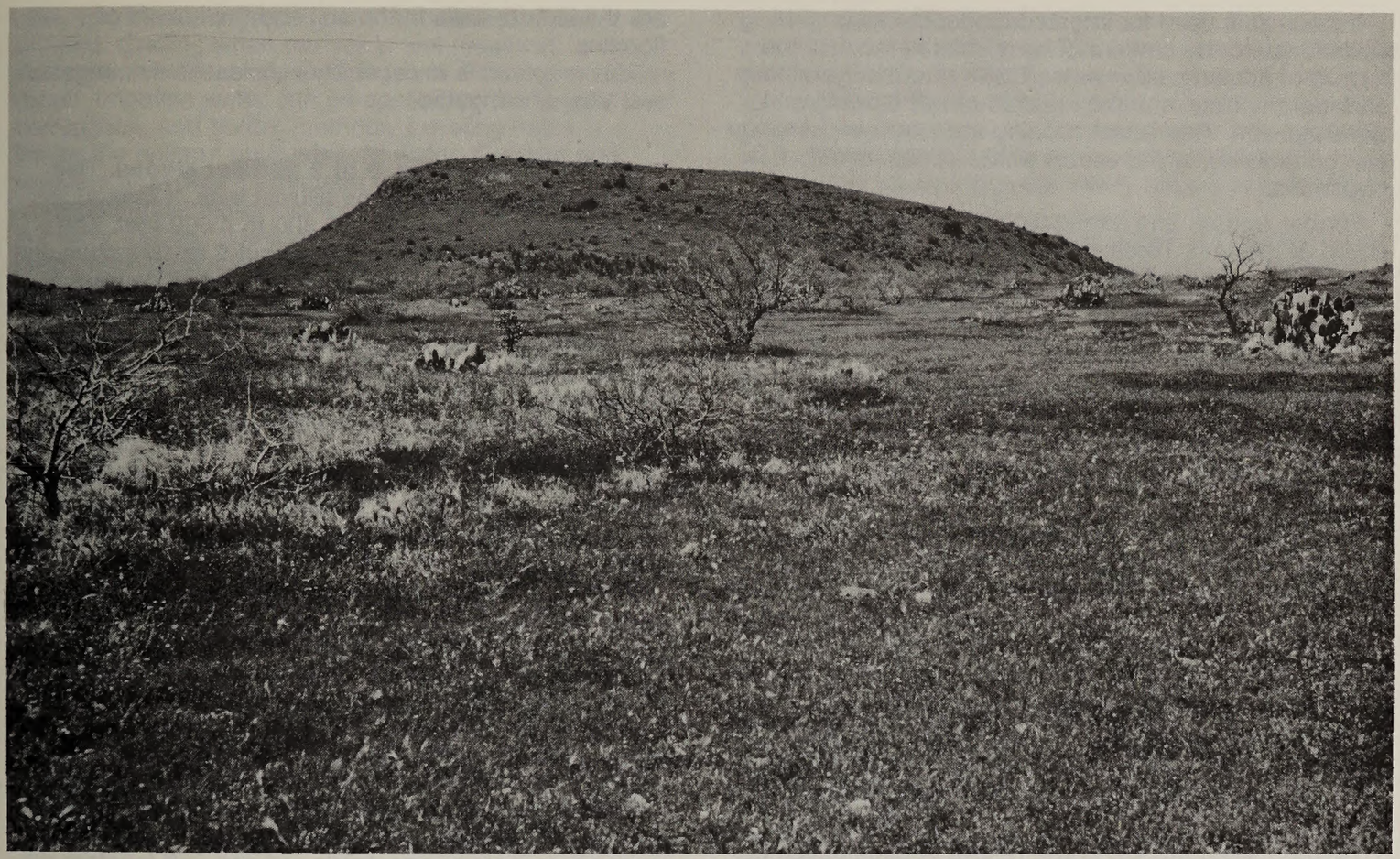


Figure 4.—Typical area of Guest-Hantz complex, 0 to 5 percent slopes, severely eroded, after erosion control measures have been installed upslope.

Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Guest soil is deep, moderately saline, and well drained. It formed in mixed alluvium. Typically, the surface layer is brown, moderately alkaline silty clay about 2 inches thick. The underlying material to a depth of 60 inches or more is brown, moderately alkaline clay.

Permeability of the Guest soil is slow. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to rare, brief periods of flooding from July through September and from February through March.

The Hantz soil is deep, moderately saline, and well drained. It formed in mixed alluvium. Typically, the surface layer is pinkish gray or light brown, strongly alkaline silty clay about 2 inches thick. The underlying material to a depth of 60 inches or more is pinkish gray, light brown, and brown, moderately alkaline clay.

Permeability of the Hantz soil is very slow. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to rare, brief periods of flooding from July through September and from February through March.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development and irrigated crops.

If the range vegetation on this unit is in good or excellent condition, the native plants are mainly alkali sacaton, vine-mesquite, tobosa, saltbush, and inland saltgrass. The present vegetation in most areas is mainly small stands of alkali sacaton, inland saltgrass, and tobosa.

Water-spreading dikes have been successfully installed on this unit (fig. 4). If proper grazing practices are used, this unit is highly productive. Proper grazing use and a planned system of grazing are needed to maintain or improve the production of forage.

If this unit is used for irrigated crops, the main limitations are the content of toxic salts in the soil, the hazard of flooding, slow water intake rate, slow and very slow permeability, and the hazards of soil blowing and water erosion. The risk of flooding and continued erosion can be reduced by the use of dikes, levees, and diversions.

Furrow, border, and corrugation irrigation systems are suited to this unit. The method used generally is governed by the crop grown. To avoid overirrigating the soil and leaching plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil, the water intake rate, and the crop needs. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

The content of toxic salts in the soil can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Soil blowing can be reduced by keeping the soil rough and cloddy when it is not protected by vegetation and using minimum tillage.

If this unit is used for hay and pasture, the main limitations are the hazard of flooding, the content of toxic salts in the soil, slow water intake rate, slow and very slow permeability, and the hazards of soil blowing and water erosion.

Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation water can be applied by the furrow, corrugation, and border methods. Leveling helps to insure the uniform application of water. Grasses and legumes grow well if adequate fertilizer is used.

If this unit is used for homesite development, the main limitations are the hazard of flooding, shrink-swell potential, and low soil strength. Flooding can be controlled only by the use of major flood control structures. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

Excavation for roads and buildings increases the hazard of erosion. Roads should be designed to offset the limited ability of the soils in this unit to support a load. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for septic tank filter fields, the main limitations are the hazard of flooding and slow or very slow permeability. Use of sandy backfill for the trench and long absorption lines helps to compensate for the slow or very slow permeability.

If this unit is used for recreation, the main limitations are the excess salts in the soil and the hazard of flooding.

This map unit is in capability subclasses IIIe, irrigated, and VIIe, nonirrigated.

19—Hantz silty clay, 0 to 2 percent slopes. This deep, well drained soil is on alluvial fans. It formed in mixed alluvium. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, the surface layer is light brown, moderately alkaline silty clay about 11 inches thick. The underlying material to a depth of 67 inches is stratified, light brown, moderately alkaline clay and brown and pinkish gray, strongly alkaline silty clay.

Included in this unit are small areas of Glendale silty clay loam and Gila loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Hantz soil is very slow. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 30 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to rare, brief periods of flooding from July through September and from February through March.

Most areas of this unit are used for irrigated crops. A few areas are used as rangeland and for homesite development and recreation.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding, slow water intake rate, very slow permeability, and the hazard of soil blowing. The risk of flooding can be reduced by the use of dikes, levees, and diversions.

Under a good management program, the soil in this unit can produce the following yields per acre of the commonly grown crops: 900 pounds of cotton lint, 6.5 tons of alfalfa hay, 100 bushels of barley, 95 bushels of wheat, and 105 bushels of grain sorghum.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. To avoid overirrigating the soils and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Tillage should be kept to a minimum.

If this unit is used for hay and pasture, the main limitations are the hazard of flooding, slow water intake

rate, very slow permeability, and the hazard of soil blowing. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation water can be applied by the furrow, corrugation, and border methods. Leveling helps to insure the uniform application of water. Grasses and legumes grow well if adequate fertilizer is used.

The potential native plant community on this Hantz soil is mainly tobosa, vine-mesquite, and minor amounts of plains bristlegrass and alkali sacaton. The present vegetation in most areas is mainly mesquite and scattered tobosa and alkali sacaton.

Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. If the shrubs are managed to create open areas, this soil produces a good stand of desirable grasses and forbs. When the plants go dormant, they deteriorate rapidly in palatability and food value. If the forage is used during this period, the livestock usually require a protein supplement.

If the plant cover is disturbed, protection from flooding is needed to control gullying, streambank cutting, and sheet erosion. Fencing, erosion control, deferred grazing, and brush control are other suitable management practices.

If this unit is used for homesite development, the main limitations are the hazard of flooding, shrink-swell potential, and low soil strength. Flooding can be controlled only by use of major flood control structures. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Roads should be designed to offset the limited ability of the soil in this unit to support a load.

Excavation for roads and buildings increases the hazard of erosion. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this soil is used for septic tank absorption fields, the main limitations are the hazard of flooding and very slow permeability. Use of sandy backfill for the trench and long absorption lines helps to compensate for the very slow permeability.

If this unit is used for recreation, the main limitations are the hazard of flooding and the clayey texture of the soil.

This map unit is in capability subclasses IIIs, irrigated, and VIIs, nonirrigated.

20—Hap gravelly sandy loam, 2 to 8 percent slopes. This deep, well drained soil is on fan terraces. It formed in mixed alluvium derived dominantly from granitic rock. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 150 days.

Typically, 20 to 50 percent of the surface is covered with fine gravel. The surface layer is brown, neutral gravelly sandy loam about 2 inches thick. The upper 14 inches of the subsoil is reddish brown, neutral and mildly alkaline gravelly sandy clay loam. The lower 21 inches is light reddish brown and light brown, moderately alkaline gravelly sandy clay loam. The substratum to a depth of 63 inches or more is light brown and pinkish white, moderately alkaline gravelly sandy loam and gravelly loamy sand.

Included in this unit are small areas of Comoro sandy loam along drainageways, Sonoita sandy loam on the valley border and near drainageways, and Torrifluvents in drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Hap soil is moderate. Available water capacity is high. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 25 to 35 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used mainly as rangeland and for wildlife habitat and recreation. It is also used for homesite development.

The potential plant community on the Hap soil is mainly bush muhly, Arizona cottontop, black grama, and plains bristlegrass. The present vegetation in most areas is mainly creosotebush, mesquite, broom snakeweed, and soaptree yucca. Grasses on this unit are mainly in areas around shrubs.

Good accessibility and a large variety of palatable plants encourage constant grazing pressure on this unit. Planned grazing systems are essential to maintain plant vigor and forage production. Fencing and deferred grazing are important in planned grazing systems.

Brush management and range seeding can be used to restore productivity on the soil in this unit. Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a greater hazard of erosion. Because of the lack of a seed source and competition from creosotebush and mesquite for moisture, desirable grasses are very slow to recover even with the best grazing management.

This unit is well suited to homesite development. It has no serious limitations.

If this unit is used for recreation, the main limitation is the gravel on the surface.

This map unit is in capability subclass VIIc.

21—Hap-Pinaleno association, 9 to 60 percent slopes. This map unit is on fan terraces and hillsides. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 50 percent Hap very gravelly sandy loam and 30 percent Pinaleno very cobbly loam. The Hap soil is on fan terraces, and the Pinaleno soil is on hillsides.

Included in this unit are small areas of Whitlock gravelly sandy loam near drainageways, Comoro sandy

loam and Santo Tomas gravelly or cobbly sandy loam in drainageways, and Eba very cobbly loam on hillsides. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Hap soil is deep and well drained. It formed in mixed alluvium derived dominantly from granitic rock. Typically, 20 to 60 percent of the surface is covered with gravel and scattered cobbles. The surface layer is brown, neutral very gravelly sandy loam about 2 inches thick. The upper 14 inches of the subsoil is reddish brown, moderately alkaline gravelly sandy clay loam. The lower 21 inches is light reddish brown and light brown, moderately alkaline gravelly sandy clay loam. The substratum to a depth of 63 inches or more is light brown and pinkish white, moderately alkaline, calcareous gravelly sandy loam and gravelly loamy sand. It has thin, weakly cemented layers in places.

Permeability of the Hap soil is moderate. Available water capacity is high. Water supplying capacity is 5 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

The Pinaleno soil is deep and well drained. It formed in mixed alluvium and colluvium. Typically, 40 to 80 percent of the surface is covered with cobbles and gravel. The surface layer is brown, moderately alkaline very cobbly loam about 2 inches thick. The subsoil is reddish brown, moderately alkaline, calcareous very gravelly clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is reddish brown and pinkish gray, moderately alkaline gravelly and very gravelly sandy loam that is cemented with lime.

Permeability of the Pinaleno soil is moderately slow. Available water capacity is moderate. Water supplying capacity is 4 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 30 inches. Runoff is medium to rapid, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

The potential plant community on the Hap soil is mainly bush muhly, black grama, plains bristlegrass, and Arizona cottontop. The potential plant community on the Pinaleno soil is mainly creosotebush, bush muhly, and black grama. Because of the low forage value of most of the potential plants on the Pinaleno soil, management should be administered according to the needs of the Hap soil. This unit produces some year-round browse for wildlife or livestock.

Good accessibility to livestock and the large variety of palatable plants on this unit encourage a constant grazing pressure. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities.

If this unit is used for homesite development and septic tank absorption filter fields, the main limitation is slope. Because erosion is a greater hazard in disturbed areas, only the part of the site that is used for construction should be disturbed. Access roads should be designed to provide adequate cut-slope grade, and drains should be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for recreation, the main limitations are slope and gravel on the surface.

This map unit is in capability subclass VIIe.

22—Haplargids-Torriorthents complex, 5 to 40 percent slopes. This map unit is on hills (fig. 5). Slopes are complex as a result of headcutting, undercutting, and sloughing of the highly erodible soil material. The eroded condition of this unit is the result of normal geologic erosion and not the result of man's activities. The erosion would be very difficult to control. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 55 percent Haplargids and 35 percent Torriorthents. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tres Hermanos very gravelly loam on narrow fan terraces; Pinaleno very gravelly loam on hills; Gila and Glendale loams on flood plains and alluvial fans; and Anthony sandy loam and Torrifluvents on flood plains and in drainageways. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Haplargids are deep and well drained. They formed in lacustrine deposits derived dominantly from mixed igneous rock. From 0 to 90 percent of the surface is covered with gravel and a moderate amount of cobbles. The surface layer ranges from very gravelly loam to silty clay and is 2 to 6 inches thick. It is moderately alkaline to strongly alkaline and is nonsaline to strongly saline. The subsoil is moderately alkaline to strongly alkaline, nonsaline to moderately saline very gravelly clay loam to silty clay 10 to 30 inches thick. It has moderate to large accumulations of lime. The substratum is moderately alkaline to strongly alkaline, and slightly saline to strongly saline clay loam to clay. In places the substratum is underlain by mudstone or soft shale. In many areas the mudstone or soft shale is exposed at the surface.

Permeability of the Haplargids is very slow to moderate. Available water capacity is low to high. Effective and observed rooting depth is 15 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate to high.

Torriorthents are deep and well drained. They formed in lacustrine deposits derived dominantly from mixed igneous rock. From 0 to 50 percent of the surface is covered with gravel and a few cobbles. The surface

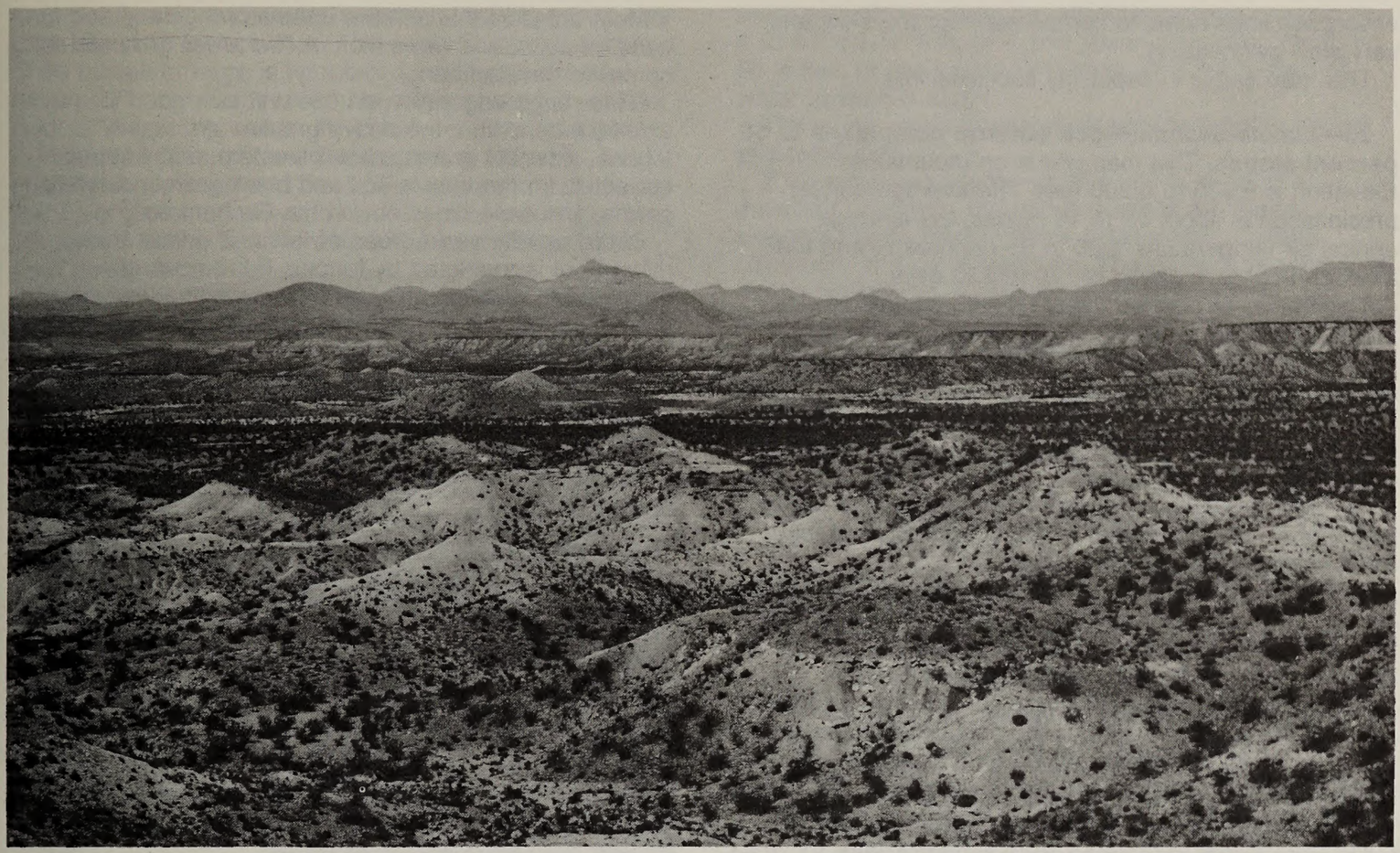


Figure 5.—Typical area of Haplargids-Torriorthents complex, 5 to 40 percent slopes.

layer is moderately alkaline to strongly alkaline, nonsaline to moderately saline very gravelly loam, gravelly clay loam, or gravelly silt loam 2 to 6 inches thick. The underlying material in the upper part ranges from calcareous, strongly alkaline gravelly loam to calcareous, moderately alkaline gravelly clay loam and is 30 to 40 inches thick. Below that, it is moderately alkaline to strongly alkaline, nonsaline to moderately saline silty clay loam or clay underlain by mudstone or soft shale in places.

Permeability of the Torriorthents is slow to moderate. Available water capacity is low to medium. Effective and observed rooting depth is 15 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate to high.

Most areas of this unit are used as rangeland and for wildlife habitat. A few areas are used for homesite development and recreation.

The potential plant community on the unit is mainly saltbush, threeawn, ocotillo, and tobosa. The present vegetation in places appears brushy because of the presence of whitethorn, creosotebush, and cacti. The very steep to vertical side slopes are essentially barren. The production of vegetation for livestock grazing is low because of the low available water capacity of the soil and the high hazard of erosion.

This unit does not respond to grazing management. Livestock normally make little use of the unit except for those areas along major trails and drainageways.

If this unit is used for homesite development, the main limitations are slope, shrink-swell potential, low soil strength, and the hazard of erosion. Because excavation for roads and buildings increases the hazard of erosion, only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if roads and buildings are constructed.

The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load.

If this unit is used for septic tank absorption fields, the main limitations are slope and the slow permeability of the soils. Use of sandy backfill for the trench and long

absorption lines helps to compensate for the slow and very slow permeability.

This map unit is in capability subclass VIIe.

23—Limpia-Graham-Rock outcrop complex, 9 to 50 percent slopes. This map unit is on mountains. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 220 days.

This unit is 45 percent Limpia extremely cobbly clay loam, 20 percent Graham extremely cobbly silty clay loam, and 15 percent Rock outcrop. The Limpia soil is dominantly on the lower two-thirds of the mountainsides, and the Graham soil is dominantly on the mountaintops and the upper one-third of the mountainsides. Rock outcrop is on the mountaintops and is scattered throughout the unit. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Atascosa very gravelly clay loam on hillsides, Santo Tomas very cobbly loam along drainageways, Peloncillo cobbly clay loam on fan terraces, and Tapco cobbly clay loam on fan terraces. Also included are areas of talus on the steeper hillsides below the areas of Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Limpia soil is deep and well drained. It formed in colluvium derived dominantly from volcanic rock. Typically, 50 to 90 percent of the surface is covered with cobbles and a few stones. The surface layer is brown, mildly alkaline extremely cobbly clay loam about 2 inches thick. The subsoil to a depth of 60 inches or more is reddish brown, brown, and dark reddish gray, mildly alkaline clay that is more than 35 percent coarse fragments.

Permeability of the Limpia soil is slow. Available water capacity is medium. Water supplying capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 35 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Graham soil is very shallow and shallow and is well drained. It formed in colluvium derived dominantly from volcanic rock. Typically, 30 to 80 percent of the surface is covered with cobbles and a few stones. The surface layer is brown, neutral extremely cobbly silty clay loam about 1 inch thick. The subsoil is mildly alkaline, dark reddish gray silty clay and reddish brown clay about 15 inches thick over basalt. Depth to basalt ranges from 8 to 20 inches.

Permeability of the Graham soil is slow. Available water capacity is low. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 8 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of areas of exposed basalt.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly tobosa, sideoats grama, cane bluestem, and Arizona cottontop on the Limpia soil and black grama, sideoats grama, and cane bluestem on the Graham soil.

Cattle usually avoid areas of this unit unless their movement is restricted by fences. If livestock are restricted to this unit, they tend to graze the less sloping areas, leaving the more steeply sloping areas essentially ungrazed. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Trails or walkways can be constructed in places to encourage grazing in areas where access is limited.

If this unit is used for homesite development, the main limitations are slope, shrink-swell potential, and cobbles and stones. On the Graham soil, depth to rock is also a limitation. The deep cuts needed to provide essentially level building sites can expose bedrock. Erosion is a greater hazard in the steeper areas.

Structures to divert runoff are needed if buildings and roads are constructed on this unit. Only the part of the site that is used for construction should be disturbed. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Roads should be designed to offset the limited ability of the soils in this unit to support a load.

If the soils in this unit are used for septic tank absorption fields, the main limitations are slope, slow permeability, and depth to rock. Use of sandy backfill for the trench and long absorption lines helps to compensate for the slow permeability. Absorption lines should be placed on the contour to prevent seepage downslope. On the Graham soil, holding tanks or central sewage systems may be needed. Another alternative is to transport the waste material to adjacent, more suitable areas for disposal.

If this unit is used for recreation, the main limitations are slope and cobbles and stones on the surface. On the Graham soil, depth to rock is also a limitation.

This map unit is in capability subclass VIIe.

24—Maloy extremely stony sandy loam, 2 to 15 percent slopes. This deep, well drained soil is on fan terraces. It formed in mixed alluvium derived dominantly from granite and gneiss. Elevation is 4,000 to 5,200 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 240 days.

Typically, 50 to 90 percent of the surface is covered with stones and cobbles (fig. 6). The surface layer is brown, slightly acid extremely stony sandy loam about 2 inches thick. The subsoil is reddish brown and yellowish

red, slightly acid and neutral extremely cobbly sandy clay loam about 36 inches thick. The substratum to a depth of 60 inches or more is light brown, mildly alkaline extremely cobbly sandy loam. In some areas the surface layer is very stony, extremely cobbly, or very cobbly.

Included in this unit are small areas of Comoro gravelly sandy loam and Santo Tomas very cobbly sandy loam along drainageways. Included areas made up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Maloy soil is moderate. Available water capacity is moderate. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

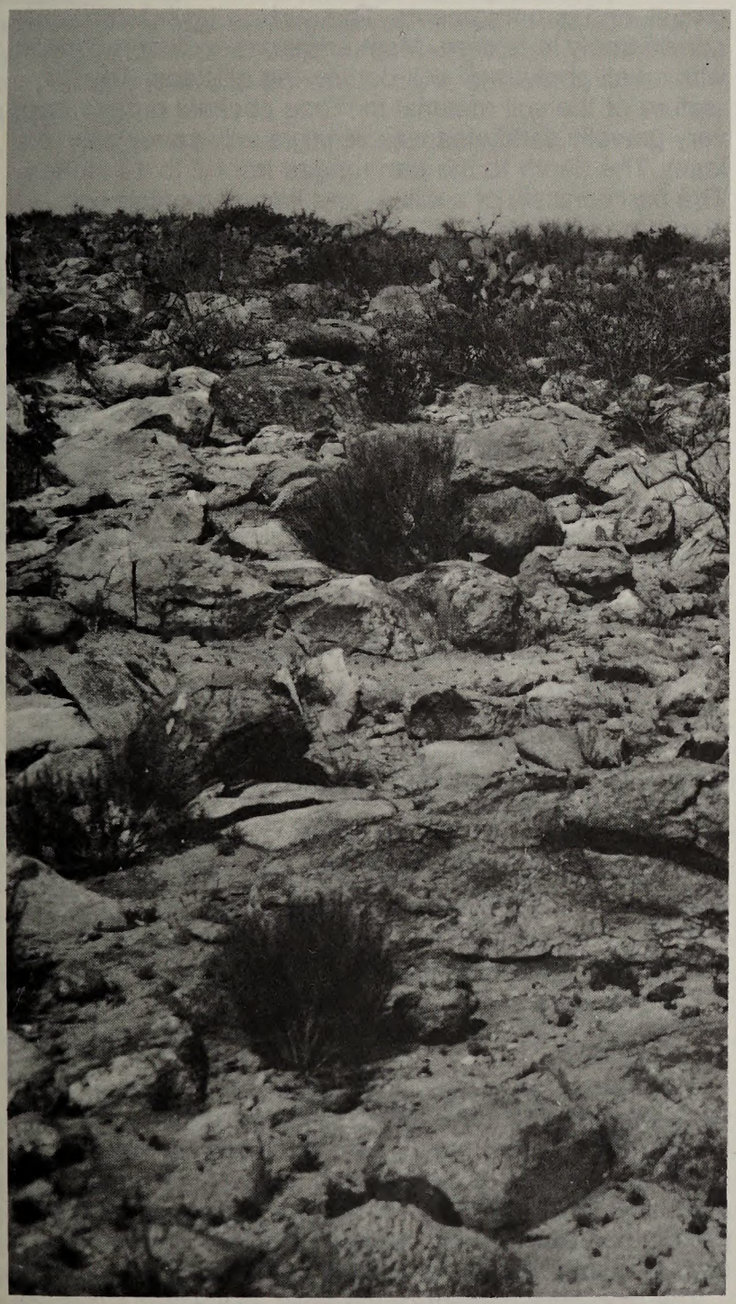


Figure 6.—Typical area of Malloy extremely stony sandy loam, 2 to 15 percent slopes.

This unit is used as rangeland and for wildlife habitat and recreation.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, black grama, bush muhly, Arizona cottontop, and cane bluestem. The present vegetation is mainly whitethorn, mesquite, catclaw, wolfberry, and cacti.

Good accessibility and the large variety of palatable plants on this unit encourage a constant grazing pressure. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Planned grazing systems are essential to maintain plant vigor and forage production. Fencing and deferred grazing are important in planned grazing systems.

If this unit is used for recreation, the main limitation is cobbles and stones on the surface.

This map unit is in capability subclass VIs.

25—Peloncillo extremely cobbly sandy clay loam, 2 to 10 percent slopes. This very shallow and shallow, well drained soil is on fan terraces. It formed in alluvium derived dominantly from volcanic rock. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, 50 to 90 percent of the surface is covered with basalt cobbles and gravel-sized pan fragments. The surface layer is very pale brown, moderately alkaline, calcareous extremely cobbly sandy clay loam about 1 inch thick. The subsoil is light brown, moderately alkaline, calcareous very gravelly clay loam about 14 inches thick. The next layer is an indurated, silica- and lime-cemented hardpan about 5 inches thick. Below this to a depth of 60 inches or more are alternating indurated, silica- and lime-cemented hardpans and layers of light brown very gravelly sandy loam. Depth to the hardpan ranges from 7 to 20 inches.

Included in this unit are small areas of Torrifluvents in drainageways, Pinaleno very cobbly loam on hillsides, soils that are similar to this Peloncillo soil but have a clay loam subsoil and are on the lower ends of fan terraces, and eroded areas where the hardpan is exposed. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Peloncillo soil is moderately slow. Available water capacity is very low. Water supplying capacity is 2 to 6 inches. Effective and observed rooting depth is 7 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native vegetation is mainly creosotebush, bush muhly, and black grama. The present vegetation is mainly creosotebush and cacti, but scattered bush muhly and black grama grow in protected areas. Minor amounts of fluffgrass grow in open areas. High lime content, low water supplying capacity, and the inhibiting influence of the creosotebush contribute to the low production of forage on this unit. Management does not appreciably improve the range condition and forage production.

If this unit is used for homesite development, the main limitation is the shallow depth to the cemented pan. Excavation for building sites is limited by the hardpan. Excavation for roads and buildings increases the hazard of erosion.

If the soil in this unit is used for septic tank absorption fields, the main limitation is depth to the hardpan. This limitation can be offset by increasing the size of the absorption field, by building up the absorption field with fill, or by using holding tanks. Another alternative is to transport the effluent offsite to a more suitable soil.

If this unit is used for recreation, the main limitation is the gravel, cobbles, and stones on the surface.

This map unit is in capability subclass VIIs.

26—Peloncillo-Orthents-Pinaleno complex, 20 to 90 percent slopes. This map unit is on fan terraces and hillsides. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 40 percent Peloncillo extremely cobbly sandy clay loam, 25 percent Orthents, and 15 percent Pinaleno very cobbly loam. The Peloncillo soil is on the fan terraces, Orthents are on the steeper part of the hillsides, and the Pinaleno soil is on the less sloping part of the hillsides.

Included in this unit are small areas of Torrifluvents in drainageways, Nickel very cobbly loam on hillsides, and soils, on the upper and middle parts of the hillsides, that are similar to the Peloncillo soil but do not have a clay loam subsoil and are steeper. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Peloncillo soil is very shallow and shallow and is well drained. It formed in mixed alluvium derived dominantly from volcanic rock. Typically, 50 to 90 percent of the surface is covered with cobbles and gravel-sized pan fragments. The surface layer is very pale brown, moderately alkaline, calcareous extremely cobbly sandy clay loam about 1 inch thick. The subsoil is light brown, moderately alkaline, calcareous very gravelly clay loam about 10 inches thick. The next layer is an indurated, silica- and lime-cemented hardpan about 1 inch thick. The substratum to a depth of 60 inches or more is alternating indurated, silica- and lime-cemented hardpans and layers of light brown very gravelly sandy loam. Depth to the upper hardpan ranges from 7 to 20 inches.

Permeability of the Peloncillo soil is moderately slow. Available water capacity is very low. Water supplying capacity is 2 to 6 inches. Effective and observed rooting depth is 7 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

The Orthents are shallow and very shallow and are well drained. They formed in alluvium and colluvium derived dominantly from volcanic rock. Generally, 20 to 60 percent of the surface is covered with cobbles, gravel, and pan fragments. The surface layer varies considerably in texture. Most areas are exposed duripan with small pockets of soil dotting the hillsides. The texture of the soil material in these pockets ranges from very gravelly sandy loam to very gravelly sandy clay loam. The depth to the pan ranges from 2 to 10 inches. The pan consists of a silica- and lime-cemented cap about 1 inch thick. The underlying material to a depth of 60 inches or more is alternating pink, indurated, silica- and lime-cemented pans and layers of light brown, moderately alkaline, weakly cemented very gravelly sandy loam.

Permeability of the Orthents is moderately slow to moderately rapid. Available water capacity is very low. Water supplying capacity is 0 to 2 inches. Effective and observed rooting depth is 2 to 10 inches. Runoff is rapid, and hazard of water erosion is moderate to high.

The Pinaleno soil is deep and well drained. It formed in mixed alluvium and colluvium. Typically, 30 to 60 percent of the surface is covered with cobbles. The surface layer is brown, moderately alkaline very cobbly loam about 2 inches thick. The subsoil is reddish brown, moderately alkaline, calcareous very gravelly clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is reddish brown and pinkish gray, weakly lime cemented, moderately alkaline gravelly and very gravelly sandy loam.

Permeability of the Pinaleno soil is moderately slow. Available water capacity is moderate. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 26 to 40 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used as rangeland and for wildlife habitat and recreation.

If the range vegetation on this unit is in good or excellent condition, the native plants are mainly creosotebush, bush muhly, and black grama. The present vegetation in most areas is mainly creosotebush and cacti. Scattered bush muhly and black grama are in protected areas around shrubs and cacti. Fluffgrass is scattered throughout the open areas.

The high lime content of the soils, low water supplying capacity, and the inhibiting influence of the creosotebush contribute to the low production of forage on this unit.

Management does not appreciably change or improve range condition or forage production on the unit. Development of livestock and wildlife watering facilities helps slightly in managing the use of the available forage.

If this unit is used for homesite development, the main limitations are slope and shallow depth to the cemented pan. Only the part of the site that is used for construction should be disturbed. Excavation for building sites is limited by the hardpan.

If this unit is used for septic tank absorption fields, the main limitations are slope and depth to the hardpan. The limitation of depth to the hardpan can be offset by increasing the size of the absorption field, by building up the absorption field with fill, or by using holding tanks. Another alternative is to transport the effluent to a more suitable soil.

This map unit is in capability subclass VIIs.

27—Pima silty clay loam, 0 to 2 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, the surface layer is brown, moderately alkaline silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches or more is brown and pale brown, moderately alkaline, stratified sandy clay loam, clay loam, and silty clay loam.

Included in this unit are small areas of Gila fine sandy loam, Guest silty clay, and Glendale silty clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Pima soil is moderately slow. Available water capacity is high. Water supplying capacity is 6 to 10 inches or more. Effective and observed rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is high. The hazard of soil blowing is moderate. This soil is subject to occasional, brief periods of flooding from July through September and from February through March.

Most areas of this unit are used for irrigated crops, mainly cotton, alfalfa, barley, wheat, and grain sorghum. A few areas are used for irrigated pasture. Some areas are used for homesite development, rangeland, wildlife habitat, and recreation.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding (fig. 7). Under a good management program, the soil in this unit can produce the following yields per acre of the commonly grown crops: 1,200 pounds of cotton lint, 8 tons of alfalfa, 125 bushels of barley, 110 bushels of wheat, and 160 bushels of grain sorghum. The risk of flooding can be reduced by the use of levees, dikes, and diversions.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. To avoid overirrigating the soil and leaching plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Crop residue left on or near the surface of the soil in this unit helps to conserve moisture, maintain tilth, and control water erosion. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Tillage should be kept to a minimum. Crops respond to nitrogen and phosphorus fertilizer.

This unit is well suited to hay and pasture. The main limitation is the hazard of flooding. Grasses and legumes grow well on this unit if adequate fertilizer is used. All adapted pasture plants can be grown, but bunch-type species planted alone generally are not suitable because of the hazard of erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation water can be applied by the border, corrugation, and sprinkler methods. Leveling helps to insure the uniform application of water.

If this unit is used for homesite development, the main limitations are the hazard of flooding, shrink-swell potential, and low soil strength. Flooding can be controlled only by use of major flood control structures. Excavation for roads and buildings increases the hazard of erosion. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. Roads should be designed to offset the limited ability of the soil to support a load. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

The potential native plant community on this unit is mainly giant sacaton, sideoats grama, tobosa, and vine-mesquite. The present vegetation in most areas is mainly mesquite and cottonwood trees with scattered bermudagrass, sacaton, and annuals. This unit produces year-round browse for wildlife or livestock. Good accessibility and a large variety of palatable plants encourage a constant grazing pressure.

Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. If the shrubs are managed to create open areas, this unit produces a good stand of desirable grasses and forbs. Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be initially subject to a greater hazard of erosion. Fencing and planned grazing systems are other management practices that are suitable for use on this unit.

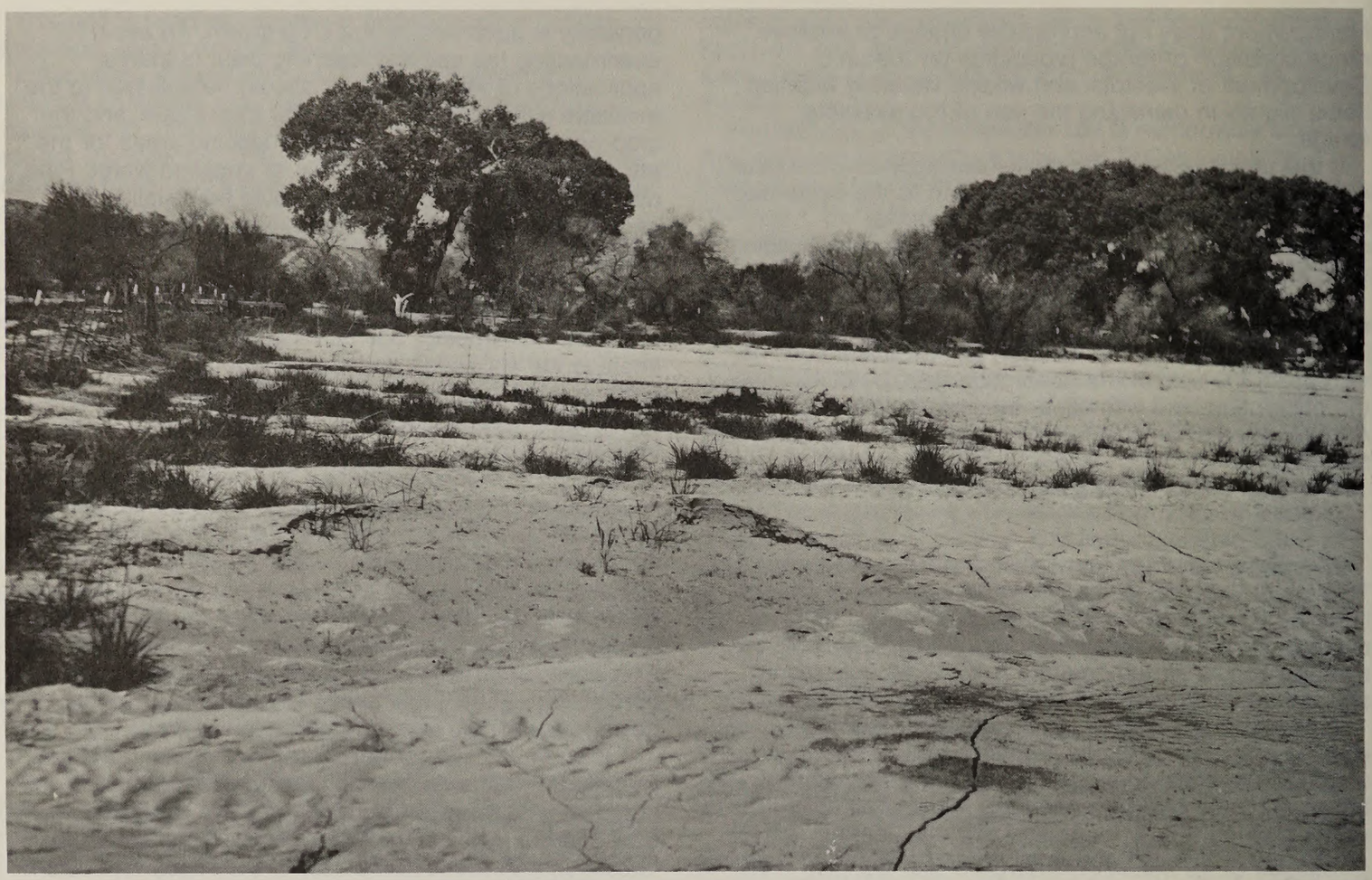


Figure 7.—Flood damage on Pima silty clay loam, 0 to 2 percent slopes.

If this unit is used for recreation, the main limitations are the hazard of flooding and the high hazard of erosion.

This map unit is in capability subclasses IIw, irrigated, and VIw, nonirrigated.

28—Pinaleno very cobbly loam, 5 to 30 percent slopes. This deep, well drained soil is on hills. It formed in mixed alluvium and colluvium. Elevation is 3,000 to 4,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, 30 to 60 percent of the surface is covered with cobbles and gravel. The surface layer is brown, moderately alkaline very cobbly loam about 2 inches thick. The upper 6 inches of the subsoil is brown, moderately alkaline, calcareous gravelly sandy clay loam. The lower 9 inches is pink, moderately alkaline, strongly calcareous very gravelly clay loam. The substratum to a depth of 60 inches or more is pink, brown, and light brown, stratified loam, sandy loam, and loamy sand that is more than 35 percent coarse fragments. It is weakly lime-cemented and moderately alkaline.

Included in this unit are small areas of Eba very cobbly sandy clay loam on the less sloping parts of fan terraces, Nickel very cobbly loam on hillsides, Continental cobbly sandy clay loam on fan terraces, and Torrifluvents in drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Pinaleno soil is moderately slow. Available water capacity is moderate. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

Most areas of this unit are used as rangeland and for wildlife habitat. A few areas are used for homesite development and recreation.

If the range vegetation on this unit is in good or excellent condition, the native plants are mainly creosotebush, bush muhly, and black grama. The

present vegetation in most areas is mainly creosotebush and cacti. Scattered grasses are in protected areas.

High lime content, low water supplying capacity, and the inhibiting influence of the creosotebush contribute to the low production of forage on this unit. Management does not appreciably change or improve the range condition or forage production. Development of livestock watering facilities helps slightly in managing the use of the available forage.

If this unit is used for homesite development, the main limitation is slope. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for septic tank absorption fields, the main limitation is slope. Tile lines should be placed on the contour.

If this unit is used for recreation, the main limitations are slope and stones and cobbles on the surface.

This map unit is in capability subclass VIIe.

29—Pinaleno-Whitlock-Tres Hermanos complex, 2 to 30 percent slopes. This map unit is on hillsides and fan terraces. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 40 percent Pinaleno very gravelly loam, 25 percent Whitlock sandy loam, and 15 percent Tres Hermanos very gravelly sandy loam. The Pinaleno soil is on the hillsides, the Whitlock soil is near drainageways on the gently sloping lower part of the fan terraces, and the Tres Hermanos soil is on moderately sloping fan terraces between the Pinaleno and Whitlock soils. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Torrifluvents in drainageways, Nickel very gravelly loam in steep areas on hillsides, and Torriorthents on steep escarpment fronts and breaks. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Pinaleno soil is deep and well drained. It formed in mixed alluvium and colluvium. Typically, 30 to 60 percent of the surface is covered with gravel and a few cobbles. The surface layer is brown, moderately alkaline, very gravelly loam about 2 inches thick. The upper 6 inches of the subsoil is brown, moderately alkaline, calcareous very gravelly sandy clay loam. The lower 9 inches is pink, moderately alkaline, strongly calcareous very gravelly clay loam. The substratum to a depth of 60 inches or more is pink, brown, and light brown, stratified very gravelly loam, very gravelly sandy loam, and very gravelly loamy sand. It is moderately alkaline and weakly lime-cemented.

Permeability of the Pinaleno soil is moderately slow. Available water capacity is moderate. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

The Whitlock soil is deep and well drained. It formed in mixed alluvium. Typically, 5 to 30 percent of the surface is covered with gravel. The surface layer is light brown, moderately alkaline sandy loam about 10 inches thick. The underlying material to a depth of about 28 inches is pinkish white, moderately alkaline, strongly calcareous loam and sandy loam. To a depth of 60 inches or more it is light brown, moderately alkaline, calcareous coarse sand and sand.

Permeability of the Whitlock soil is moderately rapid to a depth of 28 inches and rapid below this depth. Available water capacity is low. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 40 to 50 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Tres Hermanos soil is deep and well drained. It formed in mixed alluvium. Typically, 20 to 60 percent of the surface is covered with gravel and a few cobbles. The surface layer is brown, moderately alkaline, calcareous very gravelly sandy loam about 2 inches thick. The subsoil is brown and light brown, moderately alkaline, calcareous gravelly clay loam and gravelly sandy clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is white to reddish brown, stratified gravelly sandy loam and gravelly loam. It is moderately alkaline and weakly lime-cemented.

Permeability of the Tres Hermanos soil is moderately slow. Available water capacity is moderate. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 30 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as rangeland and for wildlife habitat. A few areas are used for homesite development and recreation.

If the range vegetation on this unit is in good or excellent condition, the native plants are mainly creosotebush, bush muhly, black grama, and whitethorn. The present vegetation in most areas is mainly creosotebush. Some grass grows in protected areas.

High lime content of the soil, low water supplying capacity, and the inhibiting influence of the creosotebush contribute to the low production of forage on this unit. Management does not appreciably change or improve range condition or forage production. Development of livestock watering facilities helps slightly in managing the use of the available forage.

If this unit is used for homesite development, the main limitations are slope and low soil strength. Excavation for roads and buildings increases the hazard of erosion. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIIe.

30—Pits-Dumps association. This map unit is on steep mountains and foothills in and around Morenci. It consists of deposits of material that has nearly level to gently sloping tops and very steep sides. The material is deep and well drained. Elevation is 3,400 to 5,500 feet. Attempts to revegetate areas of this unit have met with varied results. In areas of reclaimed mine tailings, topsoil has been hauled in to landscape yards and school grounds.

This unit is about 45 percent Pits and 55 percent Dumps, of which 25 percent is extremely stony, unprocessed overburden, 25 percent is chemically treated mine tailings, or slickens, and 5 percent is slag dumps.

Pits is an open pit mine that is characterized by a series of 50-foot-high benches in rock containing copper ore. It is about 1,500 feet deep and is about 2 miles across at the top. Areas of expansion of the mine extend up the sides of adjoining mountains. Extremely stony, unprocessed overburden is dumped in areas surrounding the pit. The overburden consists of rock fragments blasted out to expose the copper-bearing ore.

The chemically treated mine tailings, or slickens, are areas used as sedimentation basins for smelter wastes that are easily transported by water. This material resembles yellow gravelly sandy loam. The slag dumps are areas where molten smelter refuse has been dumped. It resembles solid black rock.

This unit is used for mining and urban development.

Suitability of this unit for cultivated crops, rangeland, and wildlife habitat is very poor. Limited available water capacity, very steep slopes, presence of toxic chemicals, and mining activities are the main limitations for these uses.

Mine tailings are suitable sites for community development if measures are taken to reduce the effect of chemicals on buildings. The overburden material and crushed slag can be used to fill in low areas for homes, streets, railroads, and flood control dikes.

This unit is in capability subclass VIIIs.

31—Rock outcrop-Atascosa-Graham complex, 9 to 70 percent slopes. This map unit is on mountains (fig. 8). Elevation is 4,000 to 5,200 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

This unit is 35 percent Rock outcrop, 30 percent Atascosa very gravelly loam, and 20 percent Graham very cobbly clay loam. Rock outcrop is on all parts of the landscape, the Atascosa soil is dominantly on mountainsides, and the Graham soil is dominantly on the tops of mountains and on the upper part of mountainsides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Santo Tomas very cobbly loam along drainageways, Limpia very cobbly silty clay loam on moderately sloping mountainsides, Peloncillo very cobbly loam on the upper part of fan terraces, and talus on the steeper parts of mountainsides, generally below areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Rock outcrop consists of areas of exposed bedrock. The dominant kinds of rock in this unit are volcanic tuff, rhyolite, andesite, and basalt. Slope is nearly vertical in places.

The Atascosa soil is very shallow and shallow and is well drained. It formed in colluvium derived dominantly from volcanic rock. Typically, 30 to 80 percent of the surface is covered with gravel and cobbles. The surface layer is brown, mildly alkaline very gravelly loam about 2 inches thick. The subsoil is brown, mildly alkaline very gravelly clay loam about 7 inches thick over andesite. Depth to andesite ranges from 4 to 20 inches.

Permeability of the Atascosa soil is moderate. Available water capacity is very low. Water supplying capacity is 8 to 10 inches. Effective and observed rooting depth is 4 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

The Graham soil is very shallow and shallow and is well drained. It formed in colluvium derived dominantly from volcanic rock. Typically, 20 to 80 percent of the surface is covered with cobbles and a few stones. The surface layer is brown, neutral very cobbly clay loam about 2 inches thick. The subsoil is dark reddish brown, mildly alkaline gravelly clay about 12 inches thick over basalt. Depth to basalt ranges from 8 to 20 inches.

Permeability of the Graham soil is slow. Available water capacity is low. Water supplying capacity is 8 to 10 inches. Effective and observed rooting depth is 8 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, black grama, cane bluestem, and plains lovegrass.

Cattle usually avoid areas of this unit unless their movement is restricted by fences. If cattle are restricted to this unit, they tend to graze the less sloping areas, leaving the steeper slopes essentially ungrazed. Trails or walkways can be constructed in places to encourage grazing in areas where access is limited. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities.

If this unit is used for homesite development, the main limitations are depth to rock, slope, and the shrink-swell

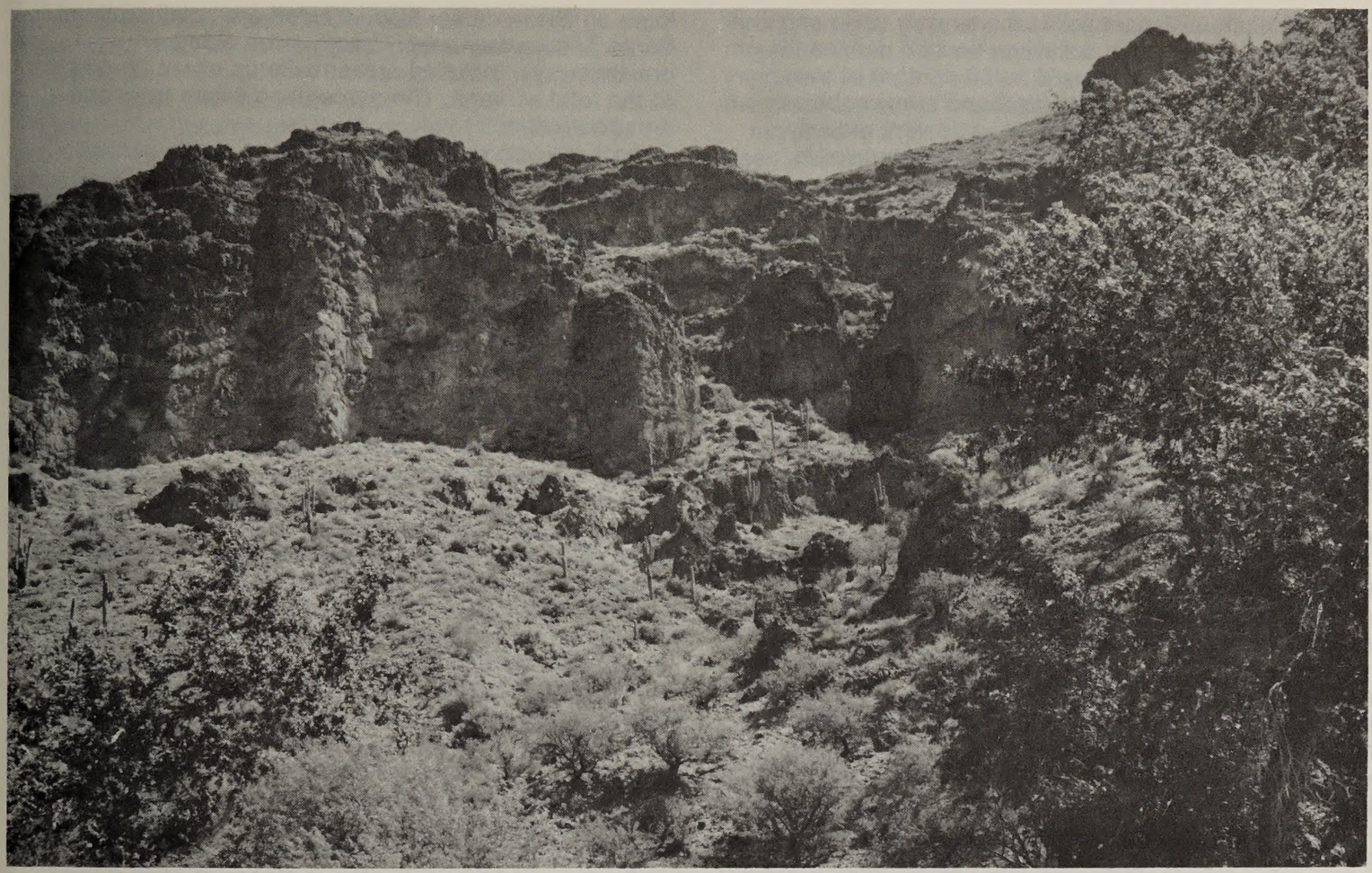


Figure 8.—Typical area of Rock outcrop-Atascosa-Graham complex, 9 to 70 percent slopes.

potential and low strength of the Graham soil. The deep cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

If this unit is used for septic tank absorption fields, the main limitations are slope and depth to rock. The limitation of depth to rock can be partially overcome by increasing the size of the absorption field and using fill to increase the depth of the soils. Tile lines should be placed on the contour. An alternative is to install holding tanks or to transport the effluent offsite to a more suitable soil.

If this unit is used for recreation, the main limitations are depth to rock and slope.

This map unit is in capability subclass VIIs.

32—Rock outcrop-Chiricahua Variant complex, 5 to 90 percent slopes. This map unit is on mountains. Elevation is 4,000 to 5,200 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

This unit is 50 percent Rock outcrop and 30 percent Chiricahua Variant very gravelly sandy clay loam. Rock outcrop occurs throughout the unit, and the Chiricahua Variant soil is on the mountainsides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of talus on the steeper part of mountainsides, generally below areas of Rock outcrop; Santo Tomas very cobbly sandy loam along drainageways; Torrifluvents in drainageways; and Eloma very gravelly clay loam on fan terraces throughout the unit. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Rock outcrop consists of exposed areas of granite. Vertical and nearly vertical exposures in places are several hundred feet high.

The Chiricahua Variant soil is moderately deep and well drained. It formed in colluvium derived dominantly from granitic rock. Typically, 50 to 90 percent of the surface is covered with fine gravel and a few cobbles. The surface layer is brown, slightly acid very gravelly sandy clay loam about 4 inches thick. The subsoil is brown and strong brown, neutral gravelly clay loam, very gravelly clay, and extremely gravelly sandy clay about 28 inches thick. The substratum, to a depth of 35 inches, is highly weathered granite that can be crushed to gravel- and sand-sized particles. Unweathered granite is at a depth of 35 inches. Depth to granite ranges from 30 to 50 inches.

Permeability of the Chiricahua Variant soil is slow. Available water capacity is very low. Water supplying capacity is 6 to 8 inches. Effective and observed rooting depth is 30 to 50 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, hairy grama, black grama, cane bluestem, and plains lovegrass.

Cattle usually avoid areas of this unit unless their movement is restricted by fences. If cattle are restricted to the unit, they tend to graze the less sloping areas, leaving the steeper slopes essentially ungrazed. Trails or walkways can be constructed in places to encourage grazing in areas where access is limited. Other suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities.

If this unit is used for homesite development, the main limitations are depth to rock, slope, shrink-swell potential, and low soil strength. The deep cuts needed to provide essentially level building sites can expose bedrock. Only the part of the site that is used for construction should be disturbed. Sanitary facilities should be located on adjacent soils with less severe limitations and the waste material transported to them.

If this unit is used for recreation, the main limitations are slope and the very gravelly surface layer.

This map unit is in capability subclass VIIe.

33—Rock outcrop-Lampshire complex, 20 to 90 percent slopes. This map unit is on mountains. Elevation is 4,000 to 5,200 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

This unit is 50 percent Rock outcrop and 30 percent Lampshire extremely cobbly sandy loam. Rock outcrop is throughout the unit, and the Lampshire soil is on the mountainsides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Alsco very cobbly sandy loam and Eloma very cobbly sandy clay loam on fan terraces. Also included are small areas of Santo Tomas very cobbly sandy loam along drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Rock outcrop consists of vertical or nearly vertical areas of exposed granite, gneiss, or schist.

The Lampshire soil is very shallow and shallow and is well drained. It formed in colluvium derived dominantly from schist and granitic rock. Typically, 30 to 80 percent of the surface is covered with cobbles, gravel, and a few stones. The surface layer is grayish brown, mildly alkaline extremely cobbly sandy loam about 1 inch thick. Below this is grayish brown, mildly alkaline extremely gravelly loam about 10 inches thick over schist. Depth to schist ranges from 4 to 20 inches.

Permeability of the Lampshire soil is moderate. Available water capacity is very low. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 4 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, hairy grama, black grama, cane bluestem, and plains lovegrass. The overstory is juniper and oak.

Cattle usually avoid areas of this unit unless their movement is restricted by fences. If cattle are restricted to the unit, they tend to graze the less sloping areas, leaving the steeper slopes essentially ungrazed. Trails or walkways can be constructed in places to encourage grazing in areas where access is limited. Other suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities.

If this unit is used for homesite development, the main limitations are slope, depth to rock, and cobbles in and on the soil. The deep cuts needed to provide essentially level building sites can expose bedrock. Because vegetation is difficult to reestablish, only the part of the site that is used for construction should be disturbed. Sanitary facilities should be located on adjacent soils that have less severe limitations and the waste material transported to them.

If this unit is used for recreation, the main limitations are depth to rock, the large number of cobbles on the surface, and slope.

This map unit is in capability subclass VIIe.

34—Rock outcrop-Luzena complex, 20 to 90 percent slopes. This map unit is on mountains. Elevation is 5,000 to 6,800 feet. The average annual precipitation is about 14 to 16 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 130 to 190 days.

This unit is 55 percent Rock outcrop and 25 percent Luzena very gravelly clay. Rock outcrop occurs

throughout the unit, and the Luzena soil is on the mountainsides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Fallsam very cobbly silty clay loam on mountainsides and moderately deep and deep soils along drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Rock outcrop consists of areas of exposed volcanic tuff, andesite, rhyolite, and basalt.

The Luzena soil is very shallow and shallow and is well drained. It formed in colluvium derived dominantly from volcanic rock. Typically, 20 to 80 percent of the surface is covered with gravel and cobbles. The surface layer is dark reddish gray, medium acid very gravelly clay about 1 inch thick. The subsoil is dark reddish brown, neutral gravelly clay about 7 inches thick over andesite. Depth to andesite ranges from 6 to 20 inches.

Permeability of the Luzena soil is slow. Available water capacity is very low. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 6 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, plains lovegrass, cane bluestem, and black grama. The overstory is scattered juniper.

Cattle usually avoid areas of this unit unless their movement is restricted by fences. If cattle are restricted to the unit, they tend to graze the less sloping areas, leaving the steeper slopes essentially ungrazed. Trails or walkways can be constructed in places to encourage grazing in areas where access is limited. Other suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities.

If this unit is used for homesite development, the main limitations are depth to rock, slope, shrink-swell potential, and low soil strenth. The deep cuts needed to provide essentially level building sites can expose bedrock. Only the part of the site that is used for construction should be disturbed. Sanitary facilities should be located on adjacent soils with less severe limitations and the waste material transported to them.

If this unit is used for recreation, the main limitations are slope, the very gravelly surface, and depth to rock.

This map unit is in capability subclass VIIe.

35—Rock outcrop-Mokiak complex, 20 to 90 percent slopes. This map unit is on mountains. Elevation is 5,000 to 6,800 feet. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 130 to 190 days.

This unit is 55 percent Rock outcrop and 25 percent Mokiak very gravelly sandy loam. Rock outcrop occurs throughout the unit, and the Mokiak soil is on the mountainsides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of moderately deep and deep soils along drainageways. These soils are very gravelly to very cobbly loam and sandy loam to an average depth of about 36 inches. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Rock outcrop consists of exposed areas of granite, gneiss, and schist.

The Mokiak soil is moderately deep and well drained. It formed in colluvium derived dominantly from granitic rock. Typically, 40 to 90 percent of the surface is covered with fine gravel. The surface layer is reddish brown, strongly acid very gravelly sandy loam about 4 inches thick. The subsoil is reddish brown and light brown, strongly acid very gravelly sandy clay loam about 17 inches thick. The substratum, to a depth of 50 inches, is highly weathered granite that can be crushed to gravel- and sand-sized particles. Unweathered granite is at a depth of 50 inches. Depth to bedrock ranges from 45 to 60 inches.

Permeability of the Mokiak soil is moderate. Available water capacity is very low. Water supplying capacity is 8 to 10 inches. Effective and observed rooting depth is 20 to 50 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development and woodland.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, black grama, hairy grama, cane bluestem, and plains lovegrass. The overstory is oak, pinyon, and manzanita.

Cattle usually avoid areas of this unit. If cattle are restricted to the unit, they tend to graze the less sloping areas, leaving the steeper slopes essentially ungrazed. Trails or walkways can be constructed in places to encourage grazing in areas where access is limited. Other suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities.

If this unit is used for homesite development, the main limitations are depth to rock and slope. The deep cuts needed to provide essentially level building sites can expose bedrock. Because vegetation is difficult to reestablish, only the part of the site that is used for construction should be disturbed. Sanitary facilities should be located on adjacent soils with less severe limitations and the waste material transported to them.

If this unit is used for recreation, the main limitations are slope and the very gravelly surface.

If used for woodland, this unit is capable of producing about 6.8 cords per acre of pinyon. The site index is 60.

This map unit is in capability subclass VIIe.

36—Santo Tomas extremely stony sandy loam, 2 to 10 percent slopes. This deep, well drained soil is on flood plains and in stream channels (fig. 9). It formed in mixed alluvium. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

Typically, 30 to 60 percent of the surface is covered with stones and 10 to 20 percent is covered with cobbles. The surface layer is dark grayish brown, neutral and moderately alkaline extremely stony sandy loam about 31 inches thick. The underlying material to a depth of 60 inches or more is brown, moderately alkaline extremely stony loamy sand.

Included in this unit are small areas of Santo Tomas very gravelly sandy loam, Comoro gravelly sandy loam, and Anthony gravelly sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Santo Tomas soil is moderate to a depth of 31 inches and rapid below this depth. Available water capacity is low. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is moderate. This soil is subject to frequent, brief periods of flooding from July through September and from February through March.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, Arizona cottontop, and bottlebrush squirreltail. Arizona ash, cottonwood, and willows are along the drainageways.

The diversity of vegetation, which includes an abundance of streamside plant species, and availability of water encourage a constant grazing pressure on this unit. The unit produces year-round browse for wildlife or livestock. Because the large amount of stones on the

Figure 9.—Typical area of Santo Tomas extremely stony sandy loam, 2 to 10 percent slopes.

surface limit grazing, this unit responds rapidly to the use of grazing management. Fencing and deferred grazing are important in planned grazing systems. The soil in this unit is limited for livestock watering ponds and other water impoundments because of seepage.

If this unit is used for homesite development, the main limitations are the stones on the surface and in the soil, the hazard of flooding, seepage, and low soil strength. Flooding can be controlled only by use of major flood control structures.

If this unit is used for septic tank absorption fields, the main limitation is the hazard of flooding.

If this unit is used for recreation, the main limitation is the hazard of flooding and the extremely stony surface.

This map unit is in capability subclass VIw.

37—Selevin extremely stony loam, 2 to 15 percent slopes. This deep, well drained soil is on fan terraces. It formed in alluvium derived dominantly from granite and gneiss. Elevation is 3,800 to 5,000 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

Typically, 30 to 50 percent of the surface is covered with stones and 10 to 30 percent is covered with cobbles and gravel. The surface layer is reddish brown, slightly acid extremely stony loam and neutral very stony sandy clay loam about 5 inches thick. The subsoil is dark reddish brown and reddish brown, mildly alkaline very stony clay about 18 inches thick. The substratum to a depth of 60 inches or more is pinkish white, moderately alkaline extremely stony sandy loam that is cemented with lime. In some areas the surface layer is extremely cobbly, very cobbly, or very stony.

Included in this unit are small areas of Alsco very cobbly loam on the hillsides below the fan terraces, Eloma very cobbly loam on the steeper part of the hillsides, and a very calcareous, shallow very cobbly loam that has a strongly lime-cemented pan and is on the breaks of fan terraces. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Selevin soil is slow. Available water capacity is low. Water supplying capacity is 8 to 12 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 30 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat and recreation.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly tobosa, sideoats grama, curlymesquite, plains lovegrass, and plains bristlegrass.

Because the large number of stones on the surface of the soil limits grazing, this unit responds rapidly to the use of grazing management. Small water catchments can be constructed if the area is large enough. No other source of water is available on this unit.

If this unit is used for homesite development, the main limitations are the shrink-swell potential and the large number of stones in the soil. Excavation for roads and buildings increases the hazard of erosion. Structures to divert runoff are needed if buildings and roads are constructed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

If this unit is used for recreation, the main limitation is the extremely stony surface.

This map unit is in capability subclass VIe.

38—Signal very cobbly clay loam, 10 to 40 percent slopes. This deep, well drained soil is on hillsides. It formed in mixed colluvium and alluvium. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

Typically, 30 to 70 percent of the surface is covered with cobbles and gravel. The surface layer is brown, slightly acid very cobbly clay loam about 2 inches thick. The subsoil is dark reddish brown and reddish brown, moderately alkaline very gravelly clay and extremely gravelly clay about 37 inches thick. The substratum to a depth of 60 inches or more is yellowish red and light reddish brown, extremely gravelly loamy coarse sand and very gravelly loam. It is moderately alkaline and is weakly to strongly cemented with lime. In some areas the surface layer is extremely cobbly, very gravelly, or extremely gravelly.

Included in this unit are small areas of Wampoo very gravelly loam on gently sloping fan terraces and limy very gravelly clay loam that is underlain by a pan and is intermingled with Wampoo soils on fan terraces. Also included are deep, limy soils, on the steeper hillsides, that have a very gravelly and very cobbly surface layer. Included areas make up about 20 percent of the total acreage.

Permeability of this Signal soil is slow. Available water capacity is high. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 30 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly sideoats grama, black grama, tobosa, and cane bluestem.

Livestock prefer this unit to most others in the survey area because of its accessibility and the ease with which watering facilities can be developed. This results in

overgrazing and subsequent deterioration of the vegetation. This unit is suitable for year-round grazing, and it generally provides high yields of forage.

Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Planned grazing systems are essential to maintain plant vigor and forage production on this unit. Fencing and deferred grazing are important in planned grazing systems.

If this unit is used for homesite development, the main limitation is slope and the shrink-swell potential of the soil. Excavation for roads and buildings increases the hazard of erosion. Because vegetation is difficult to reestablish, only the part of the site that is used for construction should be disturbed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

If this unit is used for septic tank absorption fields, the main limitations are slope and slow permeability. Tile lines should be placed on the contour. Extending the absorption field helps to offset the limitation of slow permeability. Placing the tile lines in the gravelly loamy coarse sand layer also helps to offset this limitation.

If this unit is used for recreation, the main limitations are slope and the very cobbly surface.

This map unit is in capability subclass VIe.

39—Sonoita-Bucklebar complex, 2 to 10 percent slopes. This map unit is on fan terraces. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 55 percent Sonoita sandy loam and 25 percent Bucklebar sandy loam. The Sonoita soil is on the lower part of the fan terraces, and the Bucklebar soil is on the higher, more sloping part of the fan terraces. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Comoro sandy loam and Anthony sandy loam along the drainageways. Also included are small areas of soils, on the upper ends of the fan terraces, that are similar to the Sonoita and Bucklebar soils but have a darker colored surface layer. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Sonoita soil is deep and well drained. It formed in mixed alluvium derived dominantly from granitic rock. Typically, the surface layer is light yellowish brown, neutral and slightly acid sandy loam about 14 inches thick. The subsoil is moderately alkaline light brown sandy loam and brown sandy clay loam about 31 inches thick. The substratum to a depth of 67 inches or more is light yellowish brown, moderately alkaline very gravelly loamy sand.

Permeability of the Sonoita soil is moderately rapid. Available water capacity is moderate. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 25 to 35 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Bucklebar soil is deep and well drained. It formed in mixed alluvium derived dominantly from granitic rock. Typically, the surface layer is light brown, neutral and mildly alkaline sandy loam about 7 inches thick. The subsoil is reddish brown, moderately alkaline sandy clay loam, about 20 inches thick, that has a few soft lime masses in the lower part. The substratum extends to a depth of 73 inches or more. It is light brown, moderately alkaline sandy loam and sandy clay loam in the upper 23 inches and light yellowish brown and brownish yellow, moderately alkaline gravelly sand and very gravelly sand in the lower 23 inches.

Permeability of the Bucklebar soil is moderate to a depth of 50 inches and rapid below this depth. Available water capacity is moderate. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 20 to 30 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development.

The potential plant community on this unit is mainly bush muhly, black grama, and plains bristlegrass. The present vegetation in most areas is mainly mesquite, cacti, and wolfberry. Scattered bush muhly is in protected areas.

Livestock prefer areas of this map unit to most others in the survey area because of their accessibility and the large variety of palatable plants that grow in the areas. This results in overgrazing and subsequent deterioration of the vegetation. Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Because of the lack of a seed source and the competition from woody plants for moisture, desirable grasses are very slow to recover even with the best grazing management.

If this unit is used for homesite development, the main limitation is the shrink-swell potential of the Bucklebar soil. There are few limitations on the Sonoita soil. Excavation for roads and buildings increases the hazard of erosion and in places exposes material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion. Access roads must be designed to control surface runoff and help stabilize cut slopes.

The main limitation of this unit for septic tank absorption fields is the moderate permeability of the Bucklebar soil. Tile lines should be placed on the

contour in the more steeply sloping areas and below the moderately permeable layer in the Bucklebar soil.

If this unit is used for recreation, it has few limitations.

This map unit is in capability subclass VIIe.

40—Stellar gravelly sandy clay loam, 0 to 5 percent slopes. This deep, well drained soil is on fan terraces. It formed in mixed alluvium. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

Typically, 20 to 50 percent of the surface is covered with fine and medium gravel. The surface layer is pinkish gray, moderately alkaline gravelly sandy clay loam about 3 inches thick. The subsoil is reddish brown, yellowish red, and reddish yellow, moderately alkaline clay about 47 inches thick. The substratum to a depth of 66 inches or more is light brown, moderately alkaline sandy clay loam.

Included in this unit are small areas of Stellar gravelly loam, Bucklebar sandy loam, and Tres Hermanos gravelly sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Stellar soil is slow. Available water capacity is high. Water supplying capacity is 4 to 8 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 25 inches. Runoff is slow, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly tobosa, black grama, bush muhly, and sideoats grama.

Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Planned grazing systems are essential to maintain plant vigor and forage production on this unit. Fencing and deferred grazing are important in planned grazing systems. When the plants go dormant, they deteriorate rapidly in palatability and food value. If the plants are used during this period, livestock usually require a protein supplement.

If this unit is used for homesite development, the main limitations are shrink-swell potential and low soil strength. Excavation for roads and buildings increases the hazard of erosion. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Roads should be designed to offset the limited ability of this soil to support a load. Preserving the existing plant cover during construction helps to control erosion.

If this unit is used for septic tank absorption fields, the main limitation is slow permeability. Increasing the size of the absorption field and using sandy backfill for the trench helps to compensate for the slow permeability.

If this unit is used for recreation, the main limitation is the gravelly surface.

This map unit is in capability subclass VIs.

41—Tapco-Peloncillo association, 2 to 15 percent slopes. This map unit is on fan terraces. Elevation is 3,500 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 50 percent Tapco very cobbly sandy clay loam and 30 percent Peloncillo very cobbly sandy clay loam. The Tapco soil is on the gently sloping upper part of the terraces (fig. 10), and the Peloncillo soil is on the moderately sloping lower and valley border parts of the terraces (fig. 11).

Included in this unit are small areas of Bonita cobbly silty clay on the nearly level central part of the terraces, Limpia cobbly clay loam on the moderately sloping upper part of the terraces near mountain fronts, Pinaleno very gravelly loam on the side slopes of terraces and escarpment fronts, and Tres Hermanos gravelly sandy clay loam near the valley border part of the terraces. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tapco soil is very shallow and shallow and is well drained. It formed in mixed alluvium derived dominantly from volcanic rock. Typically, 20 to 60 percent of the surface is covered with basalt cobbles and gravel. The surface layer is brown, mildly alkaline very cobbly clay loam about 2 inches thick. The subsoil is reddish brown, moderately alkaline clay about 8 inches thick. The next layer is a silica- and lime-cemented hardpan about 1 inch thick. The substratum to a depth of 60 inches or more is white, pinkish white, and pink, moderately alkaline, alternating silica- and lime-cemented pans and weakly to strongly lime- and silica-cemented layers. Depth to the hardpan ranges from 7 to 20 inches.

Permeability of the Tapco soil is slow. Available water capacity is very low. Water supplying capacity is 4 to 8 inches. Effective and observed rooting depth is 7 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Peloncillo soil is very shallow and shallow and is well drained. It formed in mixed alluvium derived dominantly from volcanic rock. Typically, 30 to 60 percent of the surface is covered with cobbles, gravel, and pan fragments. The surface layer is very pale brown, moderately alkaline, calcareous very cobbly sandy clay loam about 1 inch thick. The subsoil is light brown, moderately alkaline, strongly calcareous very gravelly clay loam about 14 inches thick. The substratum to a depth of 60 inches or more is white, pinkish white, and pink, moderately alkaline, moderately to strongly lime- and silica-cemented layers alternating with silica- and lime-cemented hardpans. Depth to the upper hardpan ranges from 7 to 20 inches.

Figure 10.—Area of Tapco soil in Tapco-Peloncillo association, 2 to 15 percent slopes.

Permeability of the Peloncillo soil is moderately slow. Available water capacity is very low. Water supplying capacity is 2 to 6 inches. Effective and observed rooting depth is 7 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development.

If the range vegetation on the Tapco soil is in good or excellent condition, the native grasses are mainly tobosa, black grama, and sideoats grama. The present vegetation is mainly tobosa. If the range vegetation on the Peloncillo soil is in good or excellent condition, the native plants are mainly creosotebush, bush muhly, and black grama. The present vegetation is mainly creosotebush. Scattered bush muhly is in protected areas. High lime content, low water supplying capacity, and the inhibiting influence of the creosotebush contribute to the low production of forage on the Peloncillo soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of species is maintained in the plant community. Suitable range management practices are fencing, implementing planned grazing systems, and developing water for livestock. Management should be administered according to the needs of the Tapco soil.

If this unit is used for homesite development, the main limitations are the depth to the cemented pan in the Tapco and Peloncillo soils and the shrink-swell potential of the Tapco soil. Excavation for building sites is limited by the hardpan. Excavation increases the hazard of erosion. The effects of shrinking and swelling of the Tapco soil can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

If this unit is used for septic tank absorption fields, the main limitation is the depth to the hardpan.

If this unit is used for recreation, the main limitations are the very cobbly surface layer and the depth to the hardpan.

This map unit is in capability subclass VIs.

42—Torrifluvents-Riverwash complex, 1 to 5 percent slopes. This deep, well drained soil is on flood plains and in stream channels. It formed in recent mixed alluvium. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 10 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 45 percent Torrifluvents and 35 percent Riverwash. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Gila fine sandy loam, Glendale silty clay loam, Pima silty clay loam, and Santo Tomas very cobbly sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Torrifluvents consist of highly variable soils that are moderately coarse textured and coarse textured and are stratified with finer textured material. Their average depth is more than 40 inches.

Permeability of the Torrifluvents is rapid. Available water capacity is very low to low. Water supplying capacity varies with location and position on the landscape. Effective rooting depth is 40 inches or more. Runoff is slow, and the hazard of water erosion is slight to high. These soils are subject to frequent flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. Where these soils are on the bottomlands of the Gila River, San Francisco River, Bonita Creek, and Eagle Creek, the water flows year round.

Riverwash consists of stratified layers of sand, cobbles, and gravel.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. Some areas are used as homesites.

If the range vegetation is in good or excellent condition, the native grasses are mainly sideoats grama, Arizona cottontop, plains bristlegrass, and bottlebrush squirreltail. In addition, cottonwood, willow, sycamore, and mesquite line the watercourses. The diversity of vegetation, which includes an abundance of streamside

Figure 11.—Area of Peloncillo soil in Tapco-Peloncillo association, 2 to 15 percent slopes.

plant species, and the availability of water on this unit encourage a constant grazing pressure. Suitable range management practices are fencing and implementing planned grazing systems.

If this unit is used for homesite development, the main limitation is the hazard of flooding. Flooding can be controlled only by use of major flood control structures. Cutbanks are not stable and are subject to slumping.

If this unit is used for recreation, the main limitation is the hazard of flooding.

This map unit is in capability subclass VIw.

43—Tres Hermanos-Continental-Nickel complex, 2 to 45 percent slopes. This map unit is on fan terraces and hillslopes. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 10 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 40 percent Tres Hermanos gravelly sandy clay loam, 20 percent Continental very gravelly sandy clay loam, and 20 percent Nickel extremely cobbly sandy loam. The Tres Hermanos soil is in moderately sloping areas on the fan terraces and hillsides, the Continental soil is in the less sloping areas on the fan terraces, and the Nickel soil is on the steeper side slopes of the fan terraces. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of tuff and conglomerate on sharp, steep breaks along drainageways, shallow soils underlain by tuff and conglomerate on steep hillsides that have been severely eroded, and Torrifluvents in stream channels. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tres Hermanos soil is deep and well drained. It formed in mixed alluvium and colluvium. Typically, 20 to 50 percent of the surface is covered with gravel and a few cobbles. The surface layer is light brown, moderately alkaline gravelly sandy clay loam about 2 inches thick. The subsoil is moderately alkaline, brown clay loam and light brown gravelly clay loam about 25 inches thick. The substratum to a depth of 60 inches or more is white sandy loam and pinkish gray gravelly sandy loam that has some very gravelly and very cobbly strata.

Permeability of the Tres Hermanos soil is moderately slow. Available water capacity is medium. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 25 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Continental soil is deep and well drained. It formed in mixed alluvium. Typically, 20 to 60 percent of the surface is covered with gravel and cobbles. The surface layer is reddish brown, moderately alkaline very gravelly sandy clay loam about 2 inches thick. The subsoil, about 30 inches thick, is reddish brown, moderately alkaline gravelly clay that has soft lime masses in the lower part. The substratum to a depth of 60 inches or more is pink, pinkish white, and white, stratified, weakly to strongly cemented very gravelly sandy loam.

Permeability of the Continental soil is slow. Available water capacity is high. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 25 inches. Runoff is slow to medium, and the hazard of water erosion is slight.

The Nickel soil is deep and well drained. It formed in mixed colluvium and alluvium. Typically, 30 to 80 percent of the surface is covered with cobbles and gravel. The surface layer is pinkish gray, moderately alkaline extremely cobbly sandy loam about 2 inches thick. The underlying material in the upper part is pinkish gray, pink, and white, moderately alkaline, weakly to moderately lime-cemented extremely gravelly sandy loam about 42 inches thick. Below that, to a depth of 60 inches or more it is reddish brown, moderately alkaline gravelly loamy sand.

Permeability of the Nickel soil is moderately slow. Available water capacity is moderate. Water supplying capacity is 2 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as rangeland and for wildlife habitat and recreation. A few areas are used for homesite development.

If the range vegetation on the Tres Hermanos and Nickel soils is in good or excellent condition, the native plants are mainly creosotebush, black grama, bush muhly, and mescat acacia. High lime content, low water supplying capacity, and the inhibiting influence of the creosotebush contribute to the low production of forage on these soils.

If the range vegetation on the Continental soil is in good or excellent condition, the native grasses are mainly black grama, bush muhly, tobosa, sideoats grama, and blue grama. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of species is maintained in the plant community.

Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities. Management of this unit should be administered according to the needs of the Continental soil.

If this unit is used for homesite development, the main limitations are slope on the Tres Hermanos and Nickel soils and the shrink-swell potential of the Continental soil. Only the part of the site that is used for construction should be disturbed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

If this unit is used for septic tank absorption fields, the main limitations are restricted permeability and slope. Increasing the size of the absorption field helps to compensate for the slow and moderately slow permeability of the soils.

If this unit is used for recreation, the main limitations are slope and the gravel and cobbles on the surface.

This map unit is in capability subclass VIIe.

44—Wampoo gravelly loam, 2 to 10 percent slopes. This moderately deep, well drained soil is on fan terraces. It formed in alluvium derived dominantly from volcanic rock. Elevation is 4,000 to 5,200 feet. The average annual precipitation is about 12 to 14 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 170 to 240 days.

Typically, 20 to 50 percent of the surface is covered with gravel and cobbles. The surface layer is brown and reddish brown, neutral gravelly loam about 5 inches thick. The subsoil is dark reddish gray and reddish brown, moderately alkaline clay and gravelly clay about 16 inches thick. The next layer is a silica- and lime-cemented hardpan about 1 inch thick. The substratum, to a depth of 28 inches or more, is pinkish white silica- and lime-cemented hardpans and alternate layers of cemented gravel, sand, and cobbles. In some areas the surface layer is cobbly or very cobbly. Depth to the hardpan ranges from 20 to 30 inches.

Included in this unit are small areas of Signal very cobbly clay loam on hillsides; soils, in the more steeply sloping areas at the ends and edges of terraces, that are similar to this Wampoo soil but have a clay loam layer above the hardpan; and moderately deep and deep, limy very gravelly loam on the edges of terraces. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Wampoo soil is slow. Available water capacity is moderate. Water supplying capacity is 6 to 10 inches. Effective and observed rooting depth is 20 to 30 inches. Runoff is slow to medium, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat, recreation, and homesite development.

If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly tobosa and sideoats grama. The vegetation produced on this unit can support large numbers of animals during the months following the summer rains. When the plants go dormant, they deteriorate rapidly in palatability and food value. If the plants are used during this period, the animals usually require a protein supplement.

Suitable range management practices are fencing, implementing planned grazing systems, and developing livestock watering facilities.

If this soil is used for homesite development, the main limitations are shrink-swell potential, depth to the hardpan, low soil strength, and the hazard of erosion. Excavation for building sites is limited by the hardpan.

Excavation for roads and buildings increases the hazard of erosion on this unit. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

If this unit is used for septic tank absorption fields, the main limitations are the depth to the hardpan, slope, and the slow permeability of the soil. Increasing the size of the absorption field and using sandy backfill for the trench helps to compensate for the slow permeability.

If this unit is used for recreation, the main limitation is the gravelly surface.

This map unit is in capability subclass VIe.

45—Whitlock-Tres Hermanos complex, 2 to 20 percent slopes. This map unit is on fan terraces. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is 62 to 66 degrees F, and the average frost-free period is 180 to 250 days.

This unit is 55 percent Whitlock sandy loam and 25 percent Tres Hermanos very gravelly sandy loam. The Whitlock soil is on the gently sloping part of the terraces, and the Tres Hermanos soil is on the moderately sloping part of the terraces that rise slightly above areas of the Whitlock soil. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Pinaleno very gravelly loam on fan terrace fronts and Anthony gravelly sandy loam in and along drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Whitlock soil is deep and well drained. It formed in mixed alluvium. Typically, 10 to 40 percent of the surface is covered with fine gravel and a few cobbles. The surface layer is light brown, moderately alkaline, calcareous sandy loam about 10 inches thick. The upper part of the underlying material is moderately alkaline, calcareous, pinkish white loam and light brown sandy loam about 18 inches thick. The lower part, to a depth of 70 inches or more, is light brown and brown, moderately alkaline, calcareous sand.

Permeability of the Whitlock soil is moderately rapid to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Water supplying capacity is 2 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 40 to 50 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Tres Hermanos soil is deep and well drained. It formed in mixed alluvium. Typically, 30 to 70 percent of the surface is covered with gravel and cobbles. The surface layer is brown, moderately alkaline very gravelly sandy loam about 2 inches thick. The subsoil is brown

and light brown, moderately alkaline, calcareous gravelly clay loam and gravelly sandy clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is white to reddish brown, weakly lime cemented, stratified gravelly sandy loam, gravelly loam, and gravelly clay loam.

Permeability of the Tres Hermanos soil is moderately slow. Available water capacity is medium. Water supplying capacity is 4 to 6 inches. Effective rooting depth is 60 inches or more. Observed rooting depth is 15 to 25 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly as rangeland and for wildlife habitat and recreation. It is also used for homesite development.

If the range vegetation is in good or excellent condition, the native plants on the Whitlock soil are mainly creosotebush, bush muhly, and whitethorn; on the Tres Hermanos soil they are mainly creosotebush, bush muhly, black grama, slim tridens, and mescat acacia.

High lime content, low water supplying capacity, and the inhibiting influence of the creosotebush contribute to the low production of forage on this unit. Management practices do not appreciably change or improve forage production. Development of livestock watering facilities helps in managing use of the available forage.

If this unit is used for homesite development, the main limitations are the shrink-swell potential and slope of the Tres Hermanos soil. The Whitlock soil has few limitations.

Excavation for houses and access roads in places exposes material that is highly susceptible to soil blowing. Structures to divert runoff are needed if buildings and roads are constructed. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. Buildings and roads can be designed to offset the effects of shrinking and swelling.

If this unit is used for septic tank absorption fields, the main limitations are the moderately slow permeability and slope of the Tres Hermanos soil. Increasing the size of the absorption field helps to compensate for the slow permeability. Placing trench lines on the contour in the steeper areas reduces seepage downslope. There are few limitations for this use on the Whitlock soil.

If this unit is used for recreation, the main limitation is the very gravelly surface layer of the Tres Hermanos soil. The Whitlock soil has few limitations for most recreation uses.

This map unit is in capability subclass VIIe.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; and as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Gene R. Goosetree, district conservationist, Soil Conservation Service, helped to write this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified, and the system of land capability classification used by the Soil Conservation Service is explained. The estimated yields of the main crops and hay and pasture plants for each soil that is cropped are given in the map unit descriptions in the section "Soil maps for detailed planning."

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 8,575 acres of land in the survey area is used for irrigated farming. The main crops are cotton, small grain, sorghum, hay, and pasture. Of the total acreage, 4,155 acres is Pima soils, 1,700 acres is Guest soils, 1,245 acres is Gila soils, and 490 acres is Hantz soils.

The potential of the irrigated soils, which occur only in the Duncan area, for increased production of food and fiber is good. Food and fiber production could be increased considerably by extending the latest management and crop production technology to all cropland in the survey area.

Proper use and management of the irrigated soils of the Duncan area requires the choice of effective cropping systems, periodic addition of organic material, flood plain management, installation of improved irrigation systems, improved water management, and minimum tillage.

An effective cropping system is one that includes a combination of practices that maintain crop growth and that improve the fertility and tilth of the soil. Such a system includes crop rotation supported by the use of green-manure crops, crop residue, fertilization, land leveling, good methods of tillage, and other suitable practices.

Because of high temperatures and low humidity, the organic matter in the soils in the survey area decomposes almost as fast as it is replaced. Organic matter can be replaced by plowing under crop residue and green-manure crops, growing grasses and legumes in the rotation, and adding barnyard manure. Pima and Guest soils are as much as 2 percent organic matter, but some of the other soils in the area are as little as one-half percent organic matter.

Management of irrigation water is the one major farming practice in the survey area upon which all other practices depend. Water is supplied from the Gila River and from shallow wells. The amount of water supplied by the river depends on the amount of runoff received from snowmelt in the mountains and from rainfall. The water is delivered to individual farms through canals and is

delivered on rotation and not on demand. Improvement in the method of delivery would improve farming in the survey area. In some places farmers use water from wells to supplement water from the river because that supply is variable.

The soils should be leveled so that irrigation water can be properly applied. The depth of some of the soils does not allow the depth of cuts necessary to completely level a field, and on such soils the grade should at least be uniform. In general, fields can be leveled to a reasonably uniform grade with little or no damage to the soils. Onsite investigation is needed to determine the depth of cuts that can be made before sand, rock, or some other material that adversely affects farming is exposed.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are given in map unit descriptions in the section "Soil maps for detailed planning." In any given year, yields may be higher or lower than those indicated in the map units because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those listed in the map unit descriptions are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system (*11*), soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined 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. The classes are defined as follows:

Class I soils have slight 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 or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that 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.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

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

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the

subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Douglas T. MacPhee, range conservationist, Soil Conservation Service, helped to write this section.

About 95 percent of the land in the survey area is range. Cow-calf-steer operations are conducted on the ranches in the area. Ranches average about 18,000 acres in size, but they range from 3,000 to 160,000 acres.

In areas that have similar climate and topography, the kind and amount of vegetation produced on rangeland are closely related to the kinds of soil in the areas. Effective management is based on the relationship between the soils and the vegetation.

Table 5 shows, for each soil in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 5 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential native plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential native plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential native plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The soils in the survey area formed in material derived from andesite, basalt, tuff, and granite, the properties of which help to determine the kinds of soil in the range sites. Bottom range sites have textures of loam, sand, and clay, and are on flood plains and alluvial fans. These sites have high potential production but are usually grazed excessively. Upland and limy range sites have textures of loam, clay, clay loam, and sandy loam and are on fan terraces. These sites have fair to good potential for forage production with the exception of limy range sites, which have low potential.

The volcanic parent material, andesite, basalt, and tuff in the eastern and northern parts of the survey area are reflected in sites that have a high percentage of clay. These sites are on fan terraces and mountains. Tobosa is the dominant forage plant and is considered to be an indicator of clayey soils. At higher elevations the soils that formed in material derived from andesite support a variety of woody species while soils derived from basalt support dominantly juniper with some oak and yucca.

The soils in the southwestern part of the survey area reflect the granitic parent material of the Pinaleno and Santa Teresa Mountains. These soils are on fan terraces and mountains, and have less clay than the soils that formed in material derived from andesite, basalt, and tuff. Range sites with loam and sandy loam textures occur most frequently on fan terraces. They support many varieties of plants, and no single species is

dominant; however, sideoats grama is important on most of the sites. At the higher elevations in the survey area, the soils in this area also support chaparral vegetation.

The forage plants in many parts of the survey area have been depleted by excessive use. There has been a decrease in grass and an increase in cacti and in woody and annual plants. Productivity of forage plants is generally below the potential of the soils. The steep and very steep mountains create problems with proper distribution of grazing, which results in overuse of some areas and underuse of others.

Management in this survey area should be directed toward proper grazing. Uniform distribution of grazing can be promoted through fencing and water development. Large investments may not be economically justifiable, because limited precipitation makes the reestablishment of desirable plants a slow process. Long term improvement programs along with observance of proper stocking rates promote range restoration.

recreation

The soils of the survey area are rated in table 6 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 6, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that 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 6 can be supplemented by other information in this survey; for example, interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 8.

Camp areas require site preparation such as shaping and leveling the 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 have mild slopes and are not wet or 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 campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for 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 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 and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

Donald W. Welch, biologist, Soil Conservation Service, helped to write this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

The survey area is located at the place where the Sonoran Desert, Plains Grassland, and Chihuahuan Desert physiographic provinces come together. These provinces support complex plant communities that, in turn, support complex groups of wildlife. In each separate province are wildlife species that occur in the other provinces.

The survey area has been heavily used by livestock since the 1880's. This has further complicated managing for wildlife habitat because of increases and invasions of noxious weeds and undesirable woody plants.

Several seasonal species that enter from Mexico are in the area. Many occur no other place in the continental United States. These include grey hawk, black hawk, and about twelve species of hummingbird. Waterfowl are

abundant along the watercourses. The vegetation in and along watercourses is the most important vegetation for perching birds and birds of prey. The density of nesting in these areas is higher than that in any comparable place in the United States.

The diversity of wildlife in the survey area can be misleading. Even though there is a wide diversity of animals, the total number of all species or of any one species is usually low. Climate and precipitation affect the amount of vegetation that grows, which affects wildlife populations. In an area of erratic rainfall such as this, populations fluctuate widely. For instance, large flocks of Gambel quail can be seen in some years. When rains are infrequent, the flocks drop drastically in number, only to increase again when adequate rain falls. This is true of most of the smaller animals in the survey area. Populations of deer and javelina reflect these fluctuations, but not so rapidly. The climate is austere, as is its effect on wildlife.

In table 7, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, sorghum, wheat, oats, sunflower, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, tall wheatgrass, lovegrass, bermudagrass, clover, trefoil, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bush muhly, vine-mesquite, Arizona cottontop, Mormon-tea, false mesquite, curlymesquite, threeawn, globemallow, and grama grasses.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are fourwing saltbush, mesquite, whitethorn, catclaw, skunkbush sumac, and yucca.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are developed springs, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include Gambel quail, pheasant, meadowlark, field sparrow, small rodents, cottontail rabbit, jackrabbit, and predators.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Rangeland wildlife habitat is divided into two groups: (1) desert shrub and grassland habitat and (2) foothills and mountain habitat.

Desert shrub and grassland habitat consists primarily of shrubs, wild herbaceous plants, and a few trees. Wildlife species associated with this kind of habitat are coyote, badger, kit fox, bobcat, antelope, black-tailed jackrabbit, red-spotted toad, Couch's spadefoot toad, Merriam's kangaroo rat, Ord's kangaroo rat, white-throated woodrat, cactus mouse, Gila monster, roundtail horned lizard, western diamondback rattlesnake, and scaled quail.

Foothills and mountain habitat consists primarly of shrubs, trees, and herbaceous forbs interspersed with grasses. Wildlife species associated with this habitat are mule deer, white-tailed deer (Sonoran), black bear, mountain lion, bobcat, coyote, hog-nosed skunk, javelina, rock squirrel, desert cottontail, green toad, cactus mouse, and band-tailed pigeon.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made

for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 9 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a

high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 10, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts,

are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 11 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and terraces and diversions.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplementrainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 12 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

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 and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups 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 (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 13 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly

erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

soil and water features

Table 14 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 14 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal 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.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or

weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*12*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 15, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning flood plain sediment, 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 development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Torrifluvents (*Torri*, meaning hot and dry, plus *fluvent*, the suborder of the Entisols that formed in flood plain sediment).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Torrifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, (calcareous), thermic Typic Torrifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*10*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*12*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Akela series

The Akela series consists of very shallow and shallow, well drained soils on foothills. These soils formed in colluvium derived from andesite, tuff, and agglomerate. Slope is 9 to 60 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of an Akela extremely gravelly sandy loam in an area of Akela-Lehmans-Rock outcrop complex, 9 to 60 percent slopes, about 9 miles north of Safford; 1,400 feet south and 1,800 feet east of the northwest corner of sec. 28, T. 5 S., R. 26 E., Graham County.

A1—0 to 1 inch; brown (7.5YR 5/4) extremely gravelly sandy loam, brown (7.5YR 4/4) moist; weak thin platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; 65 percent gravel and 10 percent cobbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—1 to 5 inches; brown (7.5YR 5/4) extremely gravelly loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure appearing massive in place; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; 65 percent mixed gravel; few fine lime veins and concretions on gravel; slightly effervescent in matrix but strongly effervescent on lime segregations; moderately alkaline; abrupt wavy boundary.

C2ca—5 to 7 inches; light brown (7.5YR 6/4) extremely gravelly loam, brown (7.5YR 4/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; 65 percent mixed gravel; common white (N 8/0) lime nodules and fine veins; strongly effervescent in matrix, violently effervescent on lime segregations; moderately alkaline; very abrupt wavy boundary.

R—7 inches; lime-coated, grayish green porphyritic andesite.

Depth to bedrock ranges from 4 to 15 inches. The control section averages 35 to 80 percent rock fragments. Content of carbonates increases with depth. The profile ranges from slightly effervescent at the surface to violently effervescent just above the bedrock.

Alsco series

The Alsco series consists of deep, well drained soils on hillsides. These soils formed in colluvium and alluvium derived from granite and gneiss. Slope is 15 to 70 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of an Alsco extremely cobbly sandy loam in an area of Eloma-Alsco complex, 15 to 70 percent slopes, about 9 miles southwest of Pima; 1,100 feet south and 1,900 feet east of the northwest corner of sec. 29, T. 7 S., R. 24 E., Graham County.

A1—0 to 2 inches; dark yellowish brown (10YR 4/4) extremely cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common fine vesicular pores and many very fine and fine interstitial pores; 50 percent cobbles, 25 percent gravel, and 15 percent stones; noneffervescent; mildly alkaline; abrupt wavy boundary.

B1t—2 to 5 inches; brown (7.5YR 4/4) extremely cobbly sandy clay loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; few thin clay films on faces of peds and lining pores; 40 percent cobbles and 30 percent gravel; noneffervescent; mildly alkaline; clear wavy boundary.

B2tca—5 to 11 inches; brown (7.5YR 4/4) very cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; common thin clay films on faces of peds and lining pores; 30 percent cobbles and 25 percent gravel; few thin lime coatings on underside of rock fragments; slightly effervescent on peds and strongly effervescent on lime features; 5 percent calcium carbonate; moderately alkaline; clear wavy boundary.

B3tca—11 to 16 inches; brown (7.5YR 5/4) very cobbly clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots and few medium roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; few thin clay films on faces of peds; 30 percent cobbles and 25 percent gravel; few fine lime veins on faces of peds and thin coatings of lime on rock fragments; strongly effervescent; 6 percent calcium carbonate; moderately alkaline; clear wavy boundary.

C1ca—16 to 21 inches; light brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; 45 percent mixed gravel; common fine lime veins and very few fine white (N 8/0) soft lime masses; strongly effervescent; 7 percent calcium carbonate; moderately alkaline; abrupt wavy boundary.

C2ca—21 to 26 inches; pinkish white (7.5YR 8/2) extremely cobbly sandy loam, pink (7.5YR 7/4) moist; weakly lime cemented; very hard, friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular and interstitial pores; 40 percent cobbles and 30 percent gravel; violently effervescent; 21 percent calcium carbonate; moderately alkaline; clear wavy boundary.

C3ca—26 to 35 inches; light brown (7.5YR 6/4) extremely cobbly sandy loam, brown (7.5YR 5/4) moist; massive; hard, friable, nonsticky and nonplastic; very few very fine roots; common very

fine interstitial pores and few very fine tubular pores; 40 percent cobbles and 30 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

C4ca—35 to 60 inches; light brown (7.5YR 6/4) extremely cobbly sandy loam, brown (7.5YR 5/4) moist; massive; hard, friable, nonsticky and nonplastic; common very fine interstitial pores; 45 percent cobbles and 25 percent gravel; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 30 inches. Depth to the calcic horizon ranges from 20 to 30 inches. The control section averages more than 35 percent rock fragments, mainly cobbles. Organic matter content is 1 to 2 percent in the upper 5 inches of the profile and is less than 1 percent in the B horizon.

The A horizon is dark yellowish brown, yellowish brown, dark brown, or brown. It is slightly acid to mildly alkaline. The B horizon is brown, dark brown, yellowish brown, or dark yellowish brown. It is clay loam or sandy clay loam and is 35 to 90 percent rock fragments, dominantly cobbles. The B horizon is noneffervescent in the upper part and strongly effervescent just above the C2 horizon. It is mildly alkaline or moderately alkaline. The C horizon is white, pinkish white, pink, light brown, very pale brown, or pale brown. It is 35 to 80 percent rock fragments, dominantly cobbles.

Anthony series

The Anthony series consists of deep, well drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slopes are 0 to 5 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of an Anthony sandy loam in an area of Anthony-Gila complex, 0 to 5 percent slopes, about 7 miles west of Pima; 200 feet south and 1,500 feet east of the northwest corner of sec. 25, T. 6 S., R. 23 E., Graham County.

A1—0 to 3 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; very weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots and common fine roots; many very fine interstitial pores and few fine tubular pores; 5 percent fine gravel; noneffervescent; moderately alkaline; abrupt smooth boundary.

C1—3 to 15 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine tubular and interstitial pores; 5 percent mixed gravel; very slightly effervescent; moderately alkaline; clear wavy boundary.

C2—15 to 34 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine tubular and interstitial pores; 2 percent fine gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

C3—34 to 45 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine tubular and interstitial pores; 15 percent mixed gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

C4—45 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; single grain; loose; few very fine roots; many very fine interstitial pores; 25 percent mixed gravel; slightly effervescent; moderately alkaline.

The profile is more than 60 inches deep. Coarse fragments make up less than 35 percent of the profile. Strata of gravel 1 inch to 2 inches thick are throughout the profile. Strata of silt and silt loam 1/2 to 1 inch thick also are throughout the profile. Soil reaction ranges from mildly alkaline to strongly alkaline throughout.

The A horizon is light brown, brown, pale brown, light yellowish brown, or yellowish brown. The C horizon is light yellowish brown, yellowish brown, pale brown, brown, or light brown. It is sandy loam or gravelly loam. Gravelly loamy sand is at a depth of 40 to 50 inches.

Aravaipa series

The Aravaipa series consists of shallow, well drained soils on rolling hills. These soils formed in alluvium derived from granitic rock. Slope is 5 to 40 percent. Average annual precipitation ranges from 14 to 16 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Aravaipa extremely gravelly loam, 5 to 40 percent slopes, about 19 miles west by southwest of Pima; 1,900 feet east and 1,700 feet south of the northwest corner of sec. 30, T. 7 S., R. 22 E., Graham County.

A1—0 to 1 inch; brown (10YR 5/3) extremely gravelly loam, dark brown (10YR 3/3) moist; weak medium platy structure parting to moderate fine granular; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine and fine interstitial pores; 50 percent fine gravel; about 75 percent of the surface is covered with fine angular gravel; medium acid; abrupt smooth boundary.

B21t—1 to 5 inches; brown (10YR 4/3) very gravelly heavy clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable, very sticky and plastic; many very fine and fine roots; many very fine and fine interstitial pores and common very fine tubular

pores; few thin clay films on faces of peds; 40 percent fine gravel; neutral; clear smooth boundary.

B22t—5 to 13 inches; brown (10YR 4/3) very gravelly clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, very sticky and very plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; 40 percent fine gravel; neutral; abrupt smooth boundary.

Cr—13 to 45 inches; yellowish red (5YR 5/6) highly weathered granite (gruss), yellowish red (5YR 4/6) moist; hard, but can be broken into fine and medium angular gravel; few very fine and fine roots; common very fine fractures; common moderately thick clay films in fractures; neutral; clear smooth boundary.

R—45 inches; granite.

Thickness of the solum and depth to highly weathered granite range from 8 to 20 inches. The control section is 35 to 50 percent gravel. Reaction of the profile ranges from medium acid to mildly alkaline. Consolidated granitic bedrock is at a depth of 40 to 60 inches.

The A horizon is brown, grayish brown, or dark brown. It is loam, sandy clay loam, or clay loam and is more than 35 percent coarse fragments. The B horizon is brown, dark brown, or dark grayish brown. It is clay, sandy clay, or heavy clay loam and is more than 35 percent coarse fragments. The C horizon is yellowish red, reddish yellow, reddish brown, brown, and strong brown. This material is highly weathered granite that, when moist, readily breaks down to gravel-sized particles.

Artesia series

The Artesia series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium. Slope is 0 to 8 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Artesia extremely cobbly sandy clay loam, 0 to 8 percent slopes, about 7 miles north of Safford; 250 feet east and 1,600 feet north of the southwest corner of sec. 9, T. 6 S., R. 26 E., Graham County.

A1—0 to 1 inch; light brown (7.5YR 6/4) extremely cobbly sandy clay loam, brown (7.5YR 5/4) moist; weak thin platy structure parting to moderate fine granular; slightly hard, friable, sticky and slightly plastic; many very fine roots and common fine roots; common very fine tubular and interstitial pores; 35 percent cobbles and 30 percent gravel; noneffervescent; mildly alkaline; abrupt smooth boundary.

B1t—1 inch to 5 inches; reddish brown (5YR 5/4) very cobbly light clay, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots and few medium roots; common very fine tubular and interstitial pores and few fine tubular pores; very few thin clay films lining pores; 25 percent cobbles and 25 percent gravel; noneffervescent; moderately alkaline; clear smooth boundary.

B21t—5 to 12 inches; reddish brown (2.5YR 4/4) very gravelly clay, reddish brown (2.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, very sticky and very plastic; common very fine and fine roots; common fine and very fine tubular and interstitial pores; common thin clay films lining pores and on faces of peds; 30 percent gravel and 10 percent cobbles; slightly effervescent; moderately alkaline; clear smooth boundary.

B22tca—12 to 24 inches; reddish yellow (5YR 6/6) very gravelly clay, yellowish red (5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots and few medium roots; common fine and very fine tubular and interstitial pores; few thin clay films lining pores and on faces of peds; 35 percent gravel and 10 percent cobbles; common fine lime veins and thin lime coatings on cobbles and pebbles; strongly effervescent; moderately alkaline; very abrupt smooth boundary.

C1sicam—24 to 25 inches; light brown and pink (7.5YR 6/4, 8/2) very strongly silica- and lime-cemented duripan, light brown and pink (7.5YR 6/4, 7/4) moist; massive; extremely hard; very few very fine tubular pores; 45 percent mixed gravel in pan; strongly effervescent; abrupt smooth boundary.

C2sica—25 to 60 inches; light brown and pink (7.5YR 6/4, 8/2) very cobbly loamy sand, brown and pink (7.5YR 8/4, 5/4) moist; massive; hard, firm, nonsticky and nonplastic; very few fine and very fine roots; many fine and very fine tubular pores; 30 percent cobbles and 20 percent gravel; violently effervescent; moderately alkaline.

Thickness of the solum and depth to the duripan range from 20 to 40 inches. The control section averages more than 35 percent coarse fragments. The profile ranges from mildly alkaline to strongly alkaline.

The A horizon is light brown or brown and is more than 35 percent coarse fragments. The B horizon is reddish brown, reddish yellow, or yellowish red. It is clay or sandy clay and is more than 35 percent coarse fragments. The C horizon is light brown or pink. It is a strongly lime and silica cemented hardpan that is underlain by loamy sand or sandy loam that is more than 35 percent coarse fragments.

Atascosa series

The Atascosa series consists of very shallow and shallow, well drained soils on mountains. These soils formed in colluvium derived from volcanic rock. Slope is 20 to 70 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of an Atascosa very gravelly loam in an area of Rock outcrop-Atascosa-Graham complex, 9 to 70 percent slopes, about 3 miles west of Morenci along Lower Eagle Creek Road; 2,000 feet north and 2,600 feet west of the southeast corner of sec. 19, T. 4 S., R. 29 E., Greenlee County.

A1—0 to 2 inches; brown (7.5YR 5/2) very gravelly loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; 40 percent mixed gravel; mildly alkaline; abrupt smooth boundary.

B2t—2 to 9 inches; brown (7.5YR 5/2) very gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; common thin clay films lining pores and few thin clay films on the faces of peds; 50 percent mixed gravel and 5 percent cobbles; mildly alkaline; abrupt wavy boundary.

R—9 inches; andesite.

Thickness of the solum and depth to bedrock are dominantly 6 to 12 inches, but they range from 4 to 20 inches. The control section averages 35 to 85 percent coarse fragments. Soil reaction is neutral to mildly alkaline.

The A horizon is brown, grayish brown, or dark grayish brown. The B horizon is brown, dark brown, dark grayish brown, or very dark grayish brown. It is sandy clay loam or clay loam and is more than 35 percent coarse fragments.

Bonita series

The Bonita series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium derived dominantly from volcanic rock. Slope is 2 to 8 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual temperature ranges from 60 to 65 degrees F.

Typical pedon of Bonita very cobbly silty clay, 2 to 8 percent slopes, approximately 6 miles southeast of Clifton; about 1,300 feet west and 1,650 feet south of the northeast corner of sec. 15, T. 5 S., R. 30 E., Greenlee County.

A11—0 to 2 inches; brown (10YR 5/3) very cobbly silty clay, dark brown (10YR 3/3) moist; weak thin platy structure parting to weak fine granular; slightly hard, friable, very sticky and plastic; common very fine roots; many very fine interstitial pores and common very fine tubular pores; 50 percent cobbles and mixed gravel; about 50 percent of the surface is covered with cobbles; noneffervescent; mildly alkaline; clear smooth boundary.

A12—2 to 6 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, friable, very sticky and very plastic; common very fine roots; many very fine tubular pores; few wormholes; common pressure faces and few slickensides; violently effervescent; moderately alkaline; clear smooth boundary.

A13—6 to 27 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, firm, very sticky and plastic; common very fine roots; common very fine and fine pores, very few medium interstitial pores, and common very fine tubular pores; many pressure faces and common slickensides; violently effervescent; moderately alkaline; clear wavy boundary.

A14—27 to 31 inches; mottled reddish brown (5YR 5/3) and yellowish red (5YR 5/8) silty clay, dark reddish brown (5YR 3/4) and yellowish red (5YR 4/6) moist; massive; hard, firm, sticky and plastic; common very fine roots; common very fine interstitial and tubular pores; common pressure faces and few slickensides; slightly effervescent; moderately alkaline; clear wavy boundary.

IIB2tcab—31 to 36 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; strong fine and very fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; very few very fine roots; many very fine interstitial pores and few very fine tubular pores; many thin clay films on faces of peds and lining pores; common very fine and fine lime veins; few fine white (N 8/0) lime masses, pink (5YR 8/3) moist; 10 percent medium and fine gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

IICca—36 to 60 inches; pink (5YR 8/3) very cobbly sandy clay loam, pink (5YR 7/4) moist; massive; weakly to strongly cemented with lime; extremely hard, extremely firm; very few very fine and fine roots; common very fine tubular and interstitial pores; distinct fine white (N 8/0) lime veins and moderately thick lime coatings on gravel, pink (5YR 8/3) moist; 50 percent cobbles and mixed gravel; violently effervescent; moderately alkaline.

A slight gilgai relief is evident in all areas of these soils. When the soils are dry, cracks 1 to 4 centimeters

wide extend to a depth of 20 inches or more. Commonly, 40 to 80 percent of the surface of these soils is covered with basalt cobbles.

The A horizon commonly extends to a depth of 30 inches or more. Coarse fragments make up less than 10 percent of the A horizon. The A11 horizon is brown or dark brown. The lower part of the A horizon is dark brown or reddish brown clay or silty clay.

The buried B horizon is variable, but it commonly is yellowish red, reddish brown, or light reddish brown sandy clay loam, gravelly sandy clay loam, clay loam, or gravelly clay loam. The buried B and the C horizons are 0 to 75 percent mixed gravel and cobbles. Reaction ranges from neutral to moderately alkaline.

The C horizon is absent in some pedons. It is weakly to strongly cemented with lime in some pedons. It is white to dark brown very gravelly loamy sand to gravelly sandy clay loam.

Bucklebar series

The Bucklebar series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium derived from granitic rock. Slope is 2 to 10 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Bucklebar sandy loam in an area of Sonoita-Bucklebar complex, 2 to 10 percent slopes, about 8 miles southwest of Pima; 1,500 feet east and 1,100 feet north of the southwest corner of sec. 18, T. 7 S., R. 24 E., Graham County.

A11—0 to 1 inch; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; weak thin platy structure parting to weak fine granular; soft, very friable; common very fine roots; common very fine vesicular pores; 5 percent fine pebbles; noneffervescent; neutral; abrupt smooth boundary.

A12—1 inch to 7 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots; many very fine tubular and interstitial pores; 5 percent fine pebbles; noneffervescent; mildly alkaline; clear smooth boundary.

B21t—7 to 15 inches; reddish brown (5YR 5/4) light sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable; slightly sticky; common very fine and fine roots and few medium roots; few very fine tubular and interstitial pores; common thin clay films on faces of peds, in pores, and bridging sand grains; 5 percent fine pebbles; noneffervescent; moderately alkaline; clear smooth boundary.

B22tca—15 to 27 inches; reddish brown (5YR 4/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; common thin clay films on faces of peds, in pores, and bridging sand grains; 10 percent fine pebbles; few fine lime threads; slightly effervescent; moderately alkaline; clear wavy boundary.

C1ca—27 to 43 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, very friable; common very fine and fine roots; common very fine and fine tubular pores; 5 percent fine pebbles; few fine lime threads; slightly effervescent; moderately alkaline; clear wavy boundary.

IIB2tcab—43 to 50 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common fine tubular pores; 5 percent fine pebbles; many fine lime threads; strongly effervescent; moderately alkaline; clear wavy boundary.

IIIC2—50 to 62 inches; light yellowish brown (10YR 6/4) gravelly sand, yellowish brown (10YR 5/4) moist; single grain; slightly hard, loose; common very fine and fine roots; common very fine and fine interstitial pores; 20 percent very fine and fine pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

IIIC3—62 to 73 inches; brownish yellow (10YR 6/6) very gravelly sand, yellowish brown (10YR 5/6) moist; single grain; loose; common very fine and fine roots; common very fine and fine interstitial pores; 40 percent very fine and fine pebbles; slightly effervescent; moderately alkaline.

Thickness of the solum ranges from 24 to 30 inches. The control section averages less than 15 percent coarse fragments. Content of carbonates increases with depth.

The A horizon is light brown or brown. The buried B2t and IIC horizons are not present in all pedons.

Cabezon series

The Cabezon series consists of very shallow and shallow, well drained soils on mountains. These soils formed in colluvium derived from basalt. Slope is 9 to 70 percent. Average annual precipitation ranges from 14 to 16 inches, and average annual air temperature ranges from 55 to 59 degrees F.

Typical pedon of a Cabezon very cobbly clay in an area of Fallsam-Cabezon-Rock outcrop complex, 9 to 70 percent slopes, about 10 miles southwest of Clifton; 800 feet north and 2,000 feet west of the southeast corner of sec. 22 , T. 6 S., R. 29 E., Greenlee County.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) very cobbly clay, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to strong fine granular; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; 40 percent cobbles and 10 percent gravel; noneffervescent; slightly acid; clear smooth boundary.

B21t—2 to 9 inches; very dark grayish brown (10YR 3/2) gravelly clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; many thin clay films lining pores and on faces of peds; 15 percent mixed gravel; noneffervescent; neutral; clear smooth boundary.

B22t—9 to 14 inches; dark brown (7.5YR 3/2) gravelly clay, dark brown (7.5YR 3/2) moist; moderate medium prismatic structure parting to strong medium angular blocky; hard, firm, very sticky and very plastic; many very fine and fine roots and few medium roots; many moderately thick clay films lining pores and on faces of peds; many pressure faces; 15 percent mixed gravel; slightly effervescent; mildly alkaline; very abrupt wavy boundary.

R1ca—14 to 17 inches; brown (7.5YR 4/2) and weak red (2.5YR 7/2) fractured basalt; common moderately thick lime coatings on fragments; strongly effervescent on lime features.

R2—17 inches; brown (7.5YR 4/2) and weak red (2.5YR 4/2) basalt; noneffervescent.

Thickness of the solum and depth to bedrock range from 8 to 20 inches. The A horizon is brown, dark brown, dark grayish brown, or very dark grayish brown. The B horizon is very dark grayish brown, brown, or dark brown. It is less than 35 percent rock fragments.

Chiricahua Variant

The Chiricahua Variant consists of moderately deep, well drained soils on mountains. These soils formed in colluvium derived from granitic rock. Slope is 5 to 90 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of a Chiricahua Variant very gravelly sandy clay loam in an area of Rock outcrop-Chiricahua Variant complex, 5 to 90 percent slopes, about 4 miles north of Clifton; 400 feet west and 100 feet north of the southeast corner of sec. 6, T. 4 S., R. 30 E., Greenlee County.

A1—0 to 4 inches; brown (7.5YR 5/2) very gravelly sandy clay loam, dark brown (7.5YR 4/2) moist; moderate thin platy structure parting to weak fine granular; slightly hard, very friable, slightly plastic; many very fine roots and common fine roots; common very fine and fine interstitial and tubular pores; 35 percent fine and medium gravel; about 40 percent of the surface is covered with fine and medium gravel; slightly acid; clear wavy boundary.

B1t—4 to 7 inches; brown (7.5YR 5/2) very gravelly clay loam, dark brown (7.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; common thin clay films on faces of peds and lining pores; 35 percent fine and medium gravel; neutral; clear wavy boundary.

B21t—7 to 17 inches; strong brown (7.5YR 5/6) very gravelly clay, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and very plastic; common very fine and fine roots and few medium roots; many very fine tubular pores and common fine tubular pores; common to many thin clay films on faces of peds and lining pores; 45 percent fine and medium gravel; neutral; clear wavy boundary.

B22t—17 to 32 inches; brown (7.5YR 5/4) extremely gravelly sandy clay, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and very plastic; common very fine roots and few fine and medium roots; few very fine and fine tubular pores; common to many thin clay films on faces of peds and lining pores; 65 percent fine gravel; neutral; clear wavy boundary.

Cr—32 to 35 inches; brown (7.5YR 5/4) weathered granite.

R—35 inches; granite.

Thickness of the solum ranges from 20 to 40 inches. Depth to bedrock ranges from 30 to 50 inches. Soil reaction ranges from slightly acid to mildly alkaline. The A horizon is dark brown or brown. The B2t horizon is brown, strong brown, dark brown, or reddish brown. It is clay, sandy clay, or clay loam and is more than 35 percent coarse fragments. It is 35 to 65 percent granitic gravel.

Comoro series

The Comoro series consists of deep, well drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slope is 2 to 8 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Comoro sandy loam in an area of Comoro-Santo Tomas complex, 2 to 8 percent slopes, about 7 miles southwest of Pima; 1,400 feet east and 2,400 feet south of the northwest corner of sec. 17, T. 7 S., R. 24 E., Graham County.

A11—0 to 2 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist;

weak thin platy structure; slightly hard, very friable; common very fine and fine roots; common very fine and fine interstitial pores; 5 percent pebbles 2 to 5 millimeters in diameter; noneffervescent; mildly alkaline; abrupt smooth boundary.

A12—2 to 12 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable; many very fine and fine roots and common medium roots; many very fine and fine interstitial pores and few fine tubular pores; noneffervescent; moderately alkaline; clear wavy boundary.

C1—12 to 21 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable; many very fine and fine roots and common medium roots; many very fine interstitial pores; thin strata of loamy fine sand and loamy sand; noneffervescent; moderately alkaline; clear wavy and irregular boundary.

C2—21 to 41 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable; many very fine and fine roots and common medium roots; many very fine interstitial pores; strata of loamy fine sand and loamy sand 1 to 3 inches thick; 5 percent pebbles 2 millimeters to 1 inch in diameter; noneffervescent; moderately alkaline; clear wavy boundary.

IIC3—41 to 60 inches; light brown (7.5YR 6/4) extremely cobbly loamy sand, dark yellowish brown (10YR 4/4) moist; single grain; loose; common very fine and fine roots; many very fine and fine interstitial pores; 40 percent cobbles and 40 percent mixed pebbles; noneffervescent; moderately alkaline.

The profile is 0 to 35 percent coarse fragments. It is neutral to moderately alkaline. The A horizon is grayish brown or dark grayish brown. The C horizon is grayish brown or brown, stratified sandy loam to loamy sand. The IIC horizon is not present in all pedons.

Continental series

The Continental series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium. Slope is 2 to 15 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Continental gravelly clay loam, 2 to 15 percent slopes, about 4 miles east of Apache Grave on Bitter Creek Road; 2,000 feet west and 1,200 feet south of the northeast corner of sec. 10, T. 7 S., R. 31 E., Greenlee County.

A1—0 to 2 inches; reddish brown (5YR 5/3) gravelly clay loam, reddish brown (5YR 4/3) moist; moderate thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine and fine vesicular pores and common very fine tubular pores; 20 percent mixed gravel and a few cobbles; noneffervescent; neutral; abrupt smooth boundary.

B1t—2 to 6 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 4/4) moist; weak fine prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, very sticky and plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; common pressure faces; 5 percent very fine and fine gravel; noneffervescent; neutral; clear smooth boundary.

B21t—6 to 17 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 4/4) moist; moderate fine and medium prismatic structure parting to strong medium angular blocky; hard, friable, very sticky and plastic; many fine and very fine roots; many fine and very fine tubular and interstitial pores; many moderately thick clay films in pores and on faces of peds; many pressure faces; 5 percent fine and very fine gravel; noneffervescent; mildly alkaline; abrupt wavy boundary.

IIB22tca—17 to 34 inches; reddish brown (5YR 5/4) very gravelly clay, reddish brown (5YR 4/4) moist; common fine angular blocky structure; hard, friable, very sticky and plastic; common very fine roots and few fine roots; many very fine and fine tubular and interstitial pores; many thin clay films in pores and on faces of peds; many pressure faces; 60 percent mixed gravel; common very fine and fine pink (7.5YR 8/2) lime veins and soft lime masses; strongly effervescent; moderately alkaline; clear wavy boundary.

IIC1—34 to 45 inches; light reddish brown (5YR 6/4) very gravelly loamy sand, reddish brown (5YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many fine and very fine interstitial pores; 40 percent fine and medium gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

IIC2a—45 to 70 inches; pink (7.5YR 7/4) very cobbly loamy sand, light brown (7.5YR 6/4) moist; massive; moderately lime cemented; hard, very friable, nonsticky and nonplastic; many very fine and fine tubular and interstitial pores; 60 percent cobbles and mixed gravel; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 21 to 38 inches. Coarse fragments make up 0 to 35 percent of the solum. Commonly, 25 to 75 percent of the surface is covered with mixed gravel and a few cobbles. Reaction of the profile ranges from neutral to moderately alkaline.

The A horizon is reddish brown or light reddish brown. It is gravelly sandy clay loam, gravelly clay loam, or very gravelly sandy clay loam. The B2t horizon is reddish brown or yellowish red clay, sandy clay, gravelly clay,

very gravelly clay, or gravelly sandy clay. The Cca horizon is white, pinkish white, and pink, stratified, gravelly, very gravelly, cobbly, or very cobbly loamy sand or sandy loam that is weakly to moderately cemented with lime.

Dona Ana series

The Dona Ana series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium. Slope is 2 to 8 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Dona Ana sandy loam in an area of Continental-Dona Ana complex, 2 to 15 percent slopes, about 4 miles southwest of Pima on Mesa Road; 2,300 feet east and 1,900 feet north of the southwest corner of sec. 34, T. 6 S., R. 24 E., Graham County.

A11—0 to 2 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; moderate thin and medium platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots and common fine roots; many fine vesicular pores and common fine and very fine tubular and interstitial pores; 5 percent very fine gravel; noneffervescent; neutral; abrupt smooth boundary.

A12—2 to 10 inches; brown (7.5YR 5/4) sandy loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure that appears massive in place; slightly hard, very friable, slightly sticky and nonplastic; many very fine and fine roots; common very fine and fine tubular pores; 5 percent very fine gravel; noneffervescent; mildly alkaline; clear smooth boundary.

B21tca—10 to 16 inches; brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores, common fine tubular pores, and few fine and very fine interstitial pores; few thin clay films on faces of peds; 5 percent very fine gravel; slightly effervescent; moderately alkaline; clear smooth boundary.

B22tca—16 to 26 inches; brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; weak medium prismatic structure parting to strong medium subangular blocky; hard, friable, sticky and slightly plastic; common very fine roots and few fine roots; many very fine tubular and interstitial pores; common thin clay films on faces of peds and lining pores; 5 percent very fine gravel; many fine and very fine lime veins and common pinkish white (7.5YR 8/2) coatings on faces of peds; strongly effervescent in matrix, violently effervescent on lime segregations; moderately alkaline; clear smooth boundary.

B23tca—26 to 35 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to strong medium angular blocky; hard, firm, sticky and plastic; common very fine roots and few fine and medium roots; common very fine and fine tubular pores and few very fine interstitial pores; many thin clay films on faces of peds and lining pores; many fine and very fine lime veins and many pinkish white (7.5YR 8/2) lime coatings on faces of peds; violently effervescent; moderately alkaline; clear smooth boundary.

C1ca—35 to 41 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; 5 percent very fine gravel; common very fine and fine pinkish white (7.5YR 8/2) lime veins and common fine soft lime masses; violently effervescent; moderately alkaline; clear smooth boundary.

C2ca—41 to 60 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; very hard, firm, slightly sticky and nonplastic; few very fine roots; common fine and very fine tubular pores; 5 percent very fine gravel; many fine and medium white (N 8/0) hard and soft lime masses; violently effervescent; moderately alkaline.

The solum ranges from 17 to 38 inches in thickness. The control section averages less than 15 percent coarse fragments. Content of carbonates increases with depth. The A horizon is light brown, brown, very pale brown, pale brown, or light yellowish brown. The B horizon is brown, light brown, reddish brown, or light reddish brown sandy clay loam or light clay loam. The C horizon is very pale brown, light brown, pinkish white, pink, or white. It is sandy clay loam, clay loam, or loam.

Eba series

The Eba series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium. Slope is 2 to 40 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of an Eba extremely cobbly sandy clay loam in an area of Eba-Pinaleno complex, 2 to 40 percent slopes, about 9 miles southwest of Pima; 800 feet south and 2,400 feet west of the northeast corner of sec. 14, T. 7 S., R. 23 E., Graham County.

A1—0 to 2 inches; brown (7.5YR 5/4) extremely cobbly sandy clay loam, brown (7.5YR 4/4) moist; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine vesicular pores and

common very fine and fine tubular pores; 45 percent cobbles and 20 percent gravel; about 65 percent of the surface is covered with cobbles and gravel; slightly effervescent; moderately alkaline; abrupt smooth boundary.

B1t—2 to 6 inches; brown (7.5YR 5/4) extremely cobbly clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores; few thin clay films lining pores and on faces of peds; 35 percent gravel and 30 percent cobbles; very slightly effervescent; moderately alkaline; clear wavy boundary.

B21tca—6 to 17 inches; reddish brown (5YR 5/4) very cobbly sandy clay, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, very sticky and plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores; common thin clay films lining pores and on faces of peds; 30 percent cobbles and 25 percent gravel; common fine pinkish white (7.5YR 8/2) lime veins and soft lime masses; violently effervescent; moderately alkaline; clear wavy boundary.

B22tca—17 to 27 inches; reddish brown (5YR 5/4) very gravelly sandy clay, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, very sticky and plastic; common very fine roots and few fine roots; common very fine and fine tubular and interstitial pores; common thin clay films lining pores and on faces of peds; 40 percent gravel and 5 percent cobbles; common fine pinkish white (7.5YR 8/2) lime veins and soft lime masses; strongly effervescent; moderately alkaline; clear wavy boundary.

B3tca—27 to 32 inches; brown (7.5YR 5/4) very gravelly heavy sandy clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots and few fine roots; common very fine and fine tubular and interstitial pores; very few thin clay films lining pores; 40 percent gravel and 5 percent cobbles; common medium pinkish white (7.5YR 8/2) lime masses and fine lime veins; violently effervescent; moderately alkaline; abrupt wavy boundary.

C1ca—32 to 48 inches; pinkish white (7.5YR 8/2) extremely gravelly sandy clay loam, pink (7.5YR 7/4) moist; massive; very weakly cemented with lime; hard, friable, sticky and slightly plastic; few very fine roots; common very fine and fine tubular pores; 50 percent gravel and 15 percent cobbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—48 to 60 inches; pink (7.5YR 8/4) very cobbly loamy sand, pink (7.5YR 7/4) moist; massive; strongly cemented with lime; very hard, firm, nonsticky and nonplastic; 30 percent cobbles and 25 percent gravel; violently effervescent; moderately alkaline.

Thickness of the solum ranges from 20 to 48 inches. The control section averages more than 35 percent coarse fragments. The profile is mildly alkaline to moderately alkaline in the A horizon and the upper part of the B horizon and moderately alkaline to strongly alkaline in the lower part of the subsoil and in the substratum.

The A horizon is brown, light brown, or yellowish brown. The B horizon is reddish brown, brown, or yellowish red. It is clay loam, sandy clay, or heavy sandy clay loam and is more than 35 percent coarse fragments. A distinct zone of lime accumulation is in the lower part of the B horizon. The C horizon is pink, pinkish white, light brown, pale brown, or brown. It ranges from loamy sand to sandy clay loam and is more than 35 percent coarse fragments. It is weakly to strongly cemented with lime in some pedons.

Eloma series

The Eloma series consists of deep, well drained soils on hillsides. These soils formed in colluvium and alluvium derived from granite and gneiss. Slope is 10 to 70 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of an Eloma very cobbly loam in an area of Eloma-Alsco complex, 15 to 70 percent slopes, about 13 miles southwest of Pima along Tripp Canyon Road; 2,300 feet east and 2,200 feet south of the northwest corner of sec. 18, T. 7 S., R. 23 E., Graham County.

A1—0 to 2 inches; brown (10YR 4/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; 40 percent cobbles and 20 percent gravel; slightly acid; abrupt smooth boundary.

B1t—2 to 5 inches; dark brown (7.5YR 4/4) very cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores; common thin clay films on faces of peds; 40 percent cobbles and 20 percent gravel; neutral; clear smooth boundary.

B21t—5 to 9 inches; dark reddish brown (5YR 3/4) very gravelly clay, dark reddish brown (5YR 3/4) moist; strong fine and medium subangular blocky structure; slightly hard, friable, very sticky and very plastic; many very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores; common

thin clay films on faces of peds; 40 percent gravel and 20 percent cobbles; neutral; clear wavy boundary.

B22t—9 to 22 inches; dark reddish brown (2.5YR 3/4) extremely cobbly clay, dark reddish brown (2.5YR 3/4) moist; strong medium angular blocky structue; hard, friable, very sticky and very plastic; many very fine and fine roots and common medium roots; common thin clay films in pores and on faces of peds; 45 percent cobbles and 25 percent gravel; neutral; clear wavy boundary.

B23t—22 to 34 inches; reddish brown (2.5YR 4/4) extremely cobbly clay, reddish brown (2.5YR 4/4) moist; strong medium angular blocky structure; hard, friable, very sticky and very plastic; many very fine and fine roots; many very fine and fine tubular pores; many moderately thick clay films in pores and on faces of peds; 45 percent cobbles and 25 percent gravel; mildly alkaline; clear wavy boundary.

B3t—34 to 45 inches; reddish brown (5YR 5/4) extremely cobbly sandy clay, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, very sticky and plastic; common very fine roots; many very fine interstitial pores and common fine tubular pores; common thin clay films in pores and on faces of peds; 45 percent cobbles and 30 percent gravel; mildly alkaline; abrupt wavy boundary.

C—45 to 60 inches; light brown (7.5YR 6/5) extremely cobbly sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; 50 percent cobbles and 30 percent gravel; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The control section averages more than 35 percent coarse fragments, dominantly cobbles.

The A horizon is brown, grayish brown, or yellowish brown. The B2t horizon is dark brown, reddish brown, or dark reddish brown. It is heavy clay loam, clay, or sandy clay that is more than 35 percent coarse fragments. The C horizon is pink, light brown, pale brown, or brown. It is sandy loam or loam that is more than 35 percent coarse fragments.

Fallsam series

The Fallsam series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from volcanic rock. Slope is 9 to 40 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 55 to 59 degrees F.

Typical pedon of a Fallsam extremely cobbly silty clay loam in an area of Fallsam-Cabezon-Rock outcrop complex, 9 to 70 percent slopes, about 8 miles southwest of Three Way; 2,300 feet west and 1,650 feet south of the northeast corner of sec. 23, T. 6 S., R. 29 E., Greenlee County.

A1—0 to 2 inches; brown (7.5YR 5/2) extremely cobbly silty clay loam, dark brown (7.5YR 3/2) moist; moderate thin platy structure parting to moderate fine and very fine granular; slightly hard, friable, very sticky and plastic; many very fine and fine roots; many very fine and common fine interstitial pores and common very fine tubular pores; 75 percent cobbles and mixed gravel; noneffervescent; slightly acid; clear wavy boundary.

B21t—2 to 12 inches; brown (7.5YR 4/2) very gravelly clay, dark brown (7.5YR 3/2) moist; strong fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; many very fine and fine roots and common medium roots; many very fine and common fine interstitial pores and few very fine tubular pores; common thin clay films on faces of peds and lining pores; 40 percent gravel; noneffervescent; neutral; clear wavy boundary.

B22t—12 to 33 inches; brown (7.5YR 5/2) extremely cobbly clay, dark brown (7.5YR 3/2) moist; strong medium and fine subangular blocky structure; hard, firm, very sticky and very plastic; many very fine and fine roots and common medium roots; many very fine and common fine interstitial pores and few very fine tubular pores; common thin clay films on faces of peds and lining pores; 75 percent cobbles and mixed gravel; noneffervescent; moderately alkaline; gradual wavy boundary.

B23tca—33 to 47 inches; brown (7.5YR 5/2) extremely cobbly clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, very sticky and very plastic; many fine and very fine roots; many fine and very fine interstitial pores and common fine and medium tubular pores; common thin clay films on faces of peds and lining pores; 75 percent lime-coated cobbles and mixed gravel; few fine white (N 8/0) and pinkish white (7.5YR 8/2) lime veins; noneffervescent in matrix, but effervescent on lime segregations; moderately alkaline; gradual wavy boundary.

B24tca—47 to 60 inches; brown (7.5YR 5/2) extremely cobbly clay, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, very friable, very sticky and very plastic; many fine and very fine roots; many fine and very fine interstitial pores and few medium tubular pores; few thin clay films on faces of peds and lining pores; 75 percent lime-coated cobbles and gravel; few fine white (N 8/0) and pinkish white (7.5YR 8/2) lime veins; noneffervescent in matrix, but effervescent on lime segregations; moderately alkaline.

Thickness of the solum and depth to bedrock range from approximately 45 inches to more than 60 inches. The solum is 35 to 85 percent coarse fragments.

The A horizon is brown, dark brown, or very dark grayish brown. The B horizon is brown, dark brown, or very dark grayish brown extremely cobbly clay, very cobbly clay, very cobbly silty clay, or very gravelly clay.

Gila series

The Gila series consists of deep, well drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slope is 0 to 5 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Gila fine sandy loam, 0 to 2 percent slopes, about 2 miles southeast of Duncan; 2,640 feet north of the southeast corner of sec. 33, T. 8 S., R. 32 E., Greenlee County.

A11—0 to 4 inches; light yellowish brown (10YR 6/4) fine sandy loam, brown (10YR 4/3) moist; moderate thin and medium platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; common fine and very fine tubular pores; slightly effervescent; moderately alkaline; abrupt wavy boundary.

A12—4 to 7 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots and few medium roots; few fine and very fine tubular pores and few fine and very fine interstitial pores; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C1—7 to 12 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and very few medium roots; common very fine and fine tubular pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—12 to 19 inches; brown (10YR 5/3) light loam, dark brown (10YR 3/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C3—19 to 60 inches; pale brown highly stratified (10YR 6/3) loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium and coarse roots; many fine and very fine tubular pores; slightly effervescent; moderately alkaline.

The profile is more than 60 inches thick. It is 0 to 35 percent coarse fragments and is neutral to strongly alkaline.

The A horizon is light yellowish brown, brown, or grayish brown. It is fine sandy loam or loam. The C horizon is brown, light brown, or pale brown. It is very fine sandy loam or loam and has numerous thin strata of coarser and finer textured material.

Glendale series

The Glendale series consists of deep, well drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slope is 0 to 5 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Glendale silty clay loam, 0 to 2 percent slopes, 1,850 feet west and 2,400 feet south of the northwest corner of sec. 3, T. 9 S., R. 32 E., Greenlee County.

Ap—0 to 10 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable, sticky and slightly plastic; many very fine and fine roots and few medium roots; common very fine and fine interstitial and tubular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1—10 to 19 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; many very fine and fine roots and few medium roots; common very fine and fine tubular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—19 to 32 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular pores and few medium tubular pores; common fine and medium lime threads; few to common very thin strata of very pale brown (10YR 8/3) silt loam and loam; strongly effervescent; moderately alkaline; gradual smooth broundary.

C3—32 to 41 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable, sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular pores and few medium tubular pores; few fine soft lime masses and threads; few to common very thin strata of very pale brown (10YR 8/3) silt loam and loam; strongly effervescent; moderately alkaline; clear smooth boundary.

C4—41 to 50 inches; pink (7.5YR 7/4) silty clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable, sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores and few medium tubular pores; few fine soft lime masses and threads; few to common very thin strata of very pale brown (10YR 8/3) silt loam and loam; strongly effervescent; moderately alkaline; gradual smooth boundary.

C5—50 to 63 inches; pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) moist; massive; slightly hard, very friable, very sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores and few medium tubular pores; few fine soft lime masses and threads; few to common very thin strata of very pale brown (10YR 8/3) silt loam and loam; strongly effervescent; moderately alkaline.

The profile is less than 15 percent coarse fragments. It is mildly alkaline to strongly alkaline. The A horizon is light brown, brown, or light yellowish brown. The C horizon is light brown, light yellowish brown, or pink. The C5 horizon is absent in some pedons.

Graham series

The Graham series consists of very shallow and shallow, well drained soils on mountains. These soils formed in colluvium derived from volcanic rock. Slope is 9 to 60 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of a Graham extremely cobbly silty clay loam in an area of Limpia-Graham-Rock outcrop complex, 9 to 50 percent slopes, about 1.5 miles southeast of Lone Star Mountain; 2,540 feet west and 300 feet north of the southeast corner of sec. 4, T. 6 S., R. 27 E., Graham County.

A1—0 to 1 inch; reddish brown (5YR 5/3) extremely cobbly silty clay loam, dark reddish brown (5YR 3/3) moist; weak thin platy structure parting to weak fine granular; slightly hard, friable, sticky and very plastic; common very fine roots and few fine roots; common very fine vesicular and interstitial pores; 50 percent basalt cobbles, 20 percent stones, and 15 percent pebbles; noneffervescent; neutral; abrupt smooth boundary.

B21t—1 inch to 3 inches; dark reddish gray (5YR 4/2) silty clay, dark reddish brown (5YR 3/2) moist; weak fine subangular blocky structure; very hard, firm, sticky and very plastic; many very fine and fine roots and common medium roots; common very fine and fine tubular pores; common pressure faces; 15 percent basalt pebbles; noneffervescent; mildly alkaline; clear smooth boundary.

B22t—3 to 6 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; very hard, firm, sticky and very plastic; common very fine and fine roots; many very fine and fine tubular pores; many pressure faces; 15 percent basalt cobbles and pebbles; noneffervescent; mildly alkaline; gradual smooth boundary.

B23t—6 to 16 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; strong medium prismatic structure parting to strong fine and medium subangular blocky; very hard, firm, sticky and very plastic; common very fine and fine roots; many very fine and fine tubular pores; many pressure faces; 5 percent basalt cobbles and pebbles; few slickensides tilted 20 to 25 degrees from the horizontal; common thin cracks 1/8 to 1/2 inch wide extend through the horizon; noneffervescent; mildly alkaline; abrupt wavy boundary.

R—16 inches; reddish gray (5YR 5/2) basalt.

Thickness of the solum and depth to bedrock range from 8 to 20 inches. The control section is less than 35 percent coarse fragments. The profile ranges from neutral to moderately alkaline throughout. The A horizon is brown or reddish brown. It is extremely cobbly silty clay loam or very cobbly clay loam. The B horizon is dark reddish gray, reddish brown, or dark reddish brown.

Guest series

The Guest series consists of deep, well drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slope is 0 to 5 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Guest silty clay, 0 to 2 percent slopes, about 2 miles south of Duncan, just east of Arizona Highway 70; 1,700 feet east and 1,200 feet south of the northwest corner of sec. 32, T. 9 S., R. 32 E., Greenlee County.

Ap—0 to 9 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; massive; hard, firm, very sticky and very plastic; many very fine and fine roots and few medium roots; many very fine and fine interstitial and tubular pores; cracks 1 inch to 1 1/2 inches wide extend to bottom of horizon; slightly effervescent; moderately alkaline; clear smooth boundary.

A11—9 to 26 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular pores; few to common very thin strata and pockets of very pale brown (10YR 8/3) silt and silt loam; cracks 1 inch to 1 1/2 inches wide extend to bottom of horizon; slightly effervescent; moderately alkaline; clear smooth boundary.

A12—26 to 44 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine roots and common fine roots; common very fine and fine tubular pores; few very fine and fine irregularly shaped soft lime masses; common very thin strata and pockets of very pale brown (10YR 8/3) silt and

silt loam; cracks 1 inch to 1 1/2 inches wide extend to a depth of 36 inches; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—44 to 54 inches; brown (10YR 5/3) clay, dark brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common very fine roots and few fine roots; common very fine and fine tubular pores; few very fine and fine irregularly shaped soft lime masses; common very thin strata and pockets of very pale brown (10YR 8/3) silt and silt loam; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—54 to 63 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium to coarse platy structure; hard, friable, very sticky and plastic; few very fine roots; common very fine and fine interstitial and tubular pores; few very fine and fine irregularly shaped soft lime masses; few to common very thin strata of very pale brown (10YR 8/3) silt and silt loam; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—63 to 72 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; hard, friable, very sticky and plastic; few very fine and fine tubular pores; strongly effervescent; moderately alkaline.

The profile is 0 to 35 percent coarse fragments. It is neutral to strongly alkaline. The A horizon is grayish brown, dark grayish brown, or brown silty clay or clay. The C horizon is grayish brown, dark grayish brown, or brown clay or silty clay.

Hantz series

The Hantz series consists of deep, well drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slope is 0 to 5 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Hantz silty clay, 0 to 2 percent slopes, 1,000 feet east and 2,200 feet north of the southwest corner of sec. 3, T. 9 S., R. 32 E., Greenlee County.

Ap—0 to 11 inches; light brown (7.5YR 6/4) silty clay, brown (7.5YR 4/4) moist; massive; hard, firm, very sticky and very plastic; common very fine and fine roots; many very fine and few fine interstitial and tubular pores; few fine pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—11 to 26 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine and fine tubular pores; common fine and medium lime threads; few fine pebbles; few to common thin strata of very pale brown (10YR 8/3) silt, silt loam, and loam; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—26 to 39 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine and fine tubular pores; few fine lime threads; few fine pebbles; few to common thin strata of very pale brown (10YR 8/3) silt, silt loam, loam, and very fine sandy loam; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—39 to 46 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; massive; very hard, firm, very sticky and very plastic; common very fine roots and few fine roots; common very fine and fine tubular pores; few very fine soft lime masses and threads; few fine pebbles; few to common thin strata of very pale brown (10YR 8/3) silt, silt loam, loam, and very fine sandy loam; strongly effervescent; moderately alkaline; clear smooth boundary.

C4—46 to 58 inches; pinkish gray (7.5YR 6/2) silty clay, brown (7.5YR 5/2) moist; massive; very hard, firm, very sticky and very plastic; few very fine roots; common very fine and fine tubular pores; very few fine soft lime masses; few to common thin strata of very pale brown (10YR 8/3) silt, silt loam, loam, and very fine sandy loam; strongly effervescent; strongly alkaline; clear smooth boundary.

C5—58 to 67 inches; pinkish gray (7.5YR 6/2) silty clay, brown (7.5YR 5/2) moist; massive; very hard, friable, very sticky and very plastic; few very fine roots; common very fine and fine tubular pores; few fine and medium soft lime masses and threads; few to common thin strata of very pale brown (10YR 8/3) silt, silt loam, loam, and very fine sandy loam; strongly effervescent; strongly alkaline.

The profile is less than 15 percent coarse fragments. It is mildly alkaline to strongly alkaline throughout. The A horizon is light brown, pale brown, or brown.

Hap series

The Hap series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium derived dominantly from granitic rock. Slope is 2 to 15 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Hap gravelly sandy loam, 2 to 8 percent slopes, about 10 miles west of Pima; 1,300 feet west and 1,400 feet south of the northeast corner of sec. 17, T. 6 S., R. 23 E., Graham County.

A1—0 to 2 inches; brown (7.5YR 5/4) gravelly sandy loam, dark brown (7.5YR 4/4) moist; moderate medium platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine vesicular pores and common very fine tubular pores; 15 percent fine gravel; about 35 percent of the surface is covered with fine gravel; neutral; abrupt smooth boundary.

B21t—2 to 10 inches; reddish brown (5YR 5/4) gravelly sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine tubular and interstitial pores; few thin clay films in pores and on faces of peds; 20 percent fine and very fine gravel; neutral; clear smooth boundary.

B22t—10 to 16 inches; reddish brown (5YR 5/4) gravelly sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine roots and common fine roots; common very fine and fine tubular and interstitial pores; few thin clay films in pores and on faces of peds; 30 percent fine and very fine gravel; mildly alkaline; clear wavy boundary.

B23tca—16 to 29 inches; light reddish brown (5YR 6/4) gravelly sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; 20 percent fine and very fine gravel; common fine lime veins and few soft lime masses: noneffervescent in matrix but strongly effervescent on lime segregations; moderately alkaline; clear wavy boundary.

B3tca—29 to 37 inches; light brown (7.5YR 6/4) gravelly light sandy clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots and few fine and medium roots; many very fine and common fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; 35 percent fine and very fine gravel; common fine soft lime masses and veins; strongly effervescent; violently effervescent on lime segregations; moderately alkaline; clear wavy boundary.

C1ca—37 to 52 inches; light brown (7.5YR 6/4) gravelly sandy loam, brown (7.5YR 4/4) moist; single grain; loose, nonsticky and nonplastic; common fine and very fine roots; many fine interstitial pores; 30 percent fine gravel; common lime coatings on gravel; few fine and medium lime concretions; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—52 to 55 inches; pinkish white (7.5YR 8/2) gravelly sandy loam, pink (7.5YR 7/4) moist; massive; extremely hard, firm, nonsticky and nonplastic; common fine tubular pores; 15 percent fine gravel; strongly cemented with lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

C3ca—55 to 63 inches; light brown (7.5YR 6/4) gravelly loamy sand, brown (7.5YR 4/4) moist; single grain; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine tubular pores; 25 percent fine and very fine gravel; slightly effervescent; moderately alkaline.

The solum ranges from 20 to 50 inches in thickness. The calcic horizon is at a depth of 20 to 40 inches. The control section averages 15 to 35 percent fine gravel. The profile is neutral to mildly alkaline in the A horizon and the upper part of the B horizon and is moderately alkaline to strongly alkaline in the lower part of the B horizon and in the C horizon. The C horizon is light brown, brown, pinkish white, or pink. It is gravelly sandy loam, gravelly loamy sand, or gravelly loam.

Lampshire series

The Lampshire series consists of very shallow and shallow, well drained soils on mountains. These soils formed in colluvium derived from schist and granitic rock. Slope is 20 to 90 percent. Average annual precipitation ranges from 12 to 16 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of a Lampshire extremely cobbly sandy loam in an area of Rock outcrop-Lampshire complex, 20 to 90 percent slopes, about 14 miles southwest of Ft. Thomas; 1,100 feet west and 1,500 feet south of the northeast corner of sec. 19, T. 6 S., R. 22 E., Graham County.

A11—0 to 1 inch; grayish brown (10YR 5/2) extremely cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots and common fine roots; many very fine and fine interstitial pores; 30 percent angular gravel and 30 percent cobbles; about 55 percent of the surface is covered with cobbles, gravel, and a few stones; mildly alkaline; clear smooth boundary.

A12—1 inch to 11 inches; grayish brown (10YR 5/2) extremely gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots and common fine roots; many very fine and fine interstitial pores; 65 percent angular gravel and a few cobbles; mildly alkaline; abrupt wavy boundary.

R—11 inches; varicolored schist.

Bedrock is at a depth of 4 to 20 inches. The control section averages 35 to 80 percent rock fragments. The

profile is slightly acid to mildly alkaline. The A horizon is grayish brown, brown, or dark grayish brown and is more than 35 percent rock fragments.

Lehmans series

The Lehmans series consists of very shallow and shallow, well drained soils on foothills. These soils formed in colluvium derived from volcanic rock. Slope is 9 to 60 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Lehmans extremely gravelly clay loam in an area of Akela-Lehmans-Rock outcrop complex, 9 to 60 percent slopes, about 11 miles north of Pima; 1,200 feet north and 100 feet west of the southeast corner of sec. 26, T. 4 S., R. 24 E., Graham County.

A1—0 to 1 inch; reddish brown (5YR 5/4) extremely gravelly clay loam, reddish brown (5YR 4/4) moist; weak thin platy structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine interstitial pores; 60 percent mixed gravel and 5 percent cobbles; about 50 to 75 percent of the surface is covered with gravel and cobbles; neutral; abrupt smooth boundary.

B21t—1 inch to 4 inches; reddish brown (5YR 5/4) gravelly clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, friable, very sticky and plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores; common thin clay films on faces of peds and lining pores; 20 percent mixed gravel; mildly alkaline; clear smooth boundary.

B22t—4 to 12 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 4/4) moist; strong medium prismatic structure parting to strong medium subangular blocky; hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine tubular and interstitial pores; many moderately thick clay films on faces of peds and lining pores; 5 percent fine gravel; moderately alkaline; very abrupt smooth boundary.

R—12 inches; purplish black basalt, partially weathered in upper 4 to 6 inches.

Depth to bedrock and thickness of the solum range from 9 to 20 inches. The control section averages less than 35 percent rock fragments. The A horizon is reddish brown, brown, light brown, or light reddish brown. The B horizon is reddish brown or yellowish red.

Limpia series

The Limpia series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from volcanic rock. Slope is 9 to 50 percent. Average annual precipitation ranges from 12 to 16 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of a Limpia extremely cobbly clay loam in an area of Limpia-Graham-Rock outcrop complex, 9 to 50 percent slopes, about 0.5 mile east of U.S. Highway 66 and about 5 miles south of Three Way; 1,300 feet west and 975 feet south of the northeast corner of sec. 27, T. 6 S., R. 30 E., Greenlee County.

A1—0 to 2 inches; brown (7.5YR 5/2) extremely cobbly clay loam, dark brown (7.5YR 4/2) moist; weak thin platy structure parting to moderate very fine granular; slightly hard, friable, sticky and slightly plastic, many very fine and fine roots; many very fine and fine interstitial pores and common very fine tubular pores; 65 percent cobbles and mixed gravel; about 70 percent of the surface is covered with cobbles and a few stones; noneffervescent; moderately alkaline; abrupt smooth boundary.

B21t—2 to 15 inches; brown (7.5YR 4/2) very gravelly clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and very plastic; many very fine and fine roots; many very fine and common fine interstitial pores and very few very fine tubular pores; common thin clay films on faces of peds and lining pores; 45 percent mixed gravel and a few cobbles; noneffervescent; moderately alkaline; clear wavy boundary.

B22t—15 to 20 inches; brown (7.5YR 4/2) very gravelly clay, dark brown (7.5YR 3/2) moist; strong coarse and medium angular blocky structure; hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine interstitial and tubular pores; many thin clay films on faces of peds and lining pores; 45 percent mixed gravel and a few cobbles; noneffervescent; moderately alkaline; clear wavy boundary.

B23t—20 to 25 inches; dark reddish gray (5YR 4/2) very gravelly clay, dark reddish brown (5YR 3/2) moist; moderate medium and coarse prismatic structure parting to strong fine angular blocky; hard, firm, sticky and plastic; common very fine roots; many fine and very fine interstitial pores and few very fine tubular pores; many thin clay films on faces of peds and lining pores; common pressure faces and few slickensides; 35 percent mixed gravel; noneffervescent; moderately alkaline; clear wavy boundary.

B24t—25 to 35 inches; brown (7.5YR 5/4) very cobbly clay, dark brown (5YR 3/2) moist; moderate medium prismatic structure parting to strong fine and medium blocky; hard, firm, very sticky and very plastic; few very fine roots; common very fine and few fine interstitial pores and few very fine tubular pores; many thin clay films on faces of peds and

lining pores; common pressure faces; 35 percent cobbles and gravel; noneffervescent; neutral; clear wavy boundary.

B25tca—35 to 40 inches; reddish brown (5YR 5/3) extremely gravelly clay, dark reddish brown (5YR 3/2) moist; moderate medium prismatic structure parting to strong fine and medium blocky; hard, firm, very sticky and very plastic; few very fine roots; common very fine and few fine interstitial pores and few very fine tubular pores; many thin clay films on faces of peds and lining pores; common pressure faces and few slickensides; 65 percent lime-coated cobbles and gravel; few fine lime veins and few medium soft pinkish white (5YR 8/2) lime masses; slightly effervescent; moderately alkaline; clear wavy boundary.

B26tca—40 to 60 inches; reddish brown (5YR 5/3) extremely gravelly clay, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to strong medium blocky; hard, firm, very sticky and very plastic; very few very fine roots; many very fine and few fine interstitial pores; many thin clay films on faces of peds and lining pores; common pressure faces and few slickensides; 65 percent cobbles and gravel; many medium lime masses; violently effervescent; moderately alkaline.

The profile is 35 to 65 percent coarse fragments. It is neutral to moderately alkaline throughout. The A1 horizon is reddish brown or brown. The B2t horizon is dark reddish gray, reddish gray, brown, or reddish brown.

Luzena series

The Luzena series consists of very shallow and shallow, well drained soils on mountains. These soils formed in colluvium derived from volcanic rock. Slope is 20 to 90 percent. Average annual precipitation ranges from 14 to 16 inches, and average annual air temperature ranges from 55 to 59 degrees F.

Typical pedon of a Luzena very gravelly clay in an area of Rock outcrop-Luzena complex, 20 to 90 percent slopes, about 5 miles north of Morenci; 800 feet east and 1,100 feet south of the northwest corner of sec. 28, T. 3 S., R. 29 E., Greenlee County.

A1—0 to 1 inch; dark reddish gray (5YR 4/2) very gravelly clay, dark reddish brown (5YR 3/2) moist; weak thin platy structure; slightly hard, friable, sticky and plastic; common very fine roots and few fine roots; many very fine and fine tubular and interstitial pores; approximately 40 percent pebbles and 10 percent cobbles; about 50 percent of the surface is covered with gravel and cobbles; medium acid; clear smooth boundary.

B2t—1 inch to 8 inches; dark reddish brown (5YR 3/2) gravelly clay, dark reddish brown (5YR 2/2) moist; moderate medium blocky structure; hard, firm, very sticky and very plastic; common very fine and fine roots and few medium roots; few very fine and fine tubular pores; many thin clay films on faces of peds and lining pores; approximately 20 percent fine pebbles; noneffervescent; neutral; abrupt irregular boundary.

R1—8 to 10 inches; pinkish gray (7.5YR 6/1) slightly weathered andesite, brown (7.5YR 5/1) moist; abrupt irregular boundary.

R2—10 inches; pinkish gray (7.5YR 6/1) andesite, brown (7.5YR 5/1) moist.

Thickness of the solum and depth to bedrock range from 6 to 20 inches. The solum is medium acid to mildly alkaline. The A horizon is dark reddish gray or dark reddish brown. The B horizon is clay or gravelly clay. It is less than 35 percent coarse fragments.

Maloy series

The Maloy series consists of deep, well drained soils on fan terraces. These soils formed in alluvium derived from granite and gneiss. Slope is 2 to 15 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Maloy extremely stony sandy loam, 2 to 15 percent slopes, about 8 miles southwest of Pima; 2,000 feet south and 2,200 feet east of the northwest corner of sec. 19, T. 7 S., R. 24 E., Graham County.

A1—0 to 2 inches; brown (7.5YR 5/4) extremely stony sandy loam, dark reddish brown (5YR 3/4) moist; weak thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine vesicular pores; 40 percent cobbles, 25 percent stones, and 20 percent gravel; about 90 percent of the surface is covered with stones and cobbles; slightly acid; clear smooth boundary.

B21t—2 to 8 inches; reddish brown (5YR 4/4) extremely cobbly sandy clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine interstitial and tubular pores; few thin clay films on faces of peds, in pores, and bridging sand grains; 45 percent cobbles, 5 percent stones, and 30 percent gravel; slightly acid; clear smooth boundary.

B22t—8 to 20 inches; reddish brown (5YR 4/4) extremely cobbly sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine interstitial and tubular pores and few medium tubular pores; 35 percent cobbles, 5

percent stones, and 30 percent gravel; slightly acid; clear wavy boundary.

B3t—20 to 38 inches; yellowish red (5YR 5/6) extremely cobbly sandy clay loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; few thin clay films on faces of peds and in pores; 40 percent cobbles, 5 percent stones, and 30 percent gravel; noneffervescent; neutral; clear wavy boundary.

Cca—38 to 60 inches; light brown (7.5YR 6/4) extremely cobbly sandy loam, strong brown (7.5YR 4/6) moist; massive; slightly hard, very friable; few very fine and fine roots; many very fine and fine interstitial pores; 50 percent cobbles, 25 percent pebbles, and 5 percent stones; few thin lime coatings on gravel; noneffervescent; mildly alkaline.

The solum ranges from 25 to 40 inches in thickness. The A horizon is brown or dark brown and is more than 35 percent coarse fragments, mainly stones and cobbles. The B horizon is reddish brown, yellowish red, or red. It is more than 35 percent coarse fragments, mainly stones and cobbles. The C horizon is light brown, brown, yellowish brown, or light yellowish brown. It is sandy loam or loam and is more than 35 percent coarse fragments, mainly cobbles.

Mokiak series

The Mokiak series consists of moderately deep, well drained soils on mountains. These soils formed in colluvium derived from granitic rock. Slope is 20 to 40 percent. Average annual precipitation ranges from 14 to 18 inches, and average annual air temperature ranges from 55 to 59 degrees F.

Typical pedon of a Mokiak very gravelly sandy loam in an area of Rock outcrop-Mokiak complex, 20 to 90 percent slopes, east of Copper King Mountain, 3.5 miles north of Morenci; 2,100 feet west and 600 feet south of the northwest corner of sec. 1, T. 29 E., R. 4 S., Greenlee County.

A11—0 to 1 inch; brown (7.5YR 4/2) very gravelly sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, nonsticky and nonplastic; many very fine and fine interstitial pores; 60 percent fine and very fine angular gravel; about 65 percent of the surface is covered with fine gravel; strongly acid; abrupt smooth boundary.

A12—1 inch to 4 inches; reddish brown (5YR 4/3) very gravelly coarse sandy loam, dark reddish brown (5YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few very fine roots; common very fine and fine tubular and interstitial pores; 45 percent fine and very fine angular gravel; strongly acid; abrupt smooth boundary.

B21t—4 to 10 inches; reddish brown (5YR 5/3) very gravelly sandy clay loam, dark reddish brown (5YR 3/3) moist; weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine roots and common fine and medium roots; many very fine and fine tubular and interstitial pores; few thin clay films in pores and on faces of peds; 40 percent fine and very fine angular gravel; strongly acid; clear wavy boundary.

B22t—10 to 21 inches; light brown (7.5YR 6/4) very gravelly sandy clay loam, brown (7.5YR 4/4) moist; weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine and medium roots; common very fine and fine tubular and interstitial pores; very few thin clay films in pores and on faces of peds; 40 percent fine and very fine angular gravel; strongly acid; gradual wavy boundary.

Cr—21 to 50 inches; highly weathered granite; massive but easily crushed by hand to fine gravel- and sand-sized particles; very few fine and very fine roots; very few very fine interstitial pores; common thin and moderately thick reddish brown (5YR 5/4) clay films on rock faces; abrupt irregular boundary.

R—50 inches; granite.

Thickness of the solum ranges from 13 to 22 inches. Depth to soft bedrock is 20 to 40 inches, and depth to hard bedrock is 45 to 60 inches. The solum is 35 to 50 percent coarse fragments. It is neutral to strongly acid. The A1 horizon is brown, dark grayish brown, reddish brown, or dark brown. The B2t horizon is reddish brown, light brown, brown, or reddish gray. It is very gravelly clay loam or very gravelly sandy clay loam.

Nickel series

The Nickel series consists of deep, well drained soils on hillsides. These soils formed in mixed colluvium and alluvium. Slope is 15 to 45 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Nickel extremely cobbly sandy loam in an area of Tres Hermanos-Continental-Nickel complex, 2 to 45 percent slopes, 1 mile northeast of Guthrie, 1,300 feet south and 2,300 feet west of the northeast corner of sec. 34, T. 5 S., R. 30 E., Greenlee County.

A1—0 to 2 inches; pinkish gray (7.5YR 6/2) extremely cobbly sandy loam, brown (7.5YR 4/4) moist; moderate thin and medium platy structure; slightly hard, very friable; many very fine roots and common fine roots; many very fine interstitial and vesicular pores and common very fine tubular pores; 75 percent cobbles and gravel; about 30 to 80 percent

of the surface is covered with cobbles and gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C1ca—2 to 8 inches; pinkish gray (7.5YR 6/2) extremely gravelly sandy loam, brown (7.5YR 4/4) moist; weak very fine granular structure appearing massive in place; slightly hard, very friable; many very fine roots and common fine roots; many very fine interstitial and tubular pores; 65 percent lime-coated gravel and cobbles; few medium white (N 8/0) and pinkish white (7.5YR 8/2) soft lime masses; strongly effervescent; moderately alkaline; clear wavy boundary.

C2ca—8 to 22 inches; pink (7.5YR 8/4) extremely gravelly coarse sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable; many very fine roots and common fine roots; many very fine interstitial and tubular pores; 65 percent lime-coated cobbles and gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

C3ca—22 to 44 inches; white (N 8/0) extremely gravelly sandy loam, very pale brown (10YR 7/3) moist; massive; weakly cemented; hard, firm; few very fine roots; common very fine vesicular pores; 75 percent lime-coated gravel and cobbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

C4—44 to 60 inches; reddish brown (5YR 4/4) gravelly loamy sand, dark reddish brown (5YR 3/4) moist; single grain; loose; few very fine roots; many very fine and fine interstitial pores; 25 percent lime-coated fine gravel; violently effervescent; moderately alkaline.

The profile is 35 to 85 percent coarse fragments. It ranges from mildly alkaline to strongly alkaline. The A1 horizon is pinkish gray, brown, light brown, light brownish gray, or pale brown. The C horizon is pink, pinkish gray, white, light brown, very pale brown, light gray, pale brown, or reddish brown.

Peloncillo series

The Peloncillo series consists of very shallow and shallow, well drained soils on fan terraces. These soils formed in alluvium derived from volcanic rock. Slope is 2 to 30 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Peloncillo extremely cobbly sandy clay loam, 2 to 10 percent slopes, about 18 miles east of Safford near old Safford road, just south of the Black Hills; 1,000 feet north of the southwest corner of sec. 32, T. 6 S., R. 29 E., Graham County.

A1—0 to 1 inch; very pale brown (10YR 7/4) extremely cobbly sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine vesicular pores and common very fine interstitial pores; 65 percent cobbles, pebbles, and pebble-sized pan fragments with thin lime coatings; about 50 to 90 percent of the surface is covered with cobbles and gravel-sized pan fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.

B21tca—1 inch to 6 inches; light brown (7.5YR 6/4) very gravelly clay loam, brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, sticky and slightly plastic; few thin clay films on faces of peds and lining pores; 50 percent pebbles and cobbles with thin lime coatings; few very fine soft lime threads and masses; strongly effervescent; moderately alkaline; clear wavy boundary.

B22tca—6 to 10 inches; light brown (7.5YR 6/4) very gravelly clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, sticky and slightly plastic; many very fine and fine roots; common very fine tubular and interstitial pores; few thin clay films on faces of peds and lining pores; 60 percent pebbles and cobbles with thin lime coatings; common very fine and fine soft lime threads and masses; violently effervescent; moderately alkaline; clear wavy boundary.

B3tca—10 to 15 inches; light brown (7.5YR 6/4) very gravelly light clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine interstitial pores; few thin clay films on faces of peds and lining pores; 50 percent pebble-sized duripan fragments; common very fine and fine soft lime filaments and masses; violently effervescent; moderately alkaline; abrupt wavy boundary.

IICsicam—15 to 20 inches; pink (7.5YR 8/4) indurated silica- and lime-cemented duripan with thin laminar surface, light brown (7.5YR 6/4) moist; extremely hard; strongly effervescent; clear wavy boundary.

IIC2sica—20 to 60 inches; alternating horizontal pink indurated silica- and lime-cemented laminar layers 1 to 2 centimeters thick and light brown weakly silica- and lime-cemented very gravelly sandy loam 8 to 25 centimeters thick.

Depth to the duripan and thickness of the solum range from 7 to 20 inches. The profile is 35 to 85 percent coarse fragments. Cobble- and gravel-sized coarse fragments are dominant; silica- and lime-cemented pan fragments make up less than one-third of the total coarse fragments.

The A horizon is very pale brown, light yellowish brown, yellowish brown, or brown. It is sandy clay loam or loam and is more than 35 percent coarse fragments, mainly cobbles and pan fragments. The B horizon is light brown, brown, light yellowish brown, or yellowish brown.

It is clay loam or heavy loam and is more than 35 percent coarse fragments, mainly pebbles and pan fragments. The C horizon is a pink, white, pinkish white, light gray, pinkish gray, or light gray, silica- and lime-cemented duripan that is laminar in the upper part and has intermittent cemented layers throughout.

Pima series

The Pima series consists of deep, well drained soils on flood plains. These soils formed in mixed alluvium. Slope is 0 to 2 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Pima silty clay loam, 0 to 2 percent slopes, about 2 miles east of Apache Grove; 260 feet west and 2,020 feet north of the southeast corner of sec. 8, T. 6 S., R. 31 E., Greenlee County.

A11—0 to 1 inch; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak thin platy structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; common fine and very fine tubular and interstitial pores; slightly effervescent; moderately alkaline; clear smooth boundary.

A12—1 inch to 8 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots and few medium roots; common fine and very fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—8 to 16 inches; brown (10YR 5/3) fine sandy clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots and few medium roots; common fine and very fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—16 to 36 inches; brown (10YR 5/3) silty clay loam; dark brown (10YR 3/3) moist; massive; slightly hard, friable, sticky and plastic; common very fine roots and few fine and very fine medium roots; many fine and very fine tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C3—36 to 60 inches; pale brown (10YR 6/3) light clay loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine tubular pores; slightly effervescent; moderately alkaline.

The profile commonly is less than 15 percent coarse fragments, but is as much as 35 percent coarse fragments in some pedons. It is mildly alkaline to strongly alkaline. The A horizon is brown or grayish brown. The C horizon is silty clay loam or sandy clay loam and has thin strata of finer and coarser textured material.

Pinaleno series

The Pinaleno series consists of deep, well drained soils on hillsides and fan terraces. These soils formed in mixed colluvium and alluvium. Slope is 5 to 60 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Pinaleno very cobbly loam, 5 to 30 percent slopes, about 3 miles east of Duncan; 400 feet west and 1,300 feet north of the southeast corner of sec. 27, T. 8 S., R. 32 E., Greenlee County.

A1—0 to 2 inches; brown (7.5YR 5/4) very cobbly loam, dark brown (7.5YR 3/4) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; common very fine interstitial and tubular pores; 20 percent cobbles and 20 percent pebbles, partially coated with lime; noneffervescent; moderately alkaline; abrupt wavy boundary.

B21tca—2 to 8 inches; brown (7.5YR 5/4) gravelly sandy clay loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots, common fine roots, and few medium roots; common very fine and fine interstitial and tubular pores; few thin clay films on faces of peds, lining pores, and bridging grains; common very fine and fine lime threads; 20 percent lime-coated pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

B22tca—8 to 17 inches; pink (7.5YR 7/4) very gravelly clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; many very fine roots, common fine roots, and few medium roots; many very fine and fine interstitial and tubular pores; few thin clay films on faces of peds, lining pores, and bridging grains; common to many very fine and fine lime threads; 55 percent lime-coated pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

C1ca—17 to 29 inches; pink (7.5YR 7/4) extremely gravelly loam, brown (7.5YR 4/4) moist; massive; soft, very friable, slightly sticky and nonplastic; many very fine roots and common fine roots; many very fine and fine interstitial and tubular pores; 40 percent pebbles and 25 percent cobbles; strongly effervescent; moderately alkaline; clear wavy boundary.

C2ca—29 to 48 inches; pink (7.5YR 7/4) extremely gravelly loamy sand, brown (7.5YR 5/4) moist; single grain; loose; many very fine roots and common fine roots; many very fine and fine

interstitial pores; 50 percent pebbles and 25 percent cobbles that are coated with lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C3ca—48 to 56 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) moist; massive; hard, very friable; few very fine roots; many very fine and fine tubular pores; common very fine and fine lime threads; 5 percent lime-coated pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

C4ca—56 to 63 inches; light brown (7.5YR 6/4) extremely gravelly sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; few very fine roots; many fine interstitial pores; common very fine and fine lime threads; 65 percent lime-coated pebbles; slightly effervescent in matrix, but strongly effervescent on lime coatings; moderately alkaline.

The solum ranges from 15 to 40 inches in thickness. The control section averages more than 35 percent coarse fragments. The profile ranges from mildly alkaline to strongly alkaline.

The A horizon is light brown or brown. The B horizon is brown, pink, or reddish brown. It is very gravelly clay loam, gravelly sandy clay loam, or very gravelly sandy clay loam. It has layers that are less than 35 percent coarse fragments but averages more than 35 percent. The C horizon is light brown, brown, pink, light yellowish brown, yellowish brown, reddish brown, or pinkish gray. It is sandy loam, loam, or sandy clay loam and has layers that are less than 35 percent coarse fragments but averages more than 35 percent.

Santo Tomas series

The Santo Tomas series consists of deep, well drained soils on flood plains, alluvial fans, and stream channels. These soils formed in mixed alluvium. Slope is 2 to 10 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of Santo Tomas extremely stony sandy loam, 2 to 10 percent slopes, about 8.5 miles southwest of Pima; 400 feet east and 800 feet south of the northwest corner of sec. 29, T. 7 S., R. 24 E., Graham County.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, very friable; common very fine and fine roots; common very fine interstitial pores; 50 percent stones, 20 percent cobbles, and 10 percent pebbles; about 45 percent of the surface is covered with stones and cobbles; noneffervescent; neutral; abrupt smooth boundary.

A12—2 to 10 inches; dark grayish brown (10YR 4/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; many very fine and fine roots, common medium roots, and few coarse roots; many very fine and fine interstitial pores and few very fine tubular pores; 70 percent stones and 15 percent cobbles and pebbles that have a thin coating of lime on undersides; noneffervescent; moderately alkaline; gradual wavy boundary.

A13—10 to 31 inches; dark grayish brown (10YR 4/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; many very fine and fine roots, common medium roots, and few coarse roots; many very fine and fine interstitial pores; 70 percent stones and 15 percent cobbles and pebbles that have a thin coating of lime, but the coating is thicker on undersides; slightly effervescent; moderately alkaline; clear wavy boundary.

C—31 to 60 inches; brown (7.5YR 5/4) extremely stony loamy sand, brown (7.5YR 4/4) moist; single grain; loose; common very fine, fine, and medium roots and few coarse roots; many very fine and fine interstitial pores; 70 percent stones and 15 percent cobbles and pebbles that have a thin coating of lime on undersides; slightly effervescent; moderately alkaline.

The profile is 35 to 90 percent coarse fragments. The A11 horizon is dark grayish brown, grayish brown, or brown very cobbly sandy loam or extremely stony sandy loam. The A12 and A13 horizons are grayish brown or dark grayish brown very stony sandy loam, extremely stony sandy loam, very cobbly sandy loam, or very gravelly sandy loam. The C horizon is brown, pale brown, or light yellowish brown very stony loamy sand, extremely stony loamy sand, or very cobbly loamy sand.

Selevin series

The Selevin series consists of deep, well drained soils on fan terraces. These soils formed in alluvium derived from granite and gneiss. Slope is 2 to 15 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of Selevin extremely stony loam, 2 to 15 percent slopes, about 8 miles southwest of Pima; 200 feet west and 1,500 feet south of the northeast corner of sec. 28, T. 7 S., R. 24 E., Graham County.

A11—0 to 2 inches; reddish brown (5YR 4/4) extremely stony loam, dark reddish brown (5YR 3/4) moist; weak thin platy structure; slightly hard, very friable, slightly sticky; common very fine and fine roots; many very fine and fine vesicular pores and few very fine tubular pores; 35 percent stones, 30 percent

cobbles, and 10 percent gravel; about 40 percent of the surface is covered with stones and cobbles; slightly acid; abrupt smooth boundary.

A12—2 to 5 inches; reddish brown (5YR 4/4) very stony sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular pores; 30 percent stones and 10 percent gravel; neutral; abrupt wavy boundary.

B21t—5 to 13 inches; dark reddish brown (2.5YR 3/4, dry and moist) very stony clay; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, very sticky and very plastic; many very fine roots, common fine roots, and few medium roots; many very fine and fine tubular pores; many pressure faces; 30 percent stones and 10 percent gravel; noneffervescent; mildly alkaline; clear wavy boundary.

B22t—13 to 19 inches; reddish brown (2.5YR 4/4) very stony clay, dark reddish brown (2.5YR 3/4) moist; strong medium prismatic structure parting to strong medium angular blocky; hard, firm, very sticky and very plastic; many very fine roots, common fine roots, and few medium roots; common very fine and fine tubular pores; many pressure faces; 30 percent stones and 10 percent gravel; noneffervescent; mildly alkaline; clear wavy boundary.

B23tca—19 to 23 inches; reddish brown (2.5YR 4/4) very stony clay, dark reddish brown (2.5YR 3/4) moist; strong medium angular blocky structure; hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine tubular pores; many pressure faces; 35 percent stones and 10 percent gravel; common medium soft irregularly shaped masses and threads of lime; violently effervescent on lime masses; moderately alkaline; abrupt wavy boundary.

Cca—23 to 60 inches; pinkish white (5YR 8/2) extremely stony sandy loam, pinkish gray (5YR 7/2) moist; massive; hard, firm, slightly sticky; few very fine interstitial pores; 65 percent granite stones with thin coatings of lime; many soft masses of lime; moderately to strongly cemented in places; violently effervescent; moderately alkaline.

Thickness of the solum and depth to the calcic horizon range from 20 to 32 inches. The control section averages more than 35 percent coarse fragments, dominantly stones. The profile is 1 to 2 percent organic matter in the upper 6 inches.

The A horizon is reddish brown, dark brown, or brown. The B horizon is dark reddish brown, reddish brown, red, or dark red. It is more than 35 percent coarse fragments, dominantly stones. The C horizon is pinkish white, pinkish gray, pink, or reddish yellow. It is sandy loam or loam and is more than 35 percent coarse fragments, dominantly stones.

Signal series

The Signal series consists of deep, well drained soils on hillsides. These soils formed in mixed alluvium. Slope is 10 to 40 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of Signal very cobbly clay loam, 10 to 40 percent slopes, about 7 miles east of Three Way; 50 feet east and 1,500 feet north of the southwest corner of sec. 25, T. 5 S., R. 31 E., Greenlee County.

A1—0 to 2 inches; brown (7.5YR 4/2) very cobbly clay loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; 30 percent cobbles and 15 percent gravel; about 50 percent of the surface is covered with cobbles and gravel; slightly acid; clear smooth boundary.

B1t—2 to 12 inches; dark reddish brown (5YR 3/2) very gravelly clay, dark reddish brown (5YR 3/2) moist; moderate fine prismatic structure parting to strong medium angular and subangular blocky; hard, firm, very sticky and very plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular and interstitial pores; many thin clay films lining pores and on faces of peds; 40 percent mixed gravel; mildly alkaline; clear smooth boundary.

B21t—12 to 19 inches; dark reddish brown (5YR 3/4) very gravelly clay, dark reddish brown (5YR 3/4) moist; strong fine and very fine angular blocky structure; hard, firm, very sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine tubular and interstitial pores; many moderately thick clay films lining pores and on faces of peds; 50 percent very fine, fine, and medium gravel; moderately alkaline; clear wavy boundary.

B22t—19 to 29 inches; dark reddish brown (5YR 3/4) very gravelly clay, dark reddish brown (5YR 3/4) moist; strong fine and very fine angular blocky structure; hard, firm, very sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine tubular and interstitial pores; many moderately thick clay films lining pores and on faces of peds; 50 percent mixed gravel and 5 percent cobbles; moderately alkaline; clear wavy boundary.

B23tca—29 to 39 inches; reddish brown (5YR 4/4) extremely gravelly clay, reddish brown (5YR 4/4) moist; moderate fine and very fine angular blocky structure; hard, firm, very sticky and plastic; common very fine and fine roots; common fine and many very fine tubular and interstitial pores; common thin clay films lining pores and on faces of peds; 65 percent mixed gravel that has thin and moderately thick coatings of lime; common soft masses and veins of

lime; slightly effervescent, violently effervescent on lime features; moderately alkaline; clear wavy boundary.

C1ca—39 to 48 inches; yellowish red (5YR 5/6) extremely gravelly loamy coarse sand, yellowish red (5YR 4/6) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine and fine tubular and interstitial pores; 65 percent mixed gravel that has thin coatings of lime; few thin veins of lime; slightly effervescent, strongly effervescent on lime segregations; moderately alkaline; clear wavy boundary.

C2ca—48 to 60 inches; light reddish brown (5YR 6/4) very gravelly loam, yellowish red (5YR 4/6) moist; massive; weakly lime-cemented; hard, friable, slightly sticky and slightly plastic; very few very fine roots; common fine and very fine tubular pores; 60 percent mixed gravel that has moderately thick coatings of lime; many fine veins of lime; strongly effervescent in matrix but violently effervescent on lime segregations; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. The control section averages more than 35 percent coarse fragments. The A horizon is brown, dark brown, or dark grayish brown. The B2t horizon is dark reddish brown, reddish brown, or dark reddish gray. It is more than 35 percent coarse fragments. The C horizon is yellowish red, light reddish brown, brown, or light brown. It is sandy loam, loam, or loamy sand and is more than 35 percent coarse fragments.

Sonoita series

The Sonoita series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium derived dominantly from granitic rock. Slope is 2 to 10 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Sonoita sandy loam in an area of Sonoita-Bucklebar complex, 2 to 10 percent slopes, about 7 miles southwest of Pima; 200 feet west and 200 feet south of the northeast corner of sec. 24, T. 7 S., R. 23 E., Graham County.

A11—0 to 1 inch; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak thin platy structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; many very fine vesicular pores, many very fine and fine interstitial pores, and few very fine tubular pores; 5 percent fine gravel; neutral; abrupt smooth boundary.

A12—1 inch to 14 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; many fine and very fine interstitial pores and common very fine tubular pores; slightly acid; abrupt smooth boundary.

B21t—14 to 36 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and very fine roots; common fine and very fine tubular and interstitial pores; common thin clay films lining pores and on faces of peds; 3 percent fine gravel; moderately alkaline; clear wavy boundary.

B22t—36 to 45 inches; brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial pores and common very fine tubular pores; many thin clay films lining pores and few thin clay films on faces of peds; 3 percent fine gravel; moderately alkaline; clear wavy boundary.

C—45 to 67 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; common fine and very fine tubular pores; 40 percent mixed gravel; slightly effervescent; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The control section averages 0 to 35 percent fine gravel. The A horizon is light yellowish brown or light brown. The B horizon is brown, light brown, or light yellowish brown. It is sandy loam, gravelly sandy loam, or sandy clay loam. The C horizon is light brown, brown, or light yellowish brown. It is sand or loamy sand and is 0 to 65 percent mixed gravel.

Stellar series

The Stellar series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium. Slope is 0 to 5 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of Stellar gravelly sandy clay loam, 0 to 5 percent slopes, about 2.25 miles southeast of the Lazy B Ranch headquarters; 600 feet west and 2,400 feet north of the southeast corner of sec. 34, T. 10 S., R. 32 E., Greenlee County.

A1—0 to 3 inches; pinkish gray (7.5YR 6/2) gravelly sandy clay loam, dark reddish gray (5YR 4/2) moist; moderate medium platy structure; slightly hard, friable, slightly sticky; many very fine, fine, and medium roots; common very fine and fine vesicular pores and many very fine and fine interstitial pores; approximately 15 percent mixed pebbles; noneffervescent; moderately alkaline; abrupt smooth boundary.

B21t—3 to 8 inches; reddish brown (5YR 4/3) light clay, dark reddish brown (5YR 3/4) moist; moderate to strong medium prismatic structure parting to strong fine and medium subangular blocky; hard, firm, sticky and plastic; many very fine, fine, and medium roots; many very fine and common fine interstitial and tubular pores; common thin clay films on faces of peds and lining pores; 3 percent fine pebbles; noneffervescent; moderately alkaline; clear smooth boundary.

B22t—8 to 21 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/4) moist; strong medium and coarse prismatic structure parting to strong medium blocky; hard, firm, very sticky and very plastic; common very fine, fine, and medium roots; many very fine and common fine tubular pores; many thin clay films on faces of peds and lining pores; 3 percent fine pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

B23tca—21 to 30 inches; yellowish red (5YR 5/6) light clay, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular and interstitial pores; common thin clay films on faces of peds and lining pores; common to many medium and large soft masses, threads, and nodules of lime; 10 percent lime-coated pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

B32tca—30 to 43 inches; reddish yellow (5YR 7/6) light clay, reddish yellow (5YR 6/6) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine and fine tubular and interstitial pores; common thin clay films on faces of peds and lining pores; common to many medium and large soft masses and nodules of lime; 3 percent lime-coated pebbles; violently effervescent; moderately alkaline; clear smooth boundary.

IIClca—43 to 50 inches; light brown (7.5YR 6/4) light clay, brown (7.5YR 5/4) moist; massive; hard, firm, sticky and plastic; few to common very fine and few fine tubular pores; many medium and large soft masses of lime; common fine gypsum crystals; 3 percent very fine and fine lime-coated gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC2ca—50 to 66 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; massive; hard, friable, sticky and slightly plastic; many very fine and common fine tubular pores; few to common medium soft masses of lime; 3 percent lime-coated pebbles; violently effervescent; strongly alkaline.

Commonly, 25 to 75 percent of the surface is covered with mixed gravel. The solum ranges from 30 to 50 inches in thickness. Coarse fragments make up 0 to 15 percent of the solum. The profile is mildly alkaline to strongly alkaline.

The A horizon is pinkish gray, light brown, or brown. The B2t horizon is reddish brown or yellowish red clay, gravelly clay, or sandy clay. The Cca horizon is light brown or pinkish gray sandy clay loam, gravelly sandy clay loam, or light clay.

Tapco series

The Tapco series consists of very shallow and shallow, well drained soils on fan terraces. These soils formed in mixed alluvium derived dominantly from volcanic rock. Slope is 2 to 15 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Tapco very cobbly clay loam in an area of Tapco-Peloncillo association, 2 to 15 percent slopes, about 3 miles north of Geronimo; 200 feet east and 900 feet north of the southwest corner of sec. 32, T. 3 S., R. 23 E., Graham County.

A1—0 to 2 inches; brown (7.5YR 5/4) very cobbly clay loam, brown (7.5YR 4/4) moist; moderate medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine vesicular pores and common fine and very fine tubular and interstitial pores; 30 percent gravel and 20 percent cobbles; mildly alkaline; abrupt smooth boundary.

B2t—2 to 10 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, very sticky and very plastic; many very fine roots and common fine roots; many fine and very fine tubular and interstitial pores; many thin clay films lining pores and on faces of peds; many pressure faces; 5 percent fine gravel; moderately alkaline; very abrupt smooth boundary.

C1sicam—10 to 11 inches; pinkish white and pink (7.5YR 8/2, 7/4) silica- and lime-cemented duripan that has a laminar cap; extremely hard; violently effervescent; clear wavy boundary.

C2sica—11 to 60 inches; alternating horizontal layers of pink indurated silica- and lime-cemented pans 1 to 2 centimeters thick and weakly silica- and lime-cemented layers 8 to 25 centimeters thick.

Thickness of the solum and depth to the duripan range from 7 to 20 inches. The control section averages less than 15 percent coarse fragments.

The A horizon is brown, dark brown, or reddish brown. The B2t horizon is reddish brown or dark reddish brown. The C horizon is alternate layers of pinkish white and pink, silica- and lime-cemented duripan and white or pinkish white, weakly to strongly silica- and lime-cemented layers.

Tres Hermanos series

The Tres Hermanos series consists of deep, well drained soils on fan terraces and hillsides. These soils formed in mixed alluvium and colluvium. Slope is 5 to 45 percent. Average annual precipitation ranges from 10 to 12 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Tres Hermanos gravelly sandy clay loam in an area of Tres Hermanos-Continental-Nickel complex, 2 to 45 percent slopes, about 5 miles northwest of Guthrie; 400 feet north and 2,900 feet west of sec. 13, T. 5 S., R. 29 E., Greenlee County.

A1—0 to 2 inches; light brown (7.5YR 6/4) gravelly sandy clay loam, brown (7.5YR 5/4) moist; weak thin platy structure parting to moderate very fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; few very fine vesicular pores and common very fine and fine interstitial pores; 25 percent mixed gravel and a few cobbles; noneffervescent; moderately alkaline; abrupt smooth boundary.

B21t—2 to 12 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; common very fine and few fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; 10 percent mixed gravel; few very fine lime veins; strongly effervescent; moderately alkaline; clear wavy boundary.

B22tca—12 to 27 inches; light brown (7.5YR 6/4) very gravelly clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; many very fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; many pressure faces; 40 percent mixed gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

C1ca—27 to 35 inches; white (N 8/0) sandy loam, pinkish white (7.5YR 8/2) moist; massive; weakly lime-cemented; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; few very fine tubular pores; 10 percent fine gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—35 to 60 inches; pinkish gray (7.5YR 6/2) gravelly sandy loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores and common very fine and fine interstitial pores; 30 percent mixed gravel; common thin lime coatings on gravel; violently effervescent; moderately alkaline.

The solum ranges from 17 to 30 inches in thickness. The profile is 15 to 35 percent coarse fragments. It is mildly alkaline to strongly alkaline.

The A1 horizon is light brown, pinkish gray, pale brown, or brown. It is very gravelly sandy loam or gravelly sandy clay loam. The B2t horizon is brown, light brown, light reddish brown, or reddish brown. It is clay loam, heavy loam, or sandy clay loam. It ranges from 10 to 40 percent coarse fragments but averages 15 to 35 percent. The C horizon is pinkish gray, white, reddish brown, light brown, brown, or very pale brown. It is sandy loam, gravelly or very gravelly sandy loam, gravelly or very gravelly loamy sand, gravelly loam, or gravelly clay loam.

Wampoo series

The Wampoo series consists of moderately deep, well drained soils on fan terraces. These soils formed in mixed alluvium derived dominantly from volcanic rock. Slope is 2 to 10 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of Wampoo gravelly loam, 2 to 10 percent slopes, about 10 miles east of Apache Grave on Bitter Creek Road; 1,600 feet east and 2,000 feet south of the northwest corner of sec. 22, T. 6 S., R. 32 E., Greenlee County.

A1—0 to 3 inches; brown (7.5YR 4/3) gravelly loam, dark brown (7.5YR 3/2) moist; weak thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; few very fine vesicular pores and common very fine interstitial pores; 20 percent mixed gravel; about 35 percent of the surface is covered with cobbles and gravel; noneffervescent; neutral; abrupt smooth boundary.

B1t—3 to 5 inches; reddish brown (5YR 4/3) gravelly heavy loam, dark reddish brown (5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular pores; few thin clay films on faces of peds; 30 percent mixed gravel; noneffervescent; neutral; clear wavy boundary.

B21t—5 to 8 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; strong fine and medium prismatic structure parting to strong fine and medium angular blocky; very hard, firm, very sticky and very plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular pores; many pressure faces; 5 percent fine gravel; noneffervescent; moderately alkaline; clear wavy boundary.

B22t—8 to 16 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; strong fine and medium prismatic structure parting to strong

fine and medium angular blocky; very hard, firm, very sticky and very plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular pores; many pressure faces; 5 percent fine mixed gravel; noneffervescent; moderately alkaline; clear wavy boundary.

B3tca—16 to 21 inches; reddish brown (5YR 5/4) gravelly clay, reddish brown (5YR 4/4) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, very sticky and very plastic; few very fine roots; common very fine and fine tubular pores; many thin clay films in pores and on faces of peds; 25 percent fine gravel; few very fine and fine soft lime masses and concretions; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1sicam—21 to 22 inches; pink (7.5YR 7/4, dry) and brown (7.5YR 7/4, moist) indurated silica- and lime-cemented duripan that has a thin laminar surface 1/8 inch thick; extremely hard; slightly effervescent.

C2sica—22 to 28 inches; pinkish white (7.5YR 8/2, dry) and pinkish gray (7.5YR 7/2, moist) silica- and lime-cemented duripans alternating with weakly to strongly cemented layers of sand, gravel, and cobbles.

Thickness of the solum and depth to the upper duripan range from 20 to 30 inches. The mollic epipedon is 7 to 10 inches thick. The control section averages 0 to 15 percent coarse fragments. Content of carbonates increases with depth. The profile ranges from noneffervescent in the A horizon and the upper part of the B horizon to violently effervescent in the horizon just above the upper duripan. The organic matter content is more than 1 percent in the upper 10 inches of the profile.

The A horizon is brown or dark brown. The B horizon is reddish brown, reddish gray, dark reddish gray, dark reddish brown, weak red, or dusky red. It is clay or gravelly clay. The Csica horizon is white, pinkish white, pinkish gray, pink, light gray, or reddish yellow.

White House series

The White House series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium derived dominantly from granitic rock. Slope is 10 to 15 percent. Average annual precipitation ranges from 12 to 14 inches, and average annual air temperature ranges from 60 to 65 degrees F.

Typical pedon of a White House gravelly loam in an area of Eloma-White House association, 10 to 60 percent slopes, about 15 miles southwest of U.S. Highway 70 and one-half mile northwest of Klondyke Road; 1,300 feet west and 2,200 feet south of the northeast corner of sec. 7, T. 7 S., R. 22 E., Graham County.

A1—0 to 1 inch; brown (7.5YR 4/4) gravelly loam, dark brown (7.5YR 3/4) moist; weak thin platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine vesicular pores and common very fine and fine tubular and interstitial pores; 15 percent fine and medium gravel; about 35 percent of the surface is covered with fine gravel; neutral; abrupt smooth boundary.

B1t—1 inch to 4 inches; dark reddish brown (5YR 3/4) clay loam, dark reddish brown (5YR 3/3) moist; strong fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; 5 percent fine gravel; neutral; abrupt smooth boundary.

B21t—4 to 7 inches; dark reddish brown (2.5YR 3/4) clay, dark reddish brown (2.5YR 3/4) moist; strong fine and medium angular blocky structure; very hard, firm, very sticky and very plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; many moderately thick clay films in pores and on faces of peds; many pressure faces; 5 percent fine gravel; mildly alkaline; clear smooth boundary.

B22t—7 to 25 inches; dark reddish brown (2.5YR 3/4) clay, dark reddish brown (2.5YR 3/4) moist; strong medium and coarse prismatic structure parting to strong medium angular blocky; very hard, firm, very sticky and very plastic; common fine and very fine roots and few medium roots; many very fine and fine tubular and interstitial pores; many moderately thick clay films in pores and on faces of peds; many pressure faces; 5 percent fine gravel; moderately alkaline; clear wavy boundary.

B23tca—25 to 33 inches; red (2.5YR 4/6) sandy clay, red (2.5YR 4/6) moist; strong fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine roots and very few medium roots; many thin clay films in pores and on faces of peds; 5 percent fine gravel; common fine soft lime masses; slightly effervescent in matrix but strongly effervescent on lime segregations; moderately alkaline; clear wavy boundary.

B24tca—33 to 46 inches; yellowish red (5YR 4/6) sandy clay, yellowish red (5YR 4/6) moist; strong fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few fine and very fine roots and very few medium roots; common thin clay films in pores and on faces of peds; common clay bridges between sand grains; 5 percent fine gravel; very few fine soft lime masses; noneffervescent in matrix but strongly effervescent on lime segregations; moderately alkaline; clear wavy boundary.

B3tca—46 to 56 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate

fine subangular blocky structure; hard, friable, sticky and slightly plastic; few fine and very fine roots and very few medium roots; common fine and very fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; common clay bridges between sand grains; 10 percent fine gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

C—56 to 65 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine tubular pores; 5 percent fine gravel; very slightly effervescent; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The control section averages less than 35 percent coarse fragments. Content of calcium carbonates in the lower part of the B2t horizon and in the C horizon is less than 15 percent.

The A horizon is brown, reddish brown, or yellowish brown. The B horizon is dark reddish brown, reddish brown, red, or yellowish red. It is clay, sandy clay, sandy clay loam, or clay loam. The C horizon is light brown, light reddish brown, brown, or light yellowish brown. It is clay loam, loam, or sandy clay loam.

Whitlock series

The Whitlock series consists of deep, well drained soils on fan terraces. These soils formed in mixed alluvium. Slope is 2 to 5 percent. Average annual precipitation ranges from 9 to 10 inches, and average annual air temperature ranges from 62 to 66 degrees F.

Typical pedon of a Whitlock sandy loam in an area of Whitlock-Tres Hermanos complex, 2 to 20 percent slopes, about 4.5 miles southwest of Pima; 1,300 feet south and 1,700 feet east of the northwest corner of sec. 10, T. 7 S., R. 24 E., Graham County.

A11—0 to 1 inch; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; moderate thin and medium platy structure; slightly hard, very friable; few very fine roots; common very fine and fine vesicular pores; 5 percent very fine and fine pebbles; about 25 percent of the surface is covered with fine gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

A12—1 inch to 10 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, very friable; few very fine and fine roots; common very fine and fine interstitial pores; 5 percent very fine and fine pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1ca—10 to 21 inches; pinkish white (7.5YR 8/2) loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable; slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; many medium and coarse irregularly shaped soft lime masses; few lime-coated pebbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—21 to 28 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, very friable; common very fine and fine roots; few very fine and fine tubular pores; 5 percent very fine lime-coated pebbles; common fine lime threads; violently effervescent; moderately alkaline; abrupt wavy boundary.

C3—28 to 51 inches; light brown (7.5YR 6/4) sand, brown (7.5YR 4/4) moist; single grain; loose; many very fine roots and common fine roots; many very fine and fine interstitial pores; 15 percent fine pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

C4—51 to 70 inches; brown (7.5YR 5/4) sand, brown (7.5YR 4/4) moist; single grain; loose; few very fine and fine roots; few very fine interstitial pores; 15 percent fine pebbles; noneffervescent; moderately alkaline.

The profile is 0 to 35 percent coarse fragments. The calcic horizon is at a depth of 6 to 12 inches. The profile is moderately alkaline or strongly alkaline.

The A horizon is light brown or pale brown. The Cca horizon is pinkish white, pink, or light brown and has common to many soft, white masses of lime. The lower part of the C horizon is light brown or brown sand, coarse sand, gravelly sand, or loamy sand.

formation of the soils

Scott D. Hutchinson and Richard C. Herriman, soil scientists, Soil Conservation Service, assisted in the preparation of this section.

Soil is a natural, three-dimensional body on the earth's surface that is capable of supporting the growth of plants. Its characteristics and qualities have been determined by physical and chemical processes that result from the interaction of five factors—climate, living organisms, time, topography, and parent material. The influence of any one of these factors determines the kind of soil that forms.

During the last million years or so, the soils in this survey area have undergone significant changes. Volcanoes have erupted, streams have carried sediment to low-lying areas, eolian sediment has been deposited, and the climate has changed as well as the living organisms in the soil. These events have altered the properties of the soils (*8*).

In the pages that follow, the soil-forming factors of climate, living organisms, and parent material are discussed separately. The factors of time and topography are discussed along with parent material in the section "Geomorphic surfaces and soil development."

climate

Climate has a strong influence on soil formation. It greatly influences the kinds of vegetation that grow and the rate at which organic matter decomposes and minerals weather. Moreover, it affects the rate of removal of material from some soil horizons and the rate of accumulation in others.

In Safford and York Valleys the average annual precipitation is 9 to 12 inches and the average annual air temperature is 62 to 66 degrees F. The soils in these valleys have an aridic moisture regime and a thermic temperature regime. The frost-free season averages 180 to 250 days each year.

In the Peloncillo and Gila Mountains and on the foot slopes of the Pinaleno Mountains, the average annual precipitation is 12 to 16 inches. A precipitation peak marked by heavy thunderstorms occurs during July and August, and a secondary peak occurs in winter. The average annual air temperature is 55 to 66 degrees F. The soils in these areas generally have an ustic moisture regime and a thermic or mesic temperature regime. Day-to-night temperature ranges usually are greatest in summer and winter. Relative humidity in summer typically is low (*4*).

living organisms

Among all living organisms, the higher plants have the most significant overall influence on soil formation. Decaying plant remains, especially fibrous grass roots, are the major source of organic matter in soils. Dieback of large plants with tap roots, such as mesquite, promotes deep penetration of water. Plants of all sizes intercept precipitation, reduce soil erosion, trap sediment, and help aerate the soils.

Animals influence soil formation by contributing organic matter and synthesizing it. They also mix soil horizons by burrowing into the soil. Vertebrate animals such as skunks, javelina, gophers, and rock squirrels are the least influenced by the organic matter content of the soil. Their influence is mainly the result of mechanical turning and mixing of the soil. Invertebrates such as insects, nematodes, earthworms, and millipedes synthesize organic matter, and thus they are dependent on the organic matter and moisture content of the soil. Animals such as earthworms are scarce in the survey area except in irrigated soils such as those of the Pima and Comoro series. Low organic matter content, low soil moisture content, and an abundance of carbonates in soils all inhibit earthworm populations.

Accumulated plant remains and inherited organic matter in alluvial deposits provide soils with varying amounts of organic matter. The organic matter content of the soils in the survey area typically is low. In the aridic or torric temperature regime of the valleys, organic matter accumulates slowly and dissipates rapidly because of the high soil temperatures. At higher elevations the precipitation is greater and temperatures are cooler during the growing season. The moisture regime is ustic. Soils in Ustollic subgroups occur in the transition zones between the valley floors and hillsides and reflect a higher organic matter content.

Coppice dunes are common in level areas where vegetation is sparse and winds are strong. Their formation is the result of the accumulation of soil material around shrub vegetation.

parent material

The survey area lies within the Basin and Range province of southern Arizona (*6*). The main drainageway in the survey area is the Gila River, which serves as the local baselevel. The Safford and York valleys of the Gila River in Graham and Greenlee Counties consist of late

Tertiary and Quaternary alluvium into which a stepped sequence of landforms has been cut (figs. 12 and 13). The Pinaleno Mountains consist of Precambrian granite, gneiss, and schist, and the Gila and Peloncillo Mountains consist of Tertiary and Quaternary andesite, basalt, rhyolite, and pyroclastics (*3*).

Evolution of the major drainageways is believed to have occurred in the Eocene or Oligocene, prior to the major mountain-building epoch. These ancestral rivers flowed in a southwesterly direction across a relatively level surface that sloped from western New Mexico to the Tucson-Gila Bend area. Uplift of the blocks of Precambrian granite and gneiss that formed the major mountain ranges in southeastern Arizona occurred at a rate slow enough to maintain the continuity of the drainageways. The dominant orientation of the Precambrian rock is to the northeastern part of the area. As uplift of the mountains proceeded, the rivers shifted their course away from the areas of the greatest uplift. These rivers maintained their ancestral channels when crossing major mountain blocks, resulting in a pattern of rivers following faulted valleys in a northwesterly direction and crossing these mountain blocks in a southwesterly direction, through narrow gorges at right angles to the mountains (*7*).

The Gila River during the late Pliocene is believed to have been part of the ancestral Salt River system. During this period, volcanic activity and uplift near the southern end of the Mazatzal Mountains dammed the ancestral Salt River system, raising the baselevel of the Salt, San Pedro, and Gila Rivers and subsequently depositing fine-grained lacustrine sediment in the Safford Valley. These deposits accumulated to a depth of at least 2,400 feet.

Although tectonism has been a major factor influencing erosion and deposition on a regional scale, cyclic change in climate, affected by Quaternary glaciations and interglaciations in adjacent mountains, has been the main factor controlling depositional processes in individual basins and river-valley segments (*5*). Most alluvial deposits in this warm and semiarid region record a succession of periods of landscape instability and of surface stability and soil formation. These deposits reflect cyclic shifts in hydrologic regimes and related vegetation changes.

Glacial melting corresponds with episodes of increased river discharge, entrenchment of major valleys, and flooding; however, large areas of fan terraces, with soils such as those of the Selevin series, were stable during interglacial periods because of the effectiveness of the plant cover in limiting erosion. Aridity increased during the transition from glacial to interglacial periods. This resulted in decreased plant cover and in widespread erosion and sedimentation during occasional thunderstorm-runoff events. Steep mountain soils similar to those of the Luzena and Mokiak series were eroded,

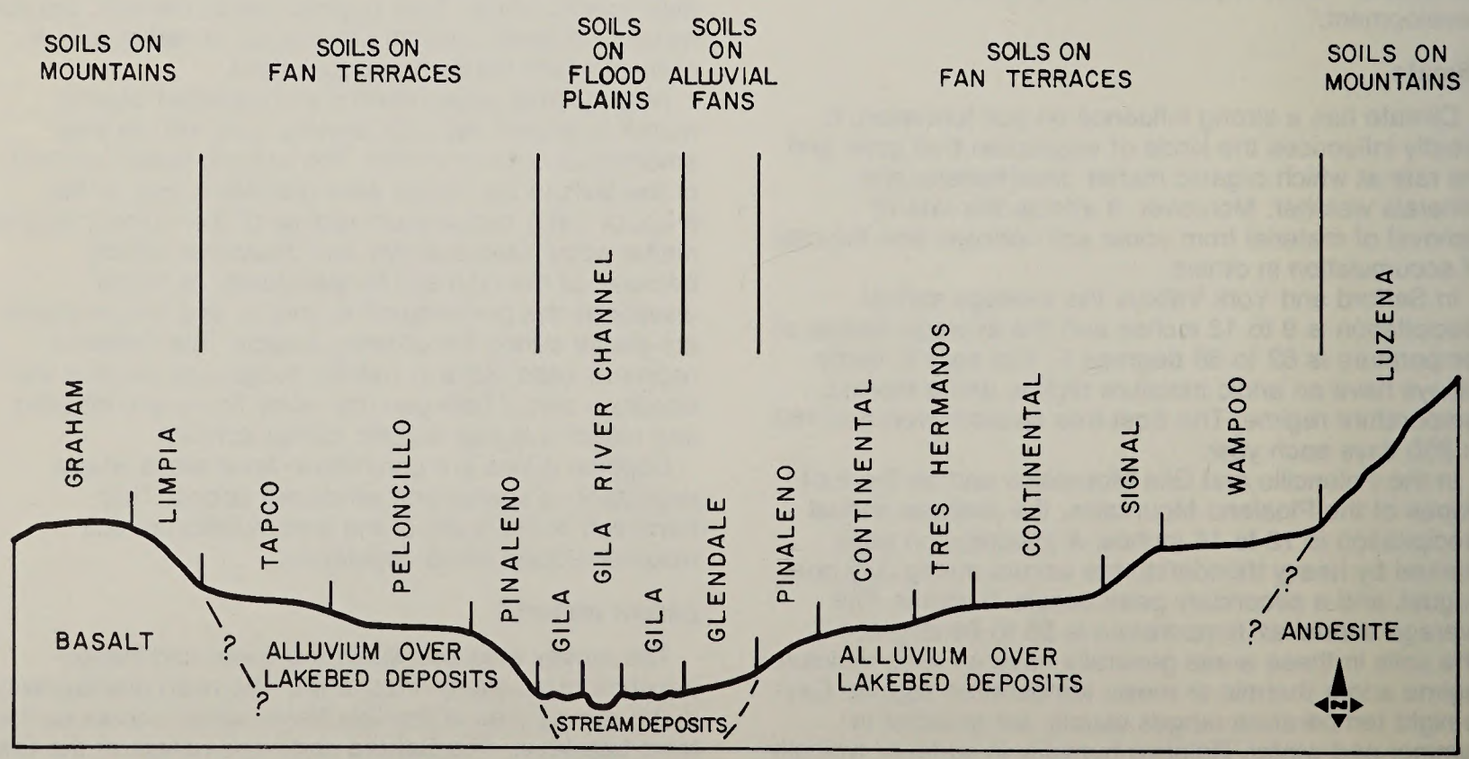


Figure 12.—Idealized soil-landscape profile of Safford Valley.

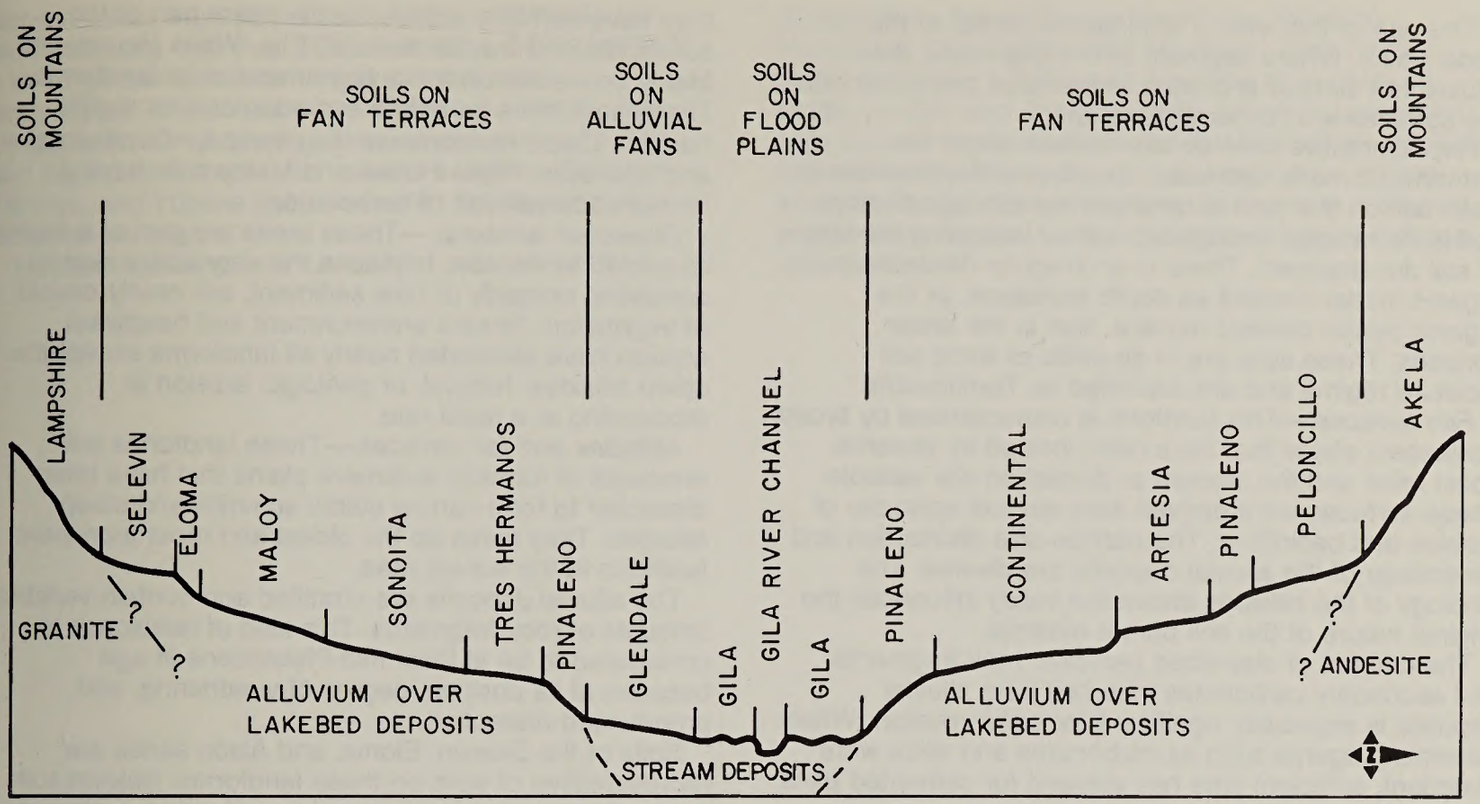


Figure 13.—Idealized soil-landscape profile of York Valley.

and sediment was deposited downslope. A concurrent decrease in river discharge then caused deposition in valleys. Aerial deflation, with subsequent deposition, has affected large areas, particularly those in and near the river valleys and depressional areas where the fresh alluvium was not protected by an adequate plant cover. Eolian carbonates mantled nearly all landscapes, including the fan terraces on which the Selevin soils formed.

geomorphic surfaces and soil development

The geomorphic surfaces recognized in the survey area and the representative soils on each surface (see figs. 12 and 13) are described in the following paragraphs.

Flood plains.—This landform developed from calcareous alluvial deposits from graded channels of the Gila River. It is characterized by undulating bar and channel topography, with less than 5 feet of relief, that resulted from periodic flooding. It consists of stratified alluvium. The extensive mountainous watershed is capable of supplying large amounts of high-velocity floodwater. Land leveling for irrigated farming and eolian deposits have modified the original topography. The Gila River channel represents the local baselevel.

The age of the sediments associated with this landscape is probably Holocene. Small areas have been partially abandoned as a flood plain. Landscape changes are produced by each flood. New channels are cut as older channels are abandoned, and fresh alluvium is deposited as the floodwater recedes.

Soils that formed in the stream deposits on the flood plain include Torrifluvents such as the Gila soils. Gila soils are very young and have an ochric epipedon with less than 1 percent organic carbon. As long as soils on flood plains continue to receive fresh alluvium, soil formation is inhibited.

Alluvial fans.—This landform is part of a broad coalescent plain covered with material derived from stream-deposited alluvium consisting of a diverse combination of sand, silt, clay, and rock fragments. The topography of this active landscape is characterized by numerous braided streams with shallow channels. In places, leveling for irrigated farming and urban development has modified the original topography. During periods of flooding, the shallow channels do not have the capacity to carry the runoff. Excess water overflows the channel banks and spreads alluvium across the surface. These fresh increments of calcareous sediment inhibit soil development. Flooding is an infrequent but sometimes violent event that results from severe summer thunderstorms in the adjacent mountains. Only a limited transfer of soluble salts has taken place within the high-carbonate parent material.

The age of this kind of landform is similar to that of flood plains. Where adjacent to the Gila River, the alluvial fan surface is graded to the flood plain; therefore, the surfaces are contemporaneous.

Representative soils on alluvial fans are in the Anthony, Comoro, Glendale, Guest, and Hantz series. Each soil on this kind of landform exhibits stratification and is calcareous throughout, further indicating the lack of soil development. There is an irregular decrease in organic matter content as depth increases, or the organic matter content remains high in the lower horizons. These soils are in an aridic or torric soil moisture regime and are classified as Torrifluvents.

Fan terraces.—This landform is characterized by broad coalescent plains that have been incised by streams. Local relief and the amount of dissection are variable. These surfaces were derived from several episodes of incision and backfilling. The particle-size distribution and mineralogy of the alluvial deposits are diverse. The lithology of the hillsides above the valley influences the original nature of the soil parent material.

The amount of clay-sized particles, rock fragments, and secondary carbonates inherited from alluvial deposits is especially significant for soil formation. Where cementing agents such as carbonates and silica were abundant, sufficient time has elapsed for cemented pans to have developed.

Fan terraces adjacent to flood plains or washes may have relief of only 5 to 25 feet. These fan terraces resulted from late Pleistocene entrenchment. Higher and older terraces with relief of more than 25 feet are associated with episodes that are at least as old as mid-Pleistocene. Typically, incision of the higher fan terraces produces steep hillsides that are as young as the stream channels truncating them. Geomorphic surfaces tend to converge toward the center of the valley. The result is diminishing and less prominent escarpments between the lower fan terraces and their incised stream channels.

Representative soils on fan terraces near the valley border are in the Bucklebar, Pinaleno, and Tres Hermanos series. These soils all have an ochric epipedon and sufficient clay to form an argillic horizon. Calcic horizons are diagnostic for the Pinaleno and Tres Hermanos soils but not for the Bucklebar soils. The carbonate-rich Tres Hermanos soils effervesce throughout. Only scattered carbonate filaments are present in Bucklebar soils.

Soils on fan terraces near the volcanic mountain fronts typically have strongly cemented and continuous horizons (duripans). Artesia, Peloncillo, Tapco, and Wampoo soils are representative of soils on higher and older landforms. Alluvial deposits are derived from siliceous rock. The accumulation of soluble silica combined with carbonates results in a strongly cemented duripan. Soils that have a duripan are on the stable upper part of hillsides.

The soils on the other fan terraces with more than 25 feet of relief have weakly cemented calcic horizons, or they have soft lime masses in the lower part of the solum. Soils of the Continental, Eba, White House, and Maloy series are on these higher and older landforms. These soils have an ochric epipedon and an argillic horizon. Calcic horizons are diagnostic for Continental and Eba soils. White House and Maloy soils have a limited accumulation of carbonates.

Dissected lakebeds.—These areas are part of a highly dissected landscape. In places the very active slopes, consisting primarily of lake sediment, are nearly devoid of vegetation. Stream entrenchment and headward erosion have eliminated nearly all landforms except the steep hillsides. Natural, or geologic, erosion is proceeding at a rapid rate.

Hillsides and fan terraces.—These landforms are remnants of formerly extensive plains that have been dissected to form narrow stable summits and steep hillsides. They make up the oldest and most prominent landform in the survey area.

The alluvial deposits are stratified and contain variable amounts of rock fragments. This kind of landscape is considered to be at least mid-Pleistocene in age because of its position, degree of weathering, and pronounced dissection.

Soils of the Selevin, Eloma, and Alsco series are representative of soils on these landforms. Selevin soils on the fan terraces have an ochric epipedon, a strongly developed argillic horizon with an abrupt upper boundary, and a calcic horizon. They are classified as Paleargids. Because weathering of granite and gneiss parent material does not typically provide abundant carbonates, the content of carbonates is probably a result of secondary enrichment from eolian carbonates. Eloma and Alsco soils are on the hillsides below the fan terraces (see fig. 12). They have an ochric epipedon and an argillic horizon. They are classified as Haplargids.

Mountains.—These landforms are dominated by active Holocene landforms, with only remnants of older and more stable landforms. The terrain is highly dissected and consists of narrow summits and steep mountainsides. Slope is 5 to 90 percent. Most of the soils are less than 20 inches deep over bedrock. The parent material of the soils includes andesite, basalt, rhyolite, pyroclastics, granite, gneiss, and schist. Clayey soils with abundant rock fragments predominate where pyroclastic parent material is available.

Typical soils on these landforms in the Gila Mountains are those of the Akela, Atascosa, Cabezon, Fallsam, Graham, Lehmans, Limpia, and Luzena series. Atascosa, Cabezon, Graham, and Luzena soils have a mollic epipedon and an argillic horizon, and they are classified as Argiustolls. Lehmans soils are Haplargids that have an ochric epipedon and an argillic horizon. Akela soils are Torriorthents that have an ochric epipedon and a weak carbonate accumulation. Fallsam and Limpia soils have a mollic epipedon and an argillic horizon. They are Argiustolls, are more than 20 inches deep, and have

slopes of less than 50 percent. All the other soils on mountains are less than 20 inches deep, have slopes of 5 to 70 percent, and commonly occupy active landscapes. Akela, Atascosa, Graham, Lehmans, and Limpia soils are generally below an elevation of 5,000 feet and have a thermic temperature regime. Cabezon, Fallsam, and Luzena soils are within the cooler mesic temperature regime.

Mokiak, Aravaipa, and Lampshire soils are on foot slopes of the Santa Teresa Mountains, Pinaleno Mountains, and Copper King Mountain. They have a mollic epipedon. Mokiak and Aravaipa soils have an argillic horizon and are Argiustolls, whereas Lampshire soils lack an argillic horizon and are Haplustolls. Mokiak soils are within the cooler mesic temperature regime, whereas Lampshire and Aravaipa soils are in a thermic temperature regime. Carbonate accumulations in these soils are low.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. I0, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method of classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Arizona Bureau of Mines, University of Arizona. 1958. Geologic map of Graham and Greenlee Counties, Arizona.

(4) Green, Christine R. and William D. Sellers. 1964. Arizona Climate. University of Arizona Press. pp. 1-503.

(5) Hawley, John W. 1975. Quaternary history of Dona Ana County region, South-Central New Mexico. pp. 139-149, illus.

(6) Melton, Mark A. 1961. Origin of the drainage and geomorphic history of southern Arizona. Arid lands colloquia, University of Arizona, Tucson. pp. 8-16.

(7) Melton, Mark A. 1965. The geomorphic and paleoclimatic significance of alluvial deposits in southern Arizona. Journal of Geology, vol. 73, no. 1, pp. 1-38.

(8) Tedrow, J. C. F. 1969. Preface. Soil Sci., vol. 107, no. 6, pp. 393-394.

(9) United States Department of Agriculture. 1950. Soil Survey of Duncan Area, Arizona-New Mexico. Soil Conserv. Serv., 48 pp., illus.

(10) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(11) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(12) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

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 body of alluvium, with or without debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the steam emerges from a narrow valley onto a plain.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

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	0 to 3.5
Low	3.5 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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

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.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—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.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

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 (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the

surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressional and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict fan, no longer active, incised by younger and lower alluvial fans. An abandoned former alluvial fan.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

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.

Geomorphic surface. A landform, or group of landforms, that represents an episode of landscape development.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hillside. The steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill.

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:
A horizon.—The mineral horizon 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 transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky

structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have 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 in which the solum 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 a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

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.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). 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 downward through the saturated 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 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, 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.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure 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
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Rooting depth, observed. The depth to which the majority of the plant roots penetrate the soil; i.e., the depth at which the number of roots observed changes from many or common to few.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil 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 (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It 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 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 plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or 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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top, or highest level of an upland feature such as a hill, mountain, or tableland.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Water supplying capacity. Available water in the soil at the start of the growing season plus precipitation, less runoff and evaporation, *or* plus run-on from higher-lying areas.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-77 at Clifton, Ariz.]

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	61.8	30.9	46.4	75	18	215	.83	.12	1.34	2	.0
February---	66.9	35.5	51.2	82	22	327	.67	.09	1.11	2	.3
March------	72.7	40.1	56.3	88	28	505	.77	---	1.33	3	.0
April------	80.8	47.4	64.1	94	35	723	.29	---	.51	1	.0
May--------	89.9	55.5	72.7	102	41	1,014	.18	---	.34	1	.0
June-------	99.4	65.2	82.3	109	51	1,269	.40	---	.73	1	.0
July-------	101.0	70.7	85.9	110	62	1,423	2.23	1.26	3.01	6	.0
August-----	98.5	69.2	83.9	107	61	1,361	2.07	.76	3.11	6	.0
September--	94.0	63.8	78.9	104	53	1,167	1.59	.19	2.68	4	.0
October----	84.3	52.9	68.6	96	38	887	1.31	.26	2.14	3	.0
November---	71.5	39.2	55.4	84	23	462	.56	.07	.92	2	.0
December---	62.0	31.7	46.9	75	20	228	1.20	.07	2.02	3	.3
Yearly:											
Average--	81.9	50.2	66.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	111	15	---	---	---	---	---	---
Total----	---	---	---	---	---	9,581	12.10	9.39	14.63	34	.6

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-77 at Clifton, Ariz.]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	February 27	March 11	March 29
2 years in 10 later than--	February 16	March 2	March 21
5 years in 10 later than--	January 24	February 14	March 6
First freezing temperature in fall:			
1 year in 10 earlier than--	November 23	November 10	November 5
2 years in 10 earlier than--	December 2	November 19	November 11
5 years in 10 earlier than--	December 21	December 7	November 23

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-77 at Clifton, Ariz.]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	281	261	235
8 years in 10	297	273	244
5 years in 10	332	296	261
2 years in 10	>365	319	278
1 year in 10	>365	331	287

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Graham County	Greenlee County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
1	Akela-Lehmans-Rock outcrop complex, 9 to 60 percent slopes	13,870	1,570	15,440	2.0
2	Anthony-Gila complex, 0 to 5 percent slopes	5,115	350	5,465	0.7
3	Aravaipa extremely gravelly loam, 5 to 40 percent slopes	8,805	0	8,805	1.2
4	Artesia extremely cobbly sandy clay loam, 0 to 8 percent slopes	6,915	845	7,760	1.0
5	Bonita very cobbly silty clay, 2 to 8 percent slopes	550	13,525	14,075	1.8
6	Calciorthids and Torriorthents, 10 to 90 percent slopes	7,790	3,890	11,680	1.5
7	Comoro-Santo Tomas complex, 2 to 8 percent slopes	5,445	0	5,445	0.7
8	Continental gravelly clay loam, 2 to 15 percent slopes	0	7,370	7,370	1.0
9	Continental-Dona Ana complex, 2 to 15 percent slopes	5,115	0	5,115	0.7
10	Eba-Pinaleno complex, 2 to 40 percent slopes	3,705	245	3,950	0.5
11	Eloma-Alsco complex, 15 to 70 percent slopes	8,995	3,290	12,285	1.6
12	Eloma-White House association, 10 to 60 percent slopes	4,965	0	4,965	0.7
13	Fallsam-Cabezon-Rock outcrop complex, 9 to 70 percent slopes	22,545	13,430	35,975	4.7
14	Gila fine sandy loam, 0 to 2 percent slopes	0	1,245	1,245	0.2
15	Glendale silty clay loam, 0 to 2 percent slopes	0	1,085	1,085	0.1
16	Glendale-Gila complex, 0 to 5 percent slopes, severely eroded	7,460	6,320	13,780	1.8
17	Guest silty clay, 0 to 2 percent slopes	0	1,700	1,700	0.2
18	Guest-Hantz complex, 0 to 5 percent slopes, severely eroded	80	6,165	6,245	0.8
19	Hantz silty clay, 0 to 2 percent slopes	0	490	490	0.1
20	Hap gravelly sandy loam, 2 to 8 percent slopes	10,385	0	10,385	1.4
21	Hap-Pinaleno association, 9 to 60 percent slopes	4,960	0	4,960	0.7
22	Haplargids-Torriorthents complex, 5 to 40 percent slopes	9,675	32,210	41,885	5.5
23	Limpia-Graham-Rock outcrop complex, 9 to 50 percent slopes	52,100	91,435	143,535	17.8
24	Maloy extremely stony sandy loam, 2 to 15 percent slopes	2,035	0	2,035	0.3
25	Peloncillo extremely cobbly sandy clay loam, 2 to 10 percent slopes	11,690	225	11,915	1.6
26	Peloncillo-Orthents-Pinaleno complex, 20 to 90 percent slopes	35,290	980	36,270	4.8
27	Pima silty clay loam, 0 to 2 percent slopes	0	4,155	4,155	0.5
28	Pinaleno very cobbly loam, 5 to 30 percent slopes	11,760	10,715	22,475	3.0
29	Pinaleno-Whitlock-Tres Hermanos complex, 2 to 30 percent slopes	13,780	0	13,780	1.8
30	Pits-Dumps association	0	7,445	7,445	1.0
31	Rock outcrop-Atascosa-Graham complex, 9 to 70 percent slopes	53,010	41,460	94,470	12.4
32	Rock outcrop-Chiricahua Variant complex, 5 to 90 percent slopes	730	4,105	4,835	0.6
33	Rock outcrop-Lampshire complex, 20 to 90 percent slopes	5,900	0	5,900	0.8
34	Rock outcrop-Luzena complex, 20 to 90 percent slopes	24,790	7,385	32,175	4.2
35	Rock outcrop-Mokiak complex, 20 to 90 percent slopes	1,200	12,725	13,925	1.8
36	Santo Tomas extremely stony sandy loam, 2 to 10 percent slopes	1,770	0	1,770	0.2
37	Selevin extremely stony loam, 2 to 15 percent slopes	2,315	0	2,315	0.3
38	Signal very cobbly clay loam, 10 to 40 percent slopes	0	17,700	17,700	2.3
39	Sonoita-Bucklebar complex, 2 to 10 percent slopes	8,140	5,160	13,300	1.7
40	Stellar gravelly sandy clay loam, 0 to 5 percent slopes	0	4,425	4,425	0.6
41	Tapco-Peloncillo association, 2 to 15 percent slopes	5,685	18,415	24,100	3.2
42	Torrifluvents-Riverwash complex, 1 to 5 percent slopes	4,260	8,095	12,355	1.6
43	Tres Hermanos-Continental-Nickel complex, 2 to 45 percent slopes	4,950	52,370	57,320	7.5
44	Wampoo gravelly loam, 2 to 10 percent slopes	1,650	12,205	13,855	1.8
45	Whitlock-Tres Hermanos complex, 2 to 20 percent slopes	9,840	0	9,840	1.3
	Total	372,845	397,155	770,000	100.0

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1*:					
Akela	Limy Slopes, 7- to 12-inch precipitation zone	Favorable	800	Black grama	25
		Normal	400	Sideoats grama	15
		Unfavorable	150	Bush muhly	15
				Cane bluestem	5
				Sand dropseed	5
				Slim tridens	5
				Arizona cottontop	5
				Desert needlegrass	5
				False-mesquite	5
Lehmans	Basalt Hills, 7- to 12-inch precipitation zone	Favorable	800	Black grama	25
		Normal	600	Sideoats grama	20
		Unfavorable	400	Tobosa	15
				Arizona cottontop	5
				Cane bluestem	5
				Curlymesquite	5
				Green sprangletop	5
				Plains lovegrass	5
Rock outcrop.					
2*:					
Anthony	Sandy Loam Upland, 7- to 12-inch precipitation zone	Favorable	650	Bush muhly	40
		Normal	500	Black grama	20
		Unfavorable	450	Plains bristlegrass	10
				Arizona cottontop	5
				Threeawn	5
				Hairy grama	5
				Sideoats grama	5
				Spike dropseed	5
				Soaptree yucca	5
Gila	Loamy Upland, 7- to 12-inch precipitation zone	Favorable	800	Bush muhly	40
		Normal	700	Giant sacaton	10
		Unfavorable	500	Alkali sacaton	10
				Tobosa	10
				Arizona cottontop	10
				Creosotebush	10
				Soaptree yucca	5
				Crucifixion-thorn	5
3---------- Aravaipa	Granite Hills, 12- to 16-inch precipitation zone	Favorable	1,100	Sideoats grama	20
		Normal	750	Blue grama	15
		Unfavorable	550	Emory oak	12
				Hairy grama	10
				Black grama	10
				Threeawn	5
				Slender grama	5
				Cane bluestem	5
				Skunkbush sumac	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
4---------- Artesia	Clay Loam Upland, 7- to 12-inch precipitation zone------	Favorable	1,000	Tobosa----------	25
		Normal	500	Arizona cottontop----------	15
		Unfavorable	300	Black grama----------	10
				Bush muhly----------	10
				Sideoats grama----------	10
				Vine-mesquite----------	5
				Green sprangletop----------	5
				Plains bristlegrass----------	5
				Cane bluestem----------	5
				Fourwing saltbush----------	5
5---------- Bonita	Clay Upland, 12- to 16-inch precipitation zone----------	Favorable	1,300	Tobosa----------	40
		Normal	1,000	Sideoats grama----------	20
		Unfavorable	800	Vine-mesquite----------	15
				Cane bluestem----------	10
				Plains bristlegrass----------	10
				Rothrock grama----------	5
6*:					
Calciorthids------	Breaks, 7- to 12-inch precipitation zone----------	Favorable	300	Saltbush----------	40
		Normal	150	Tobosa----------	15
		Unfavorable	50	Threeawn----------	10
				Ocotillo----------	10
				Broom snakeweed----------	10
				Mormon-tea----------	5
				Annual forbs----------	5
				Burroweed----------	5
Torriorthents-----	Breaks, 7- to 12-inch precipitation zone----------	Favorable	300	Saltbush----------	40
		Normal	150	Tobosa----------	15
		Unfavorable	50	Threeawn----------	10
				Ocotillo----------	10
				Broom snakeweed----------	10
				Mormon-tea----------	5
				Annual forbs----------	5
				Burroweed----------	5
7*:					
Comoro----------	Sand Bottom, 7- to 12-inch precipitation zone----------	Favorable	1,250	Bush muhly----------	40
		Normal	1,000	Black grama----------	20
		Unfavorable	800	Plains bristlegrass----------	10
				Hairy grama----------	5
				Sideoats grama----------	5
				Arizona cottontop----------	5
Santo Tomas-------	Sand Bottom, 7- to 12-inch precipitation zone----------	Favorable	3,000	Sideoats grama----------	15
		Normal	1,100	Arizona cottontop----------	15
		Unfavorable	800	Bottlebrush squirreltail------	10
				Vine-mesquite----------	5
				Plains bristlegrass----------	5
				Plains lovegrass----------	5
				Cane bluestem----------	5
				Bush muhly----------	5
				Green sprangletop----------	5
				Threeawn----------	5
				Dropseed----------	5
				Catclaw acacia----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
8---------- Continental	Loamy Upland, 7- to 12-inch precipitation zone----------	Favorable	1,000	Black grama----------	20
		Normal	800	Bush muhly----------	20
		Unfavorable	550	Tobosa----------	20
				Sideoats grama----------	15
				Blue grama----------	10
				Plains bristlegrass----------	5
				Arizona cottontop----------	5
9*:					
Continental-------	Loamy Upland, 7- to 12-inch precipitation zone----------	Favorable	1,000	Black grama----------	20
		Normal	800	Bush muhly----------	20
		Unfavorable	550	Tobosa----------	20
				Sideoats grama----------	15
				Blue grama----------	10
				Plains bristlegrass----------	5
				Arizona cottontop----------	5
Dona Ana----------	Sandy Loam Upland, 7- to 12-inch precipitation zone------	Favorable	600	Black grama----------	25
		Normal	400	Bush muhly----------	25
		Unfavorable	300	Creosotebush----------	10
				Plains bristlegrass----------	10
				Sand dropseed----------	5
				Arizona cottontop----------	5
				Sideoats grama----------	5
10*:					
Eba----------	Clay Loam Upland, 7- to 12-inch precipitation zone------	Favorable	1,000	Tobosa----------	25
		Normal	700	Arizona cottontop----------	15
		Unfavorable	300	Bush muhly----------	10
				Sideoats grama----------	10
				Vine-mesquite----------	5
				Cane bluestem----------	5
				Fourwing saltbush----------	5
				American tarbush----------	5
				Broom snakeweed----------	5
				False-mesquite----------	5
Pinaleno----------	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Creosotebush----------	35
		Normal	200	Bush muhly----------	25
		Unfavorable	50	Black grama----------	10
				Ocotillo----------	5
				Desert zinnia----------	5
				Mariola----------	5
				Threeawn----------	5
				Slim tridens----------	5
				Fluffgrass----------	5
11*:					
Eloma----------	Loamy Upland, 12- to 16-inch precipitation zone----------	Favorable	1,300	Sideoats grama----------	25
		Normal	900	Black grama----------	15
		Unfavorable	600	Plains lovegrass----------	10
				Hairy grama----------	10
				Shrubby buckwheat----------	10
				Threeawn----------	5
				False-mesquite----------	5
				Curlymesquite----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
11*:					
Alsco	Limy Slopes, 12- to 16-inch precipitation zone	Favorable	400	Creosotebush	35
		Normal	200	Bush muhly	25
		Unfavorable	50	Black grama	10
				Mariola	5
				Slim tridens	5
				Threeawn	5
				Desert zinnia	5
				Fluffgrass	5
				Ocotillo	5
12*:					
Eloma	Loamy Upland, 12- to 16-inch precipitation zone	Favorable	1,300	Sideoats grama	25
		Normal	900	Black grama	15
		Unfavorable	600	Plains lovegrass	10
				Hairy grama	10
				Shrubby buckwheat	10
				Threeawn	5
				False-mesquite	5
				Curlymesquite	5
White House	Clay Hills, 12- to 16-inch precipitation zone	Favorable	1,800	Sideoats grama	20
		Normal	1,200	Blue grama	15
		Unfavorable	600	Black grama	10
				Cane bluestem	10
				Plains lovegrass	10
				Arizona cottontop	6
				Vine-mesquite	5
				Plains bristlegrass	5
				Shrubby buckwheat	5
				False-mesquite	5
13*:					
Fallsam	Basalt Hills, 16- to 20-inch precipitation zone	Favorable	1,000	Sideoats grama	30
		Normal	700	Black grama	10
		Unfavorable	500	Tobosa	10
				Curlymesquite	5
				Plains lovegrass	5
				Green sprangletop	5
				Banana yucca	5
Cabezon	Basalt Hills, 16- to 20-inch precipitation zone	Favorable	1,250	Sideoats grama	30
		Normal	900	Tobosa	15
		Unfavorable	600	Black grama	10
				Curlymesquite	5
				Plains lovegrass	5
				Green sprangletop	5
Rock outcrop.					
14	Loam Bottom, 7- to 12-inch precipitation zone	Favorable	3,000	Giant sacaton	30
Gila		Normal	2,000	Sideoats grama	10
		Unfavorable	1,000	Tobosa	10
				Vine-mesquite	10
				Cane bluestem	5
				Green sprangletop	5
				Plains bristlegrass	5
				Alkali sacaton	5
				Bottlebrush squirreltail	5
				Bush muhly	5
				Black grama	5
				Plains lovegrass	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
15---------- Glendale	Loam Bottom, 7- to 12-inch precipitation zone----------	Favorable	3,000	Giant sacaton----------	30
		Normal	2,000	Sideoats grama----------	10
		Unfavorable	1,000	Tobosa----------	10
				Vine-mesquite----------	10
				Cane bluestem----------	5
				Green sprangletop----------	5
				Plains bristlegrass----------	5
				Alkali sacaton----------	5
				Bottlebrush squirreltail------	5
				Bush muhly----------	5
				Black grama----------	5
				Plains lovegrass----------	5
16*:					
Glendale----------	Loamy Upland, 7- to 12-inch precipitation zone----------	Favorable	800	Bush muhly----------	40
		Normal	700	Giant sacaton----------	10
		Unfavorable	500	Alkali sacaton----------	10
				Tobosa----------	10
				Arizona cottontop----------	10
				Creosotebush----------	10
				Soaptree yucca----------	5
				Crucifixion-thorn----------	5
Gila----------	Loamy Upland, 7- to 12-inch precipitation zone----------	Favorable	800	Bush muhly----------	40
		Normal	700	Giant sacaton----------	10
		Unfavorable	500	Alkali sacaton----------	10
				Tobosa----------	10
				Arizona cottontop----------	10
				Creosotebush----------	10
				Soaptree yucca----------	5
				Crucifixion-thorn----------	5
17---------- Guest	Clay Bottom, 7- to 12-inch precipitation zone----------	Favorable	1,000	Tobosa----------	50
		Normal	600	Vine-mesquite----------	25
		Unfavorable	100	Cane bluestem----------	5
				Twoflower trichloris----------	5
				Plains bristlegrass----------	5
				Sideoats grama----------	5
18*:					
Guest----------	Saline, 7- to 12-inch precipitation zone----------	Favorable	1,050	Alkali sacaton----------	50
		Normal	700	Tobosa----------	20
		Unfavorable	350	Saltbush----------	15
				Vine-mesquite----------	5
				Mat muhly----------	5
				Inland saltgrass----------	5
Hantz----------	Saline, 7- to 12-inch precipitation zone----------	Favorable	1,050	Alkali sacaton----------	50
		Normal	700	Tobosa----------	20
		Unfavorable	300	Saltbush----------	15
				Vine-mesquite----------	5
				Mat muhly----------	5
				Inland saltgrass----------	5
19---------- Hantz	Clay Bottom, 7- to 12-inch precipitation zone----------	Favorable	1,000	Tobosa----------	50
		Normal	600	Vine-mesquite----------	25
		Unfavorable	100	Cane bluestem----------	5
				Twoflower trichloris----------	5
				Plains bristlegrass----------	5
				Sideoats grama----------	5
				Seepwillow----------	5
				Catclaw acacia----------	5
				Alkali sacaton----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
20---------- Hap	Sandy Loam Upland, 7- to 12-inch precipitation zone------	Favorable	650	Bush muhly----------	30
		Normal	550	Arizona cottontop----------	15
		Unfavorable	450	Black grama----------	10
				Plains bristlegrass----------	10
				Sideoats grama----------	5
				Cane bluestem----------	5
				Hairy grama----------	5
				Mormon-tea----------	5
				Soaptree yucca----------	5
21*:					
Hap----------	Sandy Loam Upland, 7- to 12-inch precipitation zone------	Favorable	650	Bush muhly----------	30
		Normal	550	Arizona cottontop----------	15
		Unfavorable	450	Black grama----------	10
				Plains bristlegrass----------	10
				Sideoats grama----------	5
				Cane bluestem----------	5
				Hairy grama----------	5
				Mormon-tea----------	5
				Soaptree yucca----------	5
Pinaleno----------	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Creosotebush----------	35
		Normal	200	Bush muhly----------	25
		Unfavorable	50	Black grama----------	10
				Ocotillo----------	5
				Desert zinnia----------	5
				Mariola----------	5
				Threeawn----------	5
				Slim tridens----------	5
				Fluffgrass----------	5
22*:					
Haplargids--------	Breaks, 7- to 12-inch precipitation zone----------	Favorable	300	Saltbush----------	40
		Normal	150	Tobosa----------	15
		Unfavorable	50	Threeawn----------	10
				Ocotillo----------	10
				Broom snakeweed----------	10
				Mormon-tea----------	10
				Burroweed----------	5
				Annual forbs----------	5
Torriorthents-----	Breaks, 7- to 12-inch precipitation zone----------	Favorable	300	Saltbush----------	40
		Normal	150	Tobosa----------	15
		Unfavorable	50	Threeawn----------	10
				Ocotillo----------	10
				Broom snakeweed----------	10
				Mormon-tea----------	5
				Burroweed----------	5
				Annual forbs----------	5
23*:					
Limpia----------	Basalt Hills, 12- to 16-inch precipitation zone----------	Favorable	750	Tobosa----------	15
		Normal	550	Sideoats grama----------	10
		Unfavorable	300	Cane bluestem----------	10
				Bush muhly----------	10
				Curlymesquite----------	10
				Green sprangletop----------	10
				Arizona cottontop----------	10
				Black grama----------	10
				Hairy grama----------	5
				Threeawn----------	5
				Yerba-de-pasmo----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Graham	Basalt Hills, 12- to 16-inch precipitation zone	Favorable	1,000	Black grama	30
		Normal	800	Sideoats grama	20
		Unfavorable	500	Cane bluestem	10
				Arizona cottontop	5
				Curlymesquite	5
				Threeawn	5
				Tanglehead	5
				Green sprangletop	5
				False-mesquite	5
				Yerba-de-pasmo	5
Rock outcrop.					
24 Maloy	Loamy Upland, 12- to 16-inch precipitation zone	Favorable	1,000	Sideoats grama	25
		Normal	750	Black grama	15
		Unfavorable	500	Bush muhly	10
				Arizona cottontop	10
				Cane bluestem	10
				Threeawn	10
				Sand dropseed	7
				Green sprangletop	5
				Catclaw acacia	5
25 Peloncillo	Limy Upland, 7- to 12-inch precipitation zone	Favorable	400	Creosotebush	35
		Normal	200	Bush muhly	25
		Unfavorable	50	Black grama	10
				Threeawn	5
				Slim tridens	5
				Fluffgrass	5
				Mariola	5
				Desert zinnia	5
				Ocotillo	5
26*:					
Peloncillo	Limy Upland, 7- to 12-inch precipitation zone	Favorable	400	Creosotebush	35
		Normal	200	Bush muhly	25
		Unfavorable	50	Black grama	10
				Threeawn	5
				Slim tridens	5
				Fluffgrass	5
				Mariola	5
				Desert zinnia	5
				Ocotillo	5
Orthents.					
Pinaleno	Limy Upland, 7- to 12-inch precipitation zone	Favorable	400	Creosotebush	35
		Normal	200	Bush muhly	25
		Unfavorable	50	Black grama	10
				Ocotillo	5
				Desert zinnia	5
				Mariola	5
				Threeawn	5
				Slim tridens	5
				Fluffgrass	5
27 Pima	Loam Bottom, 7- to 12-inch precipitation zone	Favorable	3,000	Giant sacaton	30
		Normal	2,000	Sideoats grama	10
		Unfavorable	1,000	Tobosa	10
				Vine-mesquite	10
				Cane bluestem	5
				Green sprangletop	5
				Plains bristlegrass	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
28---------- Pinaleno	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Creosotebush----------	35
		Normal	200	Bush muhly----------	25
		Unfavorable	50	Black grama----------	10
				Ocotillo----------	5
				Desert zinnia----------	5
				Mariola----------	5
				Threeawn----------	5
				Slim tridens----------	5
				Fluffgrass----------	5
29*:					
Pinaleno----------	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Creosotebush----------	35
		Normal	200	Bush muhly----------	25
		Unfavorable	50	Black grama----------	10
				Ocotillo----------	5
				Desert zinnia----------	5
				Mariola----------	5
				Threeawn----------	5
				Slim tridens----------	5
				Fluffgrass----------	5
Whitlock----------	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Creosotebush----------	50
		Normal	250	Bush muhly----------	20
		Unfavorable	100	Whitethorn----------	10
				Black grama----------	5
				Slim tridens----------	5
				Threeawn----------	5
Tres Hermanos-----	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Bush muhly----------	30
		Normal	250	Creosotebush----------	30
		Unfavorable	100	Black grama----------	10
				Slim tridens----------	10
				Mescat acacia----------	10
				Desert zinnia----------	5
31*:					
Rock outcrop.					
Atascosa----------	Volcanic Hills, 12- to 16-inch precipitation zone----------	Favorable	1,250	Plains lovegrass----------	25
		Normal	900	Sideoats grama----------	25
		Unfavorable	650	Cane bluestem----------	15
				Black grama----------	10
				Tanglehead----------	10
				Hairy grama----------	5
				Threeawn----------	5
				Bush muhly----------	5
Graham----------	Basalt Hills, 12- to 16-inch precipitation zone----------	Favorable	1,000	Black grama----------	30
		Normal	800	Sideoats grama----------	20
		Unfavorable	500	Cane bluestem----------	10
				Arizona cottontop----------	5
				Curlymesquite----------	5
				Threeawn----------	5
				Tanglehead----------	5
				Green sprangletop----------	5
				False-mesquite----------	5
				Yerba-de-pasmo----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
32*:					
Rock outcrop.					
Chiricahua Variant	Granitic Hills, 12- to 16-inch precipitation zone	Favorable	1,250	Sideoats grama	20
		Normal	900	Hairy grama	10
		Unfavorable	600	Black grama	10
				Cane bluestem	10
				Plains lovegrass	10
				Slender grama	5
				Threeawn	5
				Bullgrass	5
				Plains bristlegrass	5
				Wooly bunchgrass	5
				Arizona cottontop	5
				False-mesquite	5
33*:					
Rock outcrop.					
Lampshire	Granitic Hills, 12- to 16-inch precipitation zone	Favorable	1,250	Sideoats grama	20
		Normal	900	Hairy grama	10
		Unfavorable	600	Black grama	10
				Cane bluestem	10
				Plains lovegrass	10
				Slender grama	5
				Threeawn	5
				Bullgrass	5
				Plains bristlegrass	5
				Wooly bunchgrass	5
				Arizona cottontop	5
				False-mesquite	5
34*:					
Rock outcrop.					
Luzena	Volcanic Hills, 16- to 20-inch precipitation zone	Favorable	1,500	Sideoats grama	15
		Normal	1,000	Plains lovegrass	15
		Unfavorable	600	Cane bluestem	15
				Black grama	10
				Wooly bunchgrass	5
				Sideflower crinkleawn	5
				Blue grama	5
				Hairy grama	5
				Slender grama	5
				Curlymesquite	5
				Emory oak	5
				Juniper	5
35*:					
Rock outcrop.					
Mokiak	Granitic Hills, 12- to 16-inch precipitation zone	Favorable	1,500	Sideoats grama	20
		Normal	1,000	Black grama	10
		Unfavorable	600	Hairy grama	10
				Cane bluestem	10
				Plains lovegrass	10
				Threeawn	5
				Slender grama	5
				Bullgrass	5
				Arizona cottontop	5
				False-mesquite	5
				Skunkbush sumac	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
36---------- Santo Tomas	Sand Bottom, 7- to 12-inch precipitation zone----------	Favorable	3,000	Sideoats grama----------	15
		Normal	1,100	Arizona cottontop----------	15
		Unfavorable	800	Bottlebrush squirreltail------	10
				Vine-mesquite----------	5
				Plains bristlegrass----------	5
				Plains lovegrass----------	5
				Cane bluestem----------	5
				Bush muhly----------	5
				Green sprangletop----------	5
				Threeawn----------	5
				Dropseed----------	5
				Catclaw acacia----------	5
37---------- Selevin	Clay Loam Upland, 12- to 16-inch precipitation zone------	Favorable	1,000	Tobosa----------	25
		Normal	700	Sideoats grama----------	15
		Unfavorable	500	Curlymesquite----------	15
				Plains lovegrass----------	10
				Plains bristlegrass----------	10
				Black grama----------	5
				Threeawn----------	5
				Bush muhly----------	5
				Snakeweed----------	5
38---------- Signal	Clay Hills, 12- to 16-inch precipitation zone----------	Favorable	2,350	Sideoats grama----------	30
		Normal	1,200	Black grama----------	10
		Unfavorable	800	Tobosa----------	10
				Cane bluestem----------	10
				Vine-mesquite----------	5
				Curlymesquite----------	5
				Green sprangletop----------	5
				Bush muhly----------	5
				Hairy grama----------	5
				Plains bristlegrass----------	5
39*:					
Sonoita----------	Sandy Loam Upland, 7- to 12-inch precipitation zone------	Favorable	1,000	Bush muhly----------	40
		Normal	800	Black grama----------	20
		Unfavorable	550	Plains bristlegrass----------	10
				Sideoats grama----------	5
				Hairy grama----------	5
				Arizona cottontop----------	5
Bucklebar---------	Sandy Loam Upland, 7- to 12-inch precipitation zone------	Favorable	1,000	Bush muhly----------	40
		Normal	800	Black grama----------	20
		Unfavorable	550	Plains bristlegrass----------	10
				Sideoats grama----------	5
				Hairy grama----------	5
				Arizona cottontop----------	5
40---------- Stellar	Clay Loam Upland, 7- to 12-inch precipitation zone------	Favorable	1,000	Tobosa----------	30
		Normal	650	Black grama----------	15
		Unfavorable	300	Bush muhly----------	10
				Sideoats grama----------	10
				Plains bristlegrass----------	5
				Green sprangletop----------	5
				Arizona cottontop----------	5
				Soaptree yucca----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
41*:					
Tapco	Clay Loam Upland, 7- to 12-inch precipitation zone	Favorable	1,000	Tobosa	30
		Normal	650	Black grama	20
		Unfavorable	300	Sideoats grama	10
				Arizona cottontop	5
				Bush muhly	5
				Green sprangletop	5
				Plains bristlegrass	5
				Cane bluestem	5
				Vine-mesquite	5
				Desertthorn	5
				Catclaw acacia	5
Peloncillo	Limy Upland, 7- to 12-inch precipitation zone	Favorable	400	Creosotebush	35
		Normal	200	Bush muhly	25
		Unfavorable	50	Black grama	10
				Threeawn	5
				Slim tridens	5
				Fluffgrass	5
				Mariola	5
				Desert zinnia	5
				Ocotillo	5
42*:					
Torrifluvents	Sand Bottom, 7- to 12-inch precipitation zone	Favorable	1,250	Bush muhly	40
		Normal	1,000	Black grama	20
		Unfavorable	800	Plains bristlegrass	10
				Hairy grama	5
				Sideoats grama	5
				Arizona cottontop	5
Riverwash.					
43*:					
Tres Hermanos	Limy Upland, 7- to 12-inch precipitation zone	Favorable	400	Bush muhly	30
		Normal	250	Creosotebush	30
		Unfavorable	100	Black grama	10
				Slim tridens	10
				Mescat acacia	10
				Desert zinnia	5
Continental	Loamy Upland, 7- to 12-inch precipitation zone	Favorable	1,000	Black grama	20
		Normal	800	Bush muhly	20
		Unfavorable	550	Tobosa	20
				Sideoats grama	15
				Blue grama	10
				Plains bristlegrass	5
				Arizona cottontop	5
Nickel	Limy Upland, 7- to 12-inch precipitation zone	Favorable	600	Creosotebush	40
		Normal	300	Black grama	20
		Unfavorable	100	Bush muhly	15
				Arizona cottontop	5
				Cane bluestem	5
				Slim tridens	5
				Fluffgrass	5
				Catclaw	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
44---------- Wampoo	Clay Upland, 12- to 16-inch precipitation zone----------	Favorable	1,300	Tobosa----------	65
		Normal	900	Sideoats grama----------	10
		Unfavorable	600	Vine-mesquite----------	5
				Curlymesquite----------	5
				Catclaw acacia----------	5
				Desertthorn----------	5
45*:					
Whitlock----------	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Creosotebush----------	50
		Normal	250	Bush muhly----------	20
		Unfavorable	100	Whitethorn----------	10
				Black grama----------	5
				Slim tridens----------	5
				Threeawn----------	5
Tres Hermanos-----	Limy Upland, 7- to 12-inch precipitation zone----------	Favorable	400	Bush muhly----------	30
		Normal	250	Creosotebush----------	30
		Unfavorable	100	Black grama----------	10
				Slim tridens----------	10
				Mescat acacia----------	10
				Desert zinnia----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1*:				
Akela	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones.
Lehmans	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones.
Rock outcrop.				
2*:				
Anthony	Severe: floods.	Slight	Moderate: slope.	Slight.
Gila	Severe: floods.	Slight	Moderate: slope.	Slight.
3--- Aravaipa	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones.
4--- Artesia	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
5--- Bonita	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
6*:				
Calciorthids.				
Torriorthents.				
7*:				
Comoro	Severe: floods.	Slight	Moderate: floods.	Slight.
Santo Tomas	Severe: floods, large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
8--- Continental	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
9*:				
Continental	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Dona Ana	Slight	Slight	Moderate: slope.	Slight.
10*:				
Eba	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones.

See footnote at end of table.

TABLE 6.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
10*:				
Pinaleno	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: large stones, small stones, slope.
11*:				
Eloma	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
Alsco	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
12*:				
Eloma	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
White House	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
13*:				
Fallsam	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
Cabezon	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope.
Rock outcrop.				
14 Gila	Severe: floods.	Slight	Moderate: floods.	Slight.
15 Glendale	Severe: floods.	Slight	Moderate: floods.	Severe: erodes easily.
16*:				
Glendale	Severe: floods.	Slight	Moderate: slope.	Slight.
Gila	Severe: floods.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
17 Guest	Severe: floods.	Moderate: too clayey, percs slowly.	Moderate: floods, too clayey, percs slowly.	Moderate: too clayey.
18*:				
Guest	Severe: floods, excess salt.	Severe: excess salt.	Severe: excess salt.	Moderate: too clayey.
Hantz	Severe: floods, excess salt.	Severe: excess salt.	Severe: excess salt.	Moderate: too clayey.

See footnote at end of table.

TABLE 6.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
19--- Hantz	Severe: floods.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.
20--- Hap	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
21*:				
Hap---	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight.
Pinaleno---	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope, large stones, small stones.
22*:				
Haplargids.				
Torriorthents.				
23*:				
Limpia---	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
Graham---	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.
Rock outcrop.				
24--- Maloy	Severe: large stones, small stones.	Severe: large stones, small stones.	Severe: large stones, slope, small stones.	Severe: large stones.
25--- Peloncillo	Severe: large stones, small stones.	Severe: large stones, small stones.	Severe: large stones, slope, small stones.	Severe: large stones.
26*:				
Peloncillo---	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
Orthents.				
Pinaleno---	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope, small stones.
27--- Pima	Severe: floods.	Slight---	Moderate: floods.	Severe: erodes easily.
28--- Pinaleno	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones.

See footnote at end of table.

TABLE 6.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
29*:				
Pinaleno	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
Whitlock	Slight	Slight	Moderate: slope.	Slight.
Tres Hermanos	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight.
30*:				
Pits.				
Dumps.				
31*:				
Rock outcrop.				
Atascosa	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.
Graham	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope.
32*:				
Rock outcrop.				
Chiricahua Variant	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.
33*:				
Rock outcrop.				
Lampshire	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, small stones.
34*:				
Rock outcrop.				
Luzena	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones.
35*:				
Rock outcrop.				
Mokiak	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.
36-- Santo Tomas	Severe: floods, large stones.	Severe: large stones.	Severe: large stones, slope.	Severe: large stones.
37-- Selevin	Severe: large stones.	Severe: large stones.	Severe: large stones, slope, small stones.	Severe: large stones.

See footnote at end of table.

TABLE 6.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
38--- Signal	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
39*:				
Sonoita---	Slight---	Slight---	Severe: slope.	Slight.
Bucklebar---	Slight---	Slight---	Severe: slope.	Slight.
40--- Stellar	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
41*:				
Tapco---	Severe: large stones, cemented pan.	Severe: large stones, cemented pan.	Severe: large stones, slope, small stones.	Severe: large stones.
Peloncillo---	Severe: large stones, small stones, cemented pan.	Severe: large stones, small stones, cemented pan.	Severe: large stones, slope, small stones.	Severe: large stones.
42*:				
Torrifluvents.				
Riverwash.				
43*:				
Tres Hermanos---	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Continental---	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Nickel---	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.
44--- Wampoo	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight.
45*:				
Whitlock---	Slight---	Slight---	Moderate: slope.	Slight.
Tres Hermanos---	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that 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
1*:									
Akela	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Lehmans	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Rock outcrop.									
2*:									
Anthony	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Gila	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
3--- Aravaipa	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
4--- Artesia	Very poor	Poor	Fair	Poor	Poor	Very poor.	Very poor	Very poor	Poor.
5--- Bonita	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
6*:									
Calciorthids.									
Torriorthents.									
7*:									
Comoro	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Santo Tomas	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
8--- Continental	Very poor	Poor	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
9*:									
Continental	Very poor	Poor	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Dona Ana	Very poor	Very poor.	Poor	Poor	Poor	Very poor.	Very poor	Very poor	Poor.
10*:									
Eba	Very poor	Fair	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair.
Pinaleno	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
11*:									
Eloma	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Alsco	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 7.--WILDLIFE HABITAT--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
12*:									
Eloma	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
White House	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
13*:									
Fallsam	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Poor.
Cabezon	Very poor	Very poor.	Fair	Fair	Poor	Very poor.	Very poor	Very poor	Fair.
Rock outcrop.									
14 Gila	Good	Good	Good	Good	Poor	Poor	Good	Poor	---
15 Glendale	Good	Good	Good	Good	Very poor.	Poor	Good	Poor	---
16*:									
Glendale	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Poor	Poor.
Gila	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
17 Guest	Good	Good	Good	Fair	Good	Good	Good	Good	---
18*:									
Guest	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Hantz	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
19 Hantz	Good	Good	Good	Fair	Good	Good	Good	Good	---
20 Hap	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
21*:									
Hap	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Pinaleno	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
22*:									
Haplargids	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Torriorthents	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
23*:									
Limpia	Very poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
Graham	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 7.--WILDLIFE HABITAT--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
23*: Rock outcrop.									
24---- Maloy	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
25. Peloncillo----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Poor.
26*: Peloncillo----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Poor.
Orthents.									
Pinaleno----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
27---- Pima	Good	Good	Fair	Good	Good	Good	Good	Good	---
28---- Pinaleno	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
29*: Pinaleno----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Whitlock----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Poor.
Tres Hermanos----	Very poor	Very poor.	Poor	Fair	Poor	Very poor.	Very poor	Very poor	Fair.
30*: Pits.									
Dumps.									
31*: Rock outcrop.									
Atascosa----	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Graham----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
32*: Rock outcrop.									
Chiricahua Variant	Very poor	Very poor.	Poor	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
33*: Rock outcrop.									
Lampshire----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
34*: Rock outcrop.									
Luzena----	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 7.--WILDLIFE HABITAT--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
35*:									
Rock outcrop.									
Mokiak	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
36---------- Santo Tomas	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
37---------- Selevin	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
38---------- Signal	Very poor	Poor	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
39*:									
Sonoita	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Bucklebar	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
40.									
Stellar	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
41*:									
Tapco	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
Peloncillo	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Poor.
42*:									
Torrifluvents.									
Riverwash.									
43*:									
Tres Hermanos	Very poor	Very poor.	Poor	Fair	Poor	Very poor.	Very poor	Very poor	Fair.
Continental	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair
Nickel	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
44---------- Wampoo	Very poor	Poor	Fair	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
45*:									
Whitlock	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Tres Hermanos	Very poor	Very poor.	Poor	Fair	Poor	Very poor.	Very poor	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1*:					
Akela	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Lehmans	Severe: depth to rock, slope.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, low strength, slope.
Rock outcrop.					
2*:					
Anthony	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Gila	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
3--- Aravaipa	Severe: slope.	Severe: depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
4--- Artesia	Moderate: cemented pan, too clayey.	Moderate: shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.
5--- Bonita	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
6*:					
Calciorthids.					
Torriorthents.					
7*:					
Comoro	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Santo Tomas	Moderate: large stones, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
8--- Continental	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
9*:					
Continental	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Dona Ana	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell.
10*:					
Eba	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
10*:					
Pinaleno	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
11*:					
Eloma	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: low strength, slope, large stones.
Alsco	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
12*:					
Eloma	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: low strength, slope, large stones.
White House	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
13*:					
Fallsam	Severe: large stones, slope.	Severe: shrink-swell, slope, large stones.	Severe: slope, shrink-swell, large stones.	Severe: shrink-swell, slope, large stones.	Severe: low strength, slope, shrink-swell.
Cabezon	Severe: depth to rock, slope.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, low strength, slope.
Rock outcrop.					
14--- Gila	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
15--- Glendale	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
16*:					
Glendale	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, floods.
Gila	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
17--- Guest	Moderate: too clayey, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, floods, shrink-swell.
18*:					
Guest	Moderate: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
Hantz	Moderate: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
19---------- Hantz	Moderate: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
20---------- Hap	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
21*: Hap----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Pinaleno---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
22*: Haplargids.					
Torriorthents.					
23*: Limpia----------	Severe: slope, large stones.	Severe: shrink-swell, slope, large stones.	Severe: slope, shrink-swell, large stones.	Severe: shrink-swell, slope, large stones.	Severe: low strength, slope, shrink-swell.
Graham----------	Severe: depth to rock, slope.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, low strength, slope.
Rock outcrop.					
24---------- Maloy	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
25---------- Peloncillo	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
26*: Peloncillo-------	Severe: cemented pan, slope.	Severe: slope, cemented pan.	Severe: cemented pan, slope.	Severe: slope, cemented pan.	Severe: cemented pan, slope.
Orthents.					
Pinaleno---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
27---------- Pima	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
28---------- Pinaleno	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
29*: Pinaleno---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Whitlock---------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
29*:					
Tres Hermanos	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, shrink-swell.
30*:					
Pits.					
Dumps.					
31*:					
Rock outcrop.					
Atascosa	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Graham	Severe: depth to rock, slope.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, low strength, slope.
32*:					
Rock outcrop.					
Chiricahua Variant	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
33*:					
Rock outcrop.					
Lampshire	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.
34*:					
Rock outcrop.					
Luzena	Severe: depth to rock, slope.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, low strength, slope.
35*:					
Rock outcrop.					
Mokiak	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
36--- Santo Tomas	Moderate: large stones, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
37--- Selevin	Severe: large stones.	Severe: shrink-swell, large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
38--- Signal	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
39*:					
Sonoita	Slight	Slight	Slight	Moderate: slope.	Slight.
Bucklebar	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.
40--- Stellar	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
41*:					
Tapco	Severe: cemented pan.	Severe: shrink-swell, cemented pan.	Severe: cemented pan, shrink-swell.	Severe: slope, cemented pan.	Severe: cemented pan.
Peloncillo	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: slope, cemented pan.	Severe: cemented pan.
42*:					
Torrifluvents.					
Riverwash.					
43*:					
Tres Hermanos	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, shrink-swell.
Continental	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Nickel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44--- Wampoo	Severe: cemented pan.	Severe: shrink-swell.	Severe: cemented pan, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
45*:					
Whitlock	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Tres Hermanos	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, shrink-swell.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the 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
1*:					
Akela	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Lehmans	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
2*:					
Anthony	Moderate: floods.	Severe: seepage, floods.	Moderate: floods.	Moderate: floods.	Good.
Gila	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
3--- Aravaipa	Severe: depth to rock, slope, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, small stones.
4--- Artesia	Severe: cemented pan, percs slowly.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: area reclaim, small stones.
5--- Bonita	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
6*:					
Calciorthids.					
Torriorthents.					
7*:					
Comoro	Severe: floods.	Severe: seepage, floods.	Severe: floods.	Severe: floods.	Poor: small stones, large stones.
Santo Tomas	Severe: floods.	Severe: floods, large stones.	Severe: floods.	Severe: floods.	Poor: small stones.
8--- Continental	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones.
9*:					
Continental	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones.
Dona Ana	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 9.--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
10*:					
Eba	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Pinaleno	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
11*:					
Eloma	Severe: percs slowly, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Alsco	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
12*:					
Eloma	Severe: percs slowly, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
White House	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
13*:					
Fallsam	Severe: percs slowly, slope, large stones.	Severe: slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, hard to pack, large stones.
Cabezon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
14 Gila	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
15 Glendale	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
16*:					
Glendale	Severe: percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
Gila	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
17 Guest	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: hard to pack.
18*:					
Guest	Severe: percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Poor: hard to pack.

See footnote at end of table.

TABLE 9.--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
18*:					
Hantz	Severe: percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Poor: hard to pack.
19----------					
Hantz	Severe: percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Poor: hard to pack.
20----------					
Hap	Moderate: percs slowly.	Severe: seepage.	Slight----------	Slight----------	Fair: small stones.
21*:					
Hap----------	Moderate: percs slowly.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Pinaleno----------	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.
22*:					
Haplargids.					
Torriorthents.					
23*:					
Limpia----------	Severe: percs slowly, slope, large stones.	Severe: slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
Graham----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
24----------					
Maloy	Severe: large stones.	Severe: seepage, slope, large stones.	Severe: large stones.	Moderate: slope.	Poor: large stones.
25----------					
Peloncillo	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Poor: area reclaim, small stones.
26*:					
Peloncillo---------	Severe: cemented pan, slope.	Severe: cemented pan, slope.	Severe: cemented pan, slope.	Severe: cemented pan, slope.	Poor: area reclaim, small stones, slope.
Orthents.					
Pinaleno----------	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
27----------					
Pima	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
28----------					
Pinaleno	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.

See footnote at end of table.

TABLE 9.--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
29*:					
Pinaleno	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.
Whitlock	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
Tres Hermanos	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.
30*:					
Pits.					
Dumps.					
31*:					
Rock outcrop.					
Atascosa	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Graham	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
32*:					
Rock outcrop.					
Chiricahua Variant	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, small stones.
33*:					
Rock outcrop.					
Lampshire	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Poor: area reclaim, large stones, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope, large stones.
34*:					
Rock outcrop.					
Luzena	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
35*:					
Rock outcrop.					
Mokiak	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
36--Santo Tomas	Severe: floods.	Severe: floods, large stones.	Severe: floods, large stones.	Severe: floods.	Poor: large stones.

See footnote at end of table.

TABLE 9.--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
37---------- Selevin	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.	Moderate: slope.	Poor: large stones.
38---------- Signal	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, small stones, slope.
39*:					
Sonoita----------	Slight----------	Severe: seepage.	Slight----------	Slight----------	Good.
Bucklebar----------	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
40---------- Stellar	Severe: percs slowly.	Moderate: slope.	Slight----------	Slight----------	Fair: small stones.
41*:					
Tapco----------	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.	Severe: cemented pan.	Poor: area reclaim, hard to pack.
Peloncillo---------	Severe: cemented pan.	Severe: cemented pan, slope.	Severe: cemented pan.	Severe: cemented pan.	Poor: area reclaim, small stones.
42*:					
Torrifluvents.					
Riverwash.					
43*:					
Tres Hermanos------	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.
Continental--------	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones.
Nickel----------	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.
44---------- Wampoo	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, too clayey.	Severe: cemented pan.	Poor: area reclaim, too clayey, hard to pack.
45*:					
Whitlock----------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight----------	Poor: seepage, too sandy.
Tres Hermanos------	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1*:				
Akela	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Lehmans	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
2*:				
Anthony	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Gila	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
3---------- Aravaipa	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
4---------- Artesia	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
5---------- Bonita	Poor: thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, large stones, area reclaim.
6*:				
Calciorthids.				
Torriorthents.				
7*:				
Comoro	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Santo Tomas	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
8---------- Continental	Good	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, too clayey, area reclaim.
9*:				
Continental	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey, area reclaim.
Dona Ana	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
10*:				
Eba	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Pinaleno	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
11*:				
Eloma	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Alsco	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
12*:				
Eloma	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
White House	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
13*:				
Fallsam	Poor: low strength, large stones, shrink-swell.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too clayey, large stones, area reclaim.
Cabezon	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.				
14 Gila	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
15 Glendale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
16*:				
Glendale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Gila	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
17 Guest	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
18*:				
Guest	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
18*:				
Hantz	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
19 Hantz	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
20 Hap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
21*:				
Hap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Pinaleno	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
22*:				
Haplargids.				
Torriorthents.				
23*:				
Limpia	Poor: low strength, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Graham	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
Rock outcrop.				
24 Maloy	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
25 Peloncillo	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
26*:				
Peloncillo	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Orthents.				
Pinaleno	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
27 Pima	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
28 Pinaleno	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
29*:				
Pinaleno	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Whitlock	Good	Probable	Improbable: too sandy.	Fair: thin layer.
Tres Hermanos	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
30*:				
Pits.				
Dumps.				
31*:				
Rock outcrop.				
Atascosa	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Graham	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, small stones.
32*:				
Rock outcrop.				
Chiricahua Variant	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
33*:				
Rock outcrop.				
Lampshire	Poor: area reclaim, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
34*:				
Rock outcrop.				
Luzena	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, small stones.
35*:				
Rock outcrop.				
Mokiak	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
36--- Santo Tomas	Poor: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
37--Selevin	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
38--Signal	Poor: slope.	Improbable: small stones.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
39*:				
Sonoita	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Bucklebar	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
40--Stellar	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
41*:				
Tapco	Poor: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
Peloncillo	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
42*:				
Torrifluvents.				
Riverwash.				
43*:				
Tres Hermanos	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Continental	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
Nickel	Poor: slope.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: small stones, area reclaim, slope.
44--Wampoo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
45*:				
Whitlock	Good	Probable	Improbable: too sandy.	Fair: thin layer.
Tres Hermanos	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
1*:					
Akela	Severe: depth to rock, slope.	Severe: thin layer, seepage.	Deep to water	Droughty, depth to rock, slope.	Slope, large stones, depth to rock.
Lehmans	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.
Rock outcrop.					
2*:					
Anthony	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing.
Gila	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing.
3--- Aravaipa	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, depth to rock.
4--- Artesia	Moderate: cemented pan, slope.	Severe: thin layer.	Deep to water	Droughty, cemented pan, slope.	Cemented pan.
5--- Bonita	Moderate: slope.	Moderate: large stones.	Deep to water	Percs slowly, slope.	Large stones, percs slowly.
6*:					
Calciorthids.					
Torriorthents.					
7*:					
Comoro	Severe: seepage.	Moderate: piping.	Deep to water	Droughty, soil blowing, floods, slope.	Soil blowing.
Santo Tomas	Moderate: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Large stones.
8--- Continental	Severe: slope.	Slight	Deep to water	Percs slowly, slope.	Slope, percs slowly.
9*:					
Continental	Severe: slope.	Slight	Deep to water	Percs slowly, slope.	Slope, percs slowly.
Dona Ana	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing.
10*:					
Eba	Severe: seepage, slope.	Slight	Deep to water	Droughty, percs slowly, slope.	Slope, percs slowly.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
10*:					
Pinaleno	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones, too sandy.
11*:					
Eloma	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, percs slowly.	Slope, large stones, percs slowly.
Alsco	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.
12*:					
Eloma	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, percs slowly.	Slope, large stones, percs slowly.
White House	Severe: slope.	Slight	Deep to water	Percs slowly, slope.	Slope, percs slowly.
13*:					
Fallsam	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, percs slowly.	Slope, large stones, percs slowly.
Cabezon	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Large stones, droughty, percs slowly.	Slope, large stones, depth to rock.
Rock outcrop.					
14--Gila	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, floods.	Soil blowing.
15--Glendale	Slight	Slight	Deep to water	Erodes easily, floods.	Erodes easily.
16*:					
Glendale	Slight	Slight	Deep to water	Erodes easily	Erodes easily.
Gila	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
17--Guest	Slight	Moderate: hard to pack.	Deep to water	Percs slowly, floods.	Percs slowly.
18*:					
Guest	Slight	Moderate: hard to pack, excess salts.	Deep to water	Droughty, slow intake, percs slowly.	Percs slowly.
Hantz	Slight	Moderate: hard to pack, excess salts.	Deep to water	Droughty, slow intake, percs slowly.	Percs slowly.
19--Hantz	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly.
20--Hap	Severe: seepage.	Moderate: thin layer.	Deep to water	Soil blowing, slope.	Soil blowing.
21*:					
Hap	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Droughty, slope.	Slope.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
21*:					
Pinaleno	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.
22*:					
Haplargids.					
Torriorthents.					
23*:					
Limpia	Severe: slope.	Severe: large stones.	Deep to water	Large stones, percs slowly, slope.	Slope, large stones, percs slowly.
Graham	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, large stones, depth to rock.
Rock outcrop.					
24--- Maloy	Severe: seepage, slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.
25--- Peloncillo	Severe: cemented pan.	Severe: thin layer.	Deep to water	Droughty, cemented pan, slope.	Cemented pan.
26*:					
Peloncillo	Severe: cemented pan, slope.	Severe: thin layer.	Deep to water	Droughty, cemented pan, slope.	Slope, cemented pan.
Orthents.					
Pinaleno	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.
27--- Pima	Slight	Slight	Deep to water	Erodes easily, floods.	Erodes easily.
28--- Pinaleno	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.
29*:					
Pinaleno	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones, too sandy.
Whitlock	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.
Tres Hermanos	Severe: slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope.
30*:					
Pits.					
Dumps.					
31*:					
Rock outcrop.					

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
31*:					
Atascosa	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.
Graham	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, large stones, depth to rock.
32*:					
Rock outcrop.					
Chiricahua Variant	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, depth to rock, percs slowly.
33*:					
Rock outcrop.					
Lampshire	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.
34*:					
Rock outcrop.					
Luzena	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, large stones, depth to rock.
35*:					
Rock outcrop.					
Mokiak	Severe: slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock.	Slope, depth to rock.
36--- Santo Tomas	Moderate: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Large stones.
37--- Selevin	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, percs slowly.	Slope, large stones, percs slowly.
38--- Signal	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, percs slowly, slope.	Slope, large stones.
39*:					
Sonoita	Severe: seepage.	Slight	Deep to water	Droughty, soil blowing, slope.	Soil blowing.
Bucklebar	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing.
40--- Stellar	Slight	Slight	Deep to water	Percs slowly, slope.	Percs slowly.
41*:					
Tapco	Severe: cemented pan, slope.	Severe: thin layer.	Deep to water	Droughty, percs slowly, cemented pan.	Slope, large stones, cemented pan.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
41*:					
Peloncillo	Severe: cemented pan, slope.	Severe: thin layer.	Deep to water	Droughty, cemented pan, slope.	Slope, cemented pan.
42*:					
Torrifluvents.					
Riverwash.					
43*:					
Tres Hermanos	Severe: slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope.
Continental	Severe: slope.	Slight	Deep to water	Percs slowly, slope.	Slope, percs slowly.
Nickel	Severe: slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.
44 Wampoo	Moderate: cemented pan, slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, cemented pan, slope.	Cemented pan, percs slowly.
45*:					
Whitlock	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.
Tres Hermanos	Severe: slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--ENGINEERING INDEX PROPERTIES

[Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1*:											
Akela	0-1	Extremely gravelly sandy loam.	GM	A-2, A-1	15-25	30-40	25-40	20-30	10-20	15-20	NP-5
	1-7	Extremely gravelly loam, very gravelly sandy loam.	SM, GM	A-2, A-1	15-25	40-70	25-50	20-45	10-30	15-20	NP-5
	7	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Lehmans	0-1	Extremely gravelly clay loam.	GC	A-2	10-20	40-60	35-40	20-30	20-25	30-40	10-20
	1-12	Clay, gravelly clay, gravelly clay loam.	CH, SC	A-7	0-5	75-100	55-90	55-70	40-65	50-60	30-40
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
2*:											
Anthony	0-3	Sandy loam	SM	A-4, A-2	0	95-100	90-100	55-70	30-40	20-30	NP-5
	3-45	Sandy loam, gravelly sandy loam.	SM	A-2	0	65-80	60-95	35-55	20-35	20-30	NP-5
	45-60	Gravelly loamy sand.	SM	A-1, A-2	0-5	65-80	60-75	30-55	10-15	---	NP
Gila	0-4	Fine sandy loam	ML	A-4	0	95-100	95-100	80-90	50-65	15-20	NP-5
	4-60	Stratified silt loam to gravelly sandy loam.	ML, SM	A-4	0	60-100	50-100	50-80	40-65	20-30	NP-5
3 Aravaipa	0-1	Extremely gravelly loam.	GM-GC, GC	A-2	0-5	40-50	20-25	15-25	10-15	25-35	5-15
	1-13	Very gravelly clay, very gravelly clay loam, very gravelly sandy clay.	GC	A-2, A-7	0	40-55	35-50	30-50	20-40	40-50	15-20
	13-45	Weathered bedrock	---	---	---	---	---	---	---	---	---
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
4 Artesia	0-1	Extremely cobbly sandy clay loam.	GC, GM-GC	A-2	50-60	55-65	50-60	40-50	20-35	25-35	10-15
	1-24	Very cobbly clay, very gravelly clay.	GC	A-2, A-6	10-35	40-50	35-50	30-50	20-40	30-35	15-20
	24-25	Cemented	---	---	---	---	---	---	---	---	---
	25-60	Very cobbly loamy sand.	GP-GM, GM, SP-SM, SM	A-1	40-55	40-70	35-70	20-45	5-15	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
5---------- Bonita	0-2	Very cobbly silty clay.	CH	A-7	50-75	90-100	90-100	90-100	85-95	55-65	40-50
	2-31	Silty clay, clay	CH	A-7	0-5	90-100	90-100	90-100	80-90	55-65	40-50
	31-60	Gravelly clay loam, sandy clay loam, very cobbly sandy clay loam.	CL, GC, SC	A-6, A-2	15-65	70-80	65-75	60-70	30-60	30-40	15-20
6*: Calciorthids.											
Torriorthents.											
7*: Comoro----------	0-12	Sandy loam-------	SM	A-2, A-4	0	95-100	95-100	60-70	30-40	10-20	NP-5
	12-41	Stratified gravelly sandy loam to loamy sand.	SM, GM	A-1, A-2, A-4	0-5	55-85	50-75	30-70	20-40	15-25	NP-5
	41-60	Extremely cobbly loamy sand.	GP-GM, SP-SM	A-1	50-60	45-65	35-50	20-30	5-10	---	NP
Santo Tomas-----	0-6	Very cobbly sandy loam.	SM	A-1, A-2	50-60	65-80	60-75	35-45	20-30	15-25	NP-5
	6-60	Very gravelly fine sandy loam, very gravelly sandy loam.	GM	A-1	15-30	30-55	25-50	20-35	10-25	15-25	NP-5
8---------- Continental	0-2	Gravelly clay loam.	CL, SC	A-6, A-2	0-10	70-80	50-75	50-65	30-55	30-40	10-20
	2-34	Clay, very gravelly clay, gravelly sandy clay.	CL, SC, CH	A-7, A-2	0-5	80-95	40-90	30-70	25-65	45-55	20-30
	34-70	Very gravelly loamy sand, very cobbly loamy sand.	GP-GM, SP-SM	A-1	25-60	35-70	30-65	15-50	5-10	---	NP
9*: Continental-----	0-6	Gravelly sandy clay loam.	SC	A-6, A-2	0-10	70-80	50-75	50-60	20-40	25-35	10-15
	6-36	Clay, gravelly clay, gravelly sandy clay.	CL, SC, CH	A-7	0-5	80-95	50-90	50-70	35-65	45-55	20-30
	36-60	Gravelly sandy clay loam, gravelly sandy loam.	SM-SC, SM	A-2	5-15	70-80	50-75	50-60	10-30	20-40	5-10
Dona Ana--------	0-10	Sandy loam-------	SM	A-4, A-2	0	95-100	90-100	60-70	30-40	20-25	NP-5
	10-35	Loam, sandy clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-90	50-80	25-40	5-15
	35-60	Loam, clay loam.	CL-ML, ML	A-4	0	95-100	90-100	80-100	60-80	25-35	5-10

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10*:											
Eba	0-6	Extremely cobbly sandy clay loam.	GM-GC, GC	A-4, A-2	50-60	50-70	40-60	35-55	30-45	25-35	5-10
	6-32	Very gravelly sandy clay, very cobbly sandy clay.	GC	A-2, A-6, A-7	5-45	35-60	30-50	25-55	25-50	35-50	15-30
	32-48	Extremely gravelly sandy clay loam.	GC, GM	A-2	5-25	35-40	30-35	25-35	15-20	35-40	10-20
	48-60	Very cobbly loamy sand.	SM	A-2, A-1	50-60	50-70	40-60	25-40	10-20	---	NP
Pinaleno	0-2	Very cobbly loam	SM-SC, GM-GC	A-2, A-4	45-60	65-80	60-75	45-60	30-50	20-30	5-10
	2-30	Very gravelly sandy loam, very gravelly clay loam.	GM-GC	A-2	0-20	30-55	25-50	15-45	10-30	20-30	5-10
	30-60	Gravelly sandy loam.	GM, SM	A-1	0-20	55-65	50-60	30-40	15-25	---	NP
11*:											
Eloma	0-2	Very cobbly loam	CL-ML, SM-SC	A-4	50-75	65-90	55-85	50-75	40-55	20-30	5-10
	2-45	Very cobbly clay loam, extremely cobbly clay, extremely cobbly sandy clay.	CL, SC	A-6, A-7	30-75	50-90	40-85	40-80	35-65	40-50	20-25
	45-60	Extremely cobbly sandy loam, very cobbly loam.	SM	A-2, A-1	50-75	35-85	30-80	30-55	20-30	15-20	NP-5
Alsco	0-2	Extremely cobbly sandy loam.	SM, GM	A-1, A-2	45-85	55-80	45-70	30-45	15-30	15-20	NP-5
	2-16	Very cobbly clay loam, very cobbly sandy clay loam.	SC, GC	A-2, A-6	45-85	55-80	45-70	40-65	20-50	30-35	10-15
	16-21	Very gravelly loam, very gravelly sandy loam.	SM, GM	A-1, A-2	10-20	55-80	30-50	30-45	10-30	15-20	NP-5
	21-60	Extremely cobbly sandy loam.	SM, GM	A-1, A-2	45-85	55-80	45-70	30-45	15-30	15-20	NP-5
12*:											
Eloma	0-2	Very cobbly loam	CL-ML, SM-SC	A-4	50-75	65-90	55-85	50-75	40-55	20-30	5-10
	2-45	Very cobbly clay loam, extremely cobbly clay, extremely cobbly sandy clay.	CL, SC	A-6, A-7	30-75	50-90	40-85	40-80	35-65	40-50	20-25
	45-60	Extremely cobbly sandy loam, very cobbly loam.	SM	A-2, A-1	50-75	35-85	30-80	30-55	20-30	15-20	NP-5
White House	0-1	Gravelly loam----	CL, SC	A-6	0-10	80-95	70-75	50-70	40-55	25-35	15-25
	1-25	Clay, clay loam	CH	A-7	0-5	90-100	80-95	70-90	60-90	50-60	30-40
	25-46	Clay loam, sandy clay.	CL, ML, SC, SM	A-6	0-10	90-100	80-95	70-90	40-60	35-45	15-25
	46-65	Sandy clay loam, clay loam, loam.	SC, SM, MH, CL	A-6	0-10	90-100	85-95	70-85	40-60	35-45	10-20

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
13*:											
Fallsam	0-2	Extremely cobbly silty clay loam.	CL	A-4	50-85	75-85	70-80	65-75	60-70	30-40	10-15
	2-60	Extremely cobbly clay, very gravelly clay.	CH, CL	A-7	50-85	75-85	70-80	65-75	55-70	45-60	20-30
Cabezon	0-2	Very cobbly clay	CH, CL	A-7	50-60	85-95	80-90	70-80	60-75	40-60	25-35
	2-14	Clay, gravelly clay.	CL, CH	A-7	10-20	65-80	60-75	55-75	50-70	40-60	25-40
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
14	0-7	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	90-100	70-80	40-50	15-25	NP-10
Gila	7-60	Stratified silt loam to gravelly sandy loam.	ML, SM	A-4	0	60-100	50-100	50-80	40-65	20-30	NP-5
15	0-10	Silty clay loam	CL	A-6	0	90-100	80-100	95-100	80-90	30-40	15-25
Glendale	10-50	Silty clay loam, silt loam.	CL	A-6	0	90-100	80-100	95-100	75-90	30-40	15-25
	50-63	Silty clay	CH	A-7	0	100	100	95-100	80-95	55-65	35-45
16*:											
Glendale	0-1	Silty clay loam	CL	A-6	0	90-100	80-100	95-100	80-90	30-40	15-25
	1-60	Silt loam, clay loam, silty clay loam.	CL	A-6	0	90-100	80-100	95-100	75-90	30-40	15-25
Gila	0-2	Loam	ML, CL-ML	A-4	0	95-100	95-100	80-90	60-65	20-30	NP-10
	2-60	Stratified silt loam to gravelly sandy loam.	ML, SM	A-4	0	60-100	50-100	50-80	40-65	20-30	NP-5
17	0-9	Silty clay	CH	A-7	0	95-100	95-100	90-100	85-95	50-60	30-40
Guest	9-72	Clay, clay loam, silty clay.	CL, CH	A-7	0	90-100	90-100	80-100	70-95	40-55	20-35
18*:											
Guest	0-2	Silty clay	CH	A-7	0	95-100	95-100	90-100	85-95	50-60	30-40
	2-60	Clay, clay loam, silty clay.	CL, CH	A-7	0	95-100	90-100	80-100	70-95	40-55	20-30
Hantz	0-2	Silty clay	CH	A-7	0	95-100	95-100	90-100	85-95	50-60	30-40
	2-60	Silty clay, clay	CH	A-7	0	95-100	90-100	80-100	70-90	50-60	30-40
19	0-11	Silty clay	CH	A-7	0	95-100	90-100	85-100	80-95	50-60	30-40
Hantz	11-67	Silty clay, clay	CH	A-7	0	90-100	80-100	70-100	60-95	50-60	30-40
20	0-2	Gravelly sandy loam.	SM	A-2, A-1	0	95-100	60-75	40-50	20-30	20-25	NP-5
Hap	2-37	Gravelly sandy clay loam.	SC	A-6, A-2	0	95-100	50-75	40-70	20-40	30-35	10-15
	37-55	Gravelly sandy loam, gravelly loam.	SM	A-2, A-1	0	95-100	55-70	35-50	20-30	20-25	NP-5
	55-63	Gravelly loamy sand.	SM	A-1	0	90-100	60-70	35-45	10-15	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
21*:											
Hap	0-2	Very gravelly sandy loam.	SM	A-1	0	80-90	40-50	25-35	10-20	---	NP
	2-37	Gravelly sandy clay loam.	SC	A-6, A-2	0	95-100	50-75	40-70	20-40	30-35	10-15
	37-55	Gravelly sandy loam, gravelly loam.	SM	A-2, A-1	0	95-100	55-70	35-50	20-30	20-25	NP-5
	55-63	Gravelly loamy sand.	SM	A-1	0	90-100	60-70	35-45	10-15	---	NP
Pinaleno	0-2	Very cobbly loam	SM-SC, GM-GC	A-2, A-4	50-60	65-80	60-75	45-60	30-50	20-30	5-10
	2-26	Very gravelly clay loam, very gravelly sandy clay loam.	GM	A-2	0-20	30-55	25-50	20-45	10-30	25-30	5-10
	26-60	Very gravelly sandy loam, gravelly sandy loam.	GM	A-1	0-20	30-55	25-50	15-35	10-20	15-20	NP-5
22*:											
Haplargids.											
Torriorthents.											
23*:											
Limpia	0-2	Extremely cobbly clay loam.	SC, GC	A-6	50-60	55-75	50-70	40-65	35-50	25-40	10-15
	2-60	Very gravelly clay, very cobbly clay, extremely gravelly clay.	GC	A-2, A-7	25-55	35-55	30-50	25-50	20-45	45-60	25-35
Graham	0-1	Extremely cobbly silty clay loam.	CL	A-6	50-60	90-100	80-90	75-90	70-85	30-40	10-20
	1-16	Silty clay, clay.	CH, CL	A-7	0-20	70-100	60-90	50-70	50-70	45-60	20-35
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
24 Maloy	0-2	Extremely stony sandy loam.	SM, GM	A-1	50-85	45-70	40-65	25-45	15-25	15-20	NP-5
	2-38	Extremely cobbly sandy clay loam, very stony sandy clay loam.	SC, GC	A-2	50-85	45-70	40-65	30-55	20-35	30-40	10-15
	38-60	Extremely cobbly sandy loam, very cobbly loam.	SM, SM-SC, GM, GM-GC	A-1, A-2, A-4	50-85	45-70	40-65	25-50	15-40	15-25	NP-10
25 Peloncillo	0-1	Extremely cobbly sandy clay loam.	SM-SC, SC, GM-GC, GC	A-2	50-85	50-65	45-60	35-55	20-30	25-35	5-15
	1-15	Very gravelly clay loam.	GC	A-2, A-6	0-5	35-55	30-50	30-45	20-40	35-40	10-15
	15-20	Indurated---------	---	---	---	---	---	---	---	---	---
	20-60	Cemented---------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26*:											
Peloncillo------	0-1	Extremely cobbly sandy clay loam.	SM-SC, SC, GM-GC, GC	A-2	50-85	50-65	45-60	35-55	20-30	25-35	5-15
	1-11	Very gravelly clay loam.	GC	A-2, A-6	0-5	35-55	30-50	30-45	20-40	35-40	10-15
	11-12	Indurated--------	---	---	---	---	---	---	---	---	---
	12-60	Cemented---------	---	---	---	---	---	---	---	---	---
Orthents.											
Pinaleno--------	0-2	Very cobbly loam	CL-ML, SM-SC, GM-GC	A-2, A-4	50-60	55-80	50-65	45-60	30-55	20-30	5-10
	2-26	Very gravelly clay loam, very gravelly sandy clay loam.	GM	A-2	0-20	30-55	25-50	20-45	10-30	25-30	5-10
	26-60	Very gravelly sandy loam, gravelly sandy loam.	GM	A-1	0-20	30-55	25-50	15-35	10-20	15-20	NP-5
27---------- Pima	0-8	Silty clay loam	CL	A-6	0	100	100	95-100	85-90	30-40	10-15
	8-60	Stratified sandy clay loam, silty clay loam, clay loam.	CL	A-6	0	75-100	60-100	55-100	50-90	30-40	10-15
28---------- Pinaleno	0-2	Very cobbly loam	CL-ML, SM-SC, GM-GC	A-2, A-4	50-60	55-80	50-65	45-60	30-55	20-30	5-10
	2-17	Very gravelly clay loam, very gravelly sandy clay loam.	GM-GC	A-2	0-20	30-55	25-50	20-45	10-30	25-30	5-10
	17-60	Extremely gravelly sandy loam, extremely gravelly loam, extremely gravelly loamy sand.	GM	A-1, A-2	0-20	30-55	25-50	20-40	10-30	15-25	NP-5
29*:											
Pinaleno--------	0-2	Very gravelly loam.	GM	A-1, A-2	0-15	30-55	25-50	20-45	15-35	20-25	NP-5
	2-17	Very gravelly clay loam, very gravelly sandy clay loam.	GM-GC	A-2	0-20	30-55	25-50	20-45	15-35	25-30	5-10
	17-60	Very gravelly loamy sand, very gravelly sandy loam, very gravelly loam.	GP-GM, SP-SM	A-1	0-20	30-55	25-50	15-35	5-10	---	NP
Whitlock--------	0-10	Sandy loam--------	SM	A-2, A-4	0	80-100	60-100	60-70	30-40	20-30	NP-5
	10-28	Sandy loam, loam	SM-SC	A-2, A-4	0	80-100	60-100	60-70	30-40	20-30	5-10
	28-60	Sand, loamy sand, coarse sand.	SM, SP-SM	A-3, A-2	0	80-100	60-100	50-75	5-20	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
29*:											
Tres Hermanos---	0-2	Very gravelly sandy loam.	GM, SM	A-1, A-2	0-5	50-70	35-50	20-35	10-20	15-25	NP-5
	2-24	Gravelly loam, gravelly sandy clay loam, gravelly clay loam.	SC, CL	A-6, A-7	0-5	75-100	60-100	50-90	40-75.	30-45	10-20
	24-60	Gravelly loam, gravelly sandy clay loam, gravelly sandy loam.	SM	A-1, A-2, A-4	0-10	65-95	60-75	40-65	20-50	20-30	NP-5
30*:											
Pits.											
Dumps.											
31*:											
Rock outcrop.											
Atascosa--------	0-2	Very gravelly loam.	GM	A-2, A-1	15-25	40-50	30-50	25-40	20-30	25-35	NP-10
	2-9	Very gravelly sandy clay loam, very gravelly clay loam.	GC	A-2	5-30	50-60	20-50	30-45	15-35	25-35	10-15
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Graham----------	0-2	Very cobbly clay loam.	CL	A-6	50-60	90-100	80-90	70-85	60-70	30-40	10-20
	2-14	Gravelly clay, gravelly clay loam.	CH	A-7	0-20	70-90	60-75	50-70	50-70	60-80	40-60
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
32*:											
Rock outcrop.											
Chiricahua Variant--------	0-4	Very gravelly sandy clay loam.	GC, SC	A-2	0-5	50-60	35-40	20-30	15-20	30-40	10-20
	4-32	Very gravelly clay, gravelly clay loam, extremely gravelly sandy clay.	CH, GC	A-7, A-4, A-2	0-15	25-75	20-70	20-60	15-55	60-70	40-50
	32-35	Weathered bedrock	---	---	---	---	---	---	---	---	---
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
33*:											
Rock outcrop.											
Lampshire-------	0-1	Extremely cobbly sandy loam.	GM	A-2	50-65	50-65	35-50	20-35	10-20	20-25	NP-5
	1-11	Extremely gravelly loam.	SM-SC, GM-GC	A-2	5-25	45-65	25-45	20-40	15-30	20-30	5-10
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
34*:											
Rock outcrop.											
Luzena	0-1	Very gravelly clay.	GC	A-2, A-6, A-7	0-15	35-60	30-50	25-45	20-45	35-50	20-30
	1-8	Gravelly clay, clay.	CL, CH	A-7	5-20	70-100	65-95	55-80	50-75	45-55	20-30
	8	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
35*:											
Rock outcrop.											
Mokiak	0-4	Very gravelly sandy loam.	SM	A-1	0-15	70-80	30-40	20-30	10-15	15-20	NP-5
	4-21	Very gravelly sandy clay loam.	GM-GC, GC	A-2	0-15	30-50	25-45	20-35	10-25	25-35	5-15
	21-50	Weathered bedrock	---	---	---	---	---	---	---	---	---
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
36 Santo Tomas	0-31	Extremely stony sandy loam.	SM	A-1, A-2	60-85	40-80	35-75	30-45	20-30	15-25	NP-5
	31-60	Extremely stony loamy sand.	SM	A-1	60-85	30-55	25-50	20-30	15-25	---	NP
37 Selevin	0-5	Extremely stony loam.	CL-ML, SM-SC, GM-GC	A-4	45-85	70-90	65-85	55-80	40-60	20-30	5-10
	5-23	Very stony clay, extremely stony clay.	CH, CL	A-7	45-85	70-90	65-85	60-85	50-80	45-55	20-30
	23-60	Very stony sandy loam, very stony loam, extremely stony sandy loam.	CL-ML, SM-SC, SM, ML	A-2, A-4	60-85	70-90	65-85	40-70	30-60	15-25	NP-10
38 Signal	0-2	Very cobbly clay loam.	SC, CL	A-7	30-40	60-85	50-75	50-70	45-60	40-50	25-35
	2-39	Very gravelly clay, very gravelly clay loam, extremely gravelly clay.	GC	A-2, A-7	0-15	30-60	25-50	20-50	15-45	40-60	20-30
	39-48	Extremely gravelly loamy coarse sand.	GP-GM	A-1	0-15	25-30	20-25	10-20	3-5	---	NP
	48-60	Very gravelly loam, very gravelly sandy clay loam.	GM	A-1	10-20	30-45	25-40	15-35	10-25	15-25	NP-5
39*:											
Sonoita	0-14	Sandy loam	SM	A-2	0-5	80-90	75-90	50-65	25-35	15-25	NP-5
	14-45	Sandy clay loam, fine sandy loam, sandy loam.	SC, SM-SC	A-2	0-5	70-95	65-95	40-75	25-35	20-30	5-15
	45-67	Very gravelly loamy sand.	GP-GM, SP-SM	A-1	0-5	25-55	20-50	20-40	5-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
39*:											
Bucklebar-------	0-7	Sandy loam-------	SM	A-2, A-4	0	95-100	95-100	60-70	30-40	20-25	NP-5
	7-27	Sandy clay loam, clay loam.	SM-SC, SC, CL-ML, CL	A-6, A-4	0-5	90-100	90-100	60-85	40-60	25-35	5-15
	27-50	Sandy loam, sandy clay loam.	SM	A-4, A-2	0-5	95-100	95-100	60-85	30-45	20-30	NP-5
	50-73	Very gravelly sand, gravelly sand.	GP, SP	A-1	0-5	45-55	40-50	20-30	0-5	---	NP
40---------- Stellar	0-3	Gravelly sandy clay loam.	SC, GC	A-2, A-6	0	55-80	50-75	40-70	25-40	25-35	10-15
	3-50	Clay, gravelly clay, sandy clay.	CH, SC	A-7	0	100	100	80-95	45-90	50-60	25-35
	50-66	Clay, sandy clay loam, gravelly sandy clay loam.	CL, GC, SC	A-6	0-5	65-100	65-100	55-100	40-70	35-40	15-20
41*:											
Tapco----------	0-2	Very cobbly clay loam.	CL-ML, SM-SC, GM-GC, CL	A-4, A-6, A-2	35-60	55-80	50-75	45-75	35-60	25-35	5-15
	2-10	Clay----------	CH	A-7	0	95-100	90-100	80-95	70-90	50-60	25-35
	10-11	Indurated--------	---	---	---	---	---	---	---	---	---
	11-60	Cemented---------	---	---	---	---	---	---	---	---	---
Peloncillo------	0-1	Very cobbly sandy clay loam.	SM-SC, SC, GM-GC, GC	A-2	50-85	50-65	45-60	35-55	15-30	20-35	5-15
	1-15	Very gravelly clay loam.	GC	A-2, A-6	0-5	35-55	30-50	30-45	20-40	35-40	10-15
	15-16	Indurated--------	---	---	---	---	---	---	---	---	---
	16-60	Cemented---------	---	---	---	---	---	---	---	---	---
42*: Torrifluvents.											
Riverwash.											
43*:											
Tres Hermanos---	0-2	Gravelly sandy clay loam.	SM-SC, SM	A-2, A-4	0-5	70-90	60-75	50-70	20-40	20-30	NP-10
	2-27	Gravelly loam, gravelly clay loam, clay loam.	SC, CL	A-6, A-7	0-5	75-100	60-100	50-90	40-75	30-45	10-20
	27-60	Gravelly loam, sandy loam, gravelly sandy loam.	SM	A-1, A-2, A-4	0-10	65-95	60-85	40-65	20-50	20-30	NP-5
Continental-----	0-2	Very gravelly sandy clay loam.	SC	A-6, A-2	0-10	45-60	35-50	30-45	20-40	30-40	10-20
	2-32	Clay, gravelly clay, gravelly sandy clay.	CL, SC, CH	A-7	0-5	80-95	50-90	50-70	35-65	45-55	20-30
	32-60	Very gravelly sandy loam.	GM	A-2	5-15	35-55	30-50	20-35	10-20	15-20	NP-5
Nickel----------	0-2	Extremely cobbly sandy loam.	SM	A-2	50-60	75-85	65-75	40-50	20-30	15-25	NP-5
	2-44	Extremely gravelly sandy loam, very gravelly fine sandy loam.	GP-GM, GM, SM	A-1	0-10	30-60	20-50	15-35	5-15	15-25	NP-5
	44-60	Gravelly loamy sand.	SM	A-1	0-5	65-80	60-75	30-50	10-20	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
44---------- Wampoo	0-5	Gravelly loam----	CL-ML, SM-SC, GM-GC	A-2, A-4	0-15	55-80	50-75	40-70	30-55	20-30	5-10
	5-16	Clay, gravelly clay.	CH, CL	A-7	0	65-100	60-95	55-90	45-70	40-60	20-40
	16-21	Gravelly clay, gravelly clay loam, gravelly sandy clay.	CL, GC, SC	A-2, A-6, A-7	0	55-80	50-75	40-70	25-65	30-45	10-25
	21-22	Indurated--------	---	---	0	---	---	---	---	---	---
	22-28	Cemented---------	---	---	0-15	---	---	---	---	---	---
45*:											
Whitlock--------	0-10	Sandy loam-------	SM	A-2, A-4	0	80-100	60-100	60-70	30-40	20-30	NP-5
	10-28	Sandy loam, loam	SM-SC	A-2, A-4	0	80-100	60-100	60-70	30-40	20-30	5-10
	28-70	Sand, loamy sand	SM, SP-SM	A-3, A-2	0	80-100	60-100	50-75	5-20	---	NP
Tres Hermanos---	0-2	Very gravelly sandy loam.	GM, SM	A-1, A-2	0-5	50-70	35-50	20-30	10-20	15-25	NP-5
	2-24	Gravelly sandy clay loam, gravelly clay loam, clay loam.	SC, CL	A-6, A-7	0-5	75-100	60-100	50-90	40-75	30-45	10-20
	24-60	Gravelly loam, gravelly clay loam, gravelly sandy loam.	SM	A-1, A-2, A-4	0-10	65-95	60-75	40-65	20-50	20-30	NP-5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				
1*:										
Akela----------	0-1	10-15	2.0-6.0	0.04-0.06	7.4-8.4	<2	Low----------	0.17	1	8
	1-7	10-15	0.6-2.0	0.07-0.10	7.4-8.4	<2	Low----------	0.17		
	7	---	---	---	---	---	----------	----		
Lehmans---------	0-1	27-35	0.2-0.6	0.05-0.07	6.6-8.4	<2	Moderate-----	0.10	1	8
	1-12	35-55	0.06-0.2	0.10-0.15	6.6-8.4	<2	High---------	0.20		
	12	---	---	---	---	---	----------	----		
Rock outcrop.										
2*:										
Anthony---------	0-3	5-18	2.0-6.0	0.11-0.13	7.4-9.0	<4	Low----------	0.24	5	3
	3-45	5-18	2.0-6.0	0.10-0.13	7.4-9.0	<4	Low----------	0.20		
	45-60	5-8	6.0-20	0.05-0.07	7.4-9.0	<4	Low----------	0.15		
Gila----------	0-4	12-18	0.6-2.0	0.13-0.15	6.6-8.4	<4	Low----------	0.32	5	3
	4-60	8-18	0.6-2.0	0.17-0.19	7.9-9.0	<4	Low----------	0.55		
3----------	0-1	15-25	0.6-2.0	0.04-0.06	5.6-6.5	<2	Low----------	0.10	2	8
Aravaipa	1-13	35-45	0.06-0.2	0.08-0.10	6.1-7.8	<2	Moderate-----	0.15		
	13-45	---	---	---	---	---	----------	----		
	45	---	---	---	---	---	----------	----		
4----------	0-1	20-30	0.2-0.6	0.04-0.08	7.4-7.8	<2	Low----------	0.17	2	8
Artesia	1-24	35-45	0.06-0.2	0.08-0.10	7.4-9.0	<2	Moderate-----	0.20		
	24-25	---	---	---	---	---	----------	----		
	25-60	3-8	6.0-20	0.03-0.05	7.4-9.0	<4	Low----------	0.10		
5----------	0-2	40-50	<0.06	0.07-0.10	6.6-8.4	<2	High---------	0.28	5	8
Bonita	2-31	40-50	<0.06	0.12-0.15	6.6-8.4	<2	High---------	0.37		
	31-60	35-40	0.06-0.2	0.10-0.16	6.6-8.4	<2	Moderate-----	0.28		
6*:										
Calciorthids.										
Torriorthents.										
7*:										
Comoro----------	0-12	8-15	2.0-6.0	0.11-0.13	6.6-8.4	<2	Low----------	0.32	5	3
	12-41	8-15	2.0-6.0	0.11-0.13	6.6-8.4	<2	Low----------	0.28		
	41-60	5-8	6.0-20	0.03-0.05	6.6-8.4	<2	Low----------	0.20		
Santo Tomas-----	0-6	10-15	2.0-6.0	0.06-0.08	6.6-8.4	<2	Low----------	0.32	5	8
	6-60	10-15	0.6-2.0	0.06-0.08	7.4-8.4	<2	Low----------	0.20		
8----------	0-2	25-35	0.2-0.6	0.11-0.15	6.1-7.3	<2	Moderate-----	0.15	5	6
Continental	2-34	40-50	0.06-0.2	0.10-0.16	6.6-8.4	<2	High---------	0.20		
	34-70	3-8	6.0-20	0.03-0.05	7.4-8.4	<2	Low----------	0.10		
9*:										
Continental-----	0-6	25-35	0.2-0.6	0.11-0.15	6.1-7.3	<2	Moderate-----	0.32	5	6
	6-36	40-50	0.06-0.2	0.10-0.14	6.6-8.4	<2	High---------	0.28		
	36-60	15-25	2.0-6.0	0.09-0.11	7.4-8.4	<2	Low----------	0.32		
Dona Ana--------	0-10	10-18	2.0-6.0	0.10-0.13	6.6-7.8	<2	Low----------	0.32	5	3
	10-35	20-35	0.6-2.0	0.13-0.17	7.9-8.4	2-4	Moderate-----	0.32		
	35-60	15-30	0.6-2.0	0.14-0.17	7.9-8.4	2-4	Low----------	0.37		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				
10*:										
Eba	0-6	20-30	0.6-2.0	0.04-0.06	7.4-8.4	<2	Low	0.20	5	8
	6-32	40-55	0.06-0.2	0.07-0.09	7.4-9.0	2-4	Moderate	0.15		
	32-48	30-35	0.2-0.6	0.04-0.06	7.9-9.0	2-4	Low	0.10		
	48-60	5-8	6.0-20	0.03-0.05	7.9-9.0	<2	Low	0.10		
Pinaleno	0-2	10-20	0.6-2.0	0.07-0.11	7.4-8.4	<2	Low	0.15	5	8
	2-30	15-30	0.2-0.6	0.05-0.09	7.4-8.4	<2	Low	0.10		
	30-60	10-15	2.0-6.0	0.07-0.10	7.9-9.0	<2	Low	0.15		
11*:										
Eloma	0-2	15-25	0.6-2.0	0.07-0.11	6.1-7.3	<2	Low	0.32	5	8
	2-45	35-45	0.06-0.2	0.07-0.10	6.6-7.8	<2	Moderate	0.32		
	45-60	10-15	0.6-2.0	0.03-0.04	7.9-8.4	<2	Low	0.20		
Alsco	0-2	5-15	2.0-6.0	0.03-0.05	6.1-7.8	<2	Low	0.17	5	8
	2-16	25-30	0.2-0.6	0.04-0.07	7.4-8.4	<2	Low	0.28		
	16-21	10-15	2.0-6.0	0.04-0.06	7.9-8.4	<2	Low	0.32		
	21-60	5-15	2.0-6.0	0.03-0.05	7.9-8.4	<2	Low	0.17		
12*:										
Eloma	0-2	15-25	0.6-2.0	0.07-0.11	6.1-7.3	<2	Low	0.24	5	8
	2-45	35-45	0.06-0.2	0.07-0.10	6.6-7.8	<2	Moderate	0.10		
	45-60	10-15	0.6-2.0	0.03-0.04	7.9-8.4	<2	Low	0.20		
White House	0-1	20-27	0.6-2.0	0.10-0.14	6.6-7.3	<2	Moderate	0.32	5	6
	1-25	35-60	0.06-0.2	0.14-0.16	6.6-8.4	<2	High	0.15		
	25-46	35-50	0.2-0.6	0.14-0.16	7.9-8.4	<2	High	0.24		
	46-65	30-40	0.2-0.6	0.12-0.15	7.9-8.4	<2	Moderate	0.27		
13*:										
Fallsam	0-2	27-35	0.2-0.6	0.04-0.06	6.1-7.3	<2	Low	0.20	5	8
	2-60	40-55	0.06-0.2	0.02-0.05	6.6-8.4	<2	High	0.15		
Cabezon	0-2	40-50	0.06-0.2	0.06-0.10	6.1-7.8	<2	High	0.20	1	8
	2-14	45-60	0.06-0.2	0.12-0.14	6.1-7.8	<2	High	0.28		
	14	---	---	---	---	---	---	----		
Rock outcrop.										
14	0-7	10-17	0.6-2.0	0.13-0.15	6.6-8.4	<4	Low	0.32	5	3
Gila	7-60	10-18	0.6-2.0	0.18-0.20	7.9-9.0	<4	Low	0.55		
15	0-10	30-35	0.2-0.6	0.16-0.20	7.4-8.4	2-4	Moderate	0.49	5	4L
Glendale	10-50	25-35	0.2-0.6	0.16-0.20	7.9-9.0	2-4	Moderate	0.49		
	50-63	40-50	0.06-0.2	0.13-0.16	7.9-9.0	2-4	High	0.32		
16*:										
Glendale	0-1	27-35	0.2-0.6	0.16-0.20	7.4-8.4	2-4	Moderate	0.49	5	4L
	1-60	25-35	0.2-0.6	0.16-0.21	7.9-9.0	2-4	Moderate	0.55		
Gila	0-2	12-18	0.6-2.0	0.16-0.18	6.6-8.4	<4	Low	0.55	5	4L
	2-60	8-18	0.6-2.0	0.17-0.19	7.9-9.0	<4	Low	0.55		
17	0-9	40-50	0.06-0.2	0.14-0.16	6.6-8.4	2-4	High	0.32	5	4
Guest	9-72	35-60	0.06-0.2	0.14-0.19	7.9-9.0	2-4	High	0.32		
18*:										
Guest	0-2	40-50	0.06-0.2	0.06-0.10	6.6-9.0	4-16	High	0.32	5	4
	2-60	35-50	0.06-0.2	0.06-0.10	7.9-9.0	4-16	High	0.32		
Hantz	0-2	40-50	0.06-0.2	0.06-0.10	7.4-9.0	4-16	High	0.32	5	4
	2-60	40-50	<0.06	0.06-0.10	7.4-9.0	4-16	High	0.32		
19	0-11	40-50	0.06-0.2	0.14-0.16	7.4-9.0	2-4	High	0.32	5	4
Hantz	11-67	40-50	<0.06	0.14-0.16	7.4-9.0	2-4	High	0.32		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				
20----------	0-2	15-20	2.0-6.0	0.08-0.10	6.6-7.8	<2	Low----------	0.20	5	3
Hap	2-37	25-30	0.6-2.0	0.10-0.14	6.6-8.4	<2	Low----------	0.20		
	37-55	5-15	2.0-6.0	0.07-0.10	7.9-9.0	<2	Low----------	0.20		
	55-63	5-10	6.0-20	0.04-0.06	7.9-9.0	<2	Low----------	0.15		
21*:										
Hap----------	0-2	5-15	2.0-6.0	0.06-0.08	6.6-7.3	<2	Low----------	0.17	5	8
	2-37	25-30	0.6-2.0	0.08-0.10	6.6-8.4	<2	Low----------	0.20		
	37-55	5-15	2.0-6.0	0.07-0.10	7.9-8.4	<2	Low----------	0.20		
	55-63	5-10	6.0-20	0.04-0.06	7.9-9.0	<2	Low----------	0.15		
Pinaleno--------	0-2	10-20	0.6-2.0	0.07-0.10	7.9-8.4	<2	Low----------	0.15	5	8
	2-26	25-30	0.2-0.6	0.05-0.09	7.4-8.4	<2	Low----------	0.10		
	26-60	10-15	2.0-6.0	0.04-0.07	7.9-9.0	<2	Low----------	0.15		
22*:										
Haplargids.										
Torriorthents.										
23*:										
Limpia----------	0-2	27-35	0.2-0.6	0.08-0.12	6.6-8.4	<2	Low----------	0.24	5	8
	2-60	40-55	0.06-0.2	0.06-0.10	6.6-8.4	<2	High---------	0.17		
Graham----------	0-1	27-35	0.2-0.6	0.04-0.06	6.6-7.8	<2	Moderate-----	0.20	1	8
	1-16	40-55	0.06-0.2	0.12-0.16	7.4-8.4	<2	High---------	0.24		
	16	---	---	---	---	---	----------	----		
Rock outcrop.										
24----------	0-2	5-15	2.0-6.0	0.03-0.06	6.1-7.3	<2	Low----------	0.10	5	8
Maloy	2-38	25-35	0.6-2.0	0.03-0.06	6.1-7.3	<2	Low----------	0.10		
	38-60	10-20	2.0-6.0	0.04-0.08	7.4-8.4	<2	Low----------	0.10		
25----------	0-1	20-30	0.6-2.0	0.03-0.06	7.9-8.4	<4	Low----------	0.15	1	8
Peloncillo	1-15	27-35	0.2-0.6	0.08-0.12	7.9-8.4	<4	Low----------	0.17		
	15-20	---	---	---	---	---	----------	----		
	20-60	---	---	---	---	---	----------	----		
26*:										
Peloncillo------	0-1	20-30	0.6-2.0	0.03-0.06	7.9-8.4	<4	Low----------	0.15	1	8
	1-11	27-35	0.2-0.6	0.08-0.12	7.9-8.4	<4	Low----------	0.17		
	11-12	---	---	---	---	---	----------	----		
	12-60	---	---	---	---	---	----------	----		
Orthents.										
Pinaleno--------	0-2	10-20	0.6-2.0	0.08-0.11	7.9-8.4	<2	Low----------	0.15	5	8
	2-26	20-25	0.2-0.6	0.05-0.09	7.4-8.4	<2	Low----------	0.10		
	26-60	10-15	2.0-6.0	0.04-0.08	7.9-9.0	<2	Low----------	0.15		
27----------	0-8	27-35	0.2-0.6	0.19-0.21	7.4-8.4	<2	Moderate-----	0.55	5	4L
Pima	8-60	25-35	0.2-0.6	0.19-0.21	7.4-8.4	<4	Moderate-----	0.49		
28----------	0-2	10-20	0.6-2.0	0.08-0.11	7.9-8.4	<2	Low----------	0.15	5	8
Pinaleno	2-17	20-25	0.2-0.6	0.05-0.09	7.4-8.4	<2	Low----------	0.10		
	17-60	10-20	0.6-2.0	0.05-0.09	7.9-9.0	<2	Low----------	0.10		
29*:										
Pinaleno--------	0-2	10-15	0.6-2.0	0.06-0.10	7.9-8.4	<2	Low----------	0.15	5	8
	2-17	20-25	0.2-0.6	0.05-0.09	7.4-8.4	<2	Low----------	0.10		
	17-60	3-8	2.0-6.0	0.03-0.07	7.9-9.0	<2	Low----------	0.10		
Whitlock--------	0-10	10-15	2.0-6.0	0.11-0.13	7.9-8.4	<4	Low----------	0.24	5	3
	10-28	10-15	2.0-6.0	0.11-0.13	7.9-8.4	<4	Low----------	0.24		
	28-60	3-5	6.0-20	0.04-0.07	7.9-9.0	<4	Low----------	0.10		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				
29*:										
Tres Hermanos---	0-2	10-15	2.0-6.0	0.05-0.07	7.4-8.4	<2	Low----------	0.20	5	8
	2-24	20-30	0.2-0.6	0.10-0.17	7.4-8.4	2-4	Moderate-----	0.24		
	24-60	15-25	0.6-2.0	0.07-0.10	7.9-8.4	2-4	Low----------	0.24		
30*:										
Pits.										
Dumps.										
31*:										
Rock outcrop.										
Atascosa--------	0-2	10-20	0.6-2.0	0.06-0.10	6.1-7.8	<2	Low----------	0.17	1	8
	2-9	25-30	0.6-2.0	0.08-0.11	7.4-7.8	<2	Low----------	0.28		
	9	---	---	---	---	---	----------	----		
Graham----------	0-2	27-35	0.2-0.6	0.07-0.12	6.6-7.8	<2	Moderate-----	0.24	1	8
	2-14	35-55	0.06-0.2	0.10-0.14	7.4-8.4	<2	High---------	0.24		
	14	---	---	---	---	---	----------	----		
32*:										
Rock outcrop.										
Chiricahua Variant--------	0-4	20-30	0.2-0.6	0.07-0.09	5.6-7.3	<2	Low----------	0.28	2	8
	4-32	35-45	0.06-0.2	0.08-0.10	6.1-7.8	<2	Moderate-----	0.20		
	32-35	---	---	---	---	---	----------	----		
	35	---	---	---	---	---	----------	----		
33*:										
Rock outcrop.										
Lampshire-------	0-1	5-20	2.0-6.0	0.03-0.05	6.6-7.8	<2	Low----------	0.20	1	8
	1-11	10-20	0.6-2.0	0.03-0.06	6.6-7.8	<2	Low----------	0.15		
	11	---	---	---	---	---	----------	----		
34*:										
Rock outcrop.										
Luzena----------	0-1	40-50	0.06-0.2	0.06-0.09	5.6-7.8	<2	High---------	0.15	1	8
	1-8	40-60	0.06-0.2	0.12-0.15	5.6-7.8	<2	High---------	0.17		
	8	---	---	---	---	---	----------	----		
35*:										
Rock outcrop.										
Mokiak----------	0-4	10-15	2.0-6.0	0.05-0.08	5.1-7.3	<2	Low----------	0.17	2	8
	4-21	20-35	0.6-2.0	0.07-0.09	5.1-7.3	<2	Low----------	0.15		
	21-50	---	---	---	---	---	----------	----		
	50	---	---	---	---	---	----------	----		
36---------------	0-31	10-15	0.6-2.0	0.03-0.05	6.6-8.4	<2	Low----------	0.24	5	8
Santo Tomas	31-60	3-5	6.0-20.0	0.03-0.05	7.4-8.4	<2	Low----------	0.20		
37---------------	0-5	15-27	0.6-2.0	0.03-0.06	6.1-7.3	<2	Low----------	0.20	5	8
Selevin	5-23	40-50	0.06-0.2	0.05-0.09	7.4-8.4	<2	High---------	0.10		
	23-60	5-20	0.6-2.0	0.03-0.07	7.9-8.4	<2	Low----------	0.10		
38---------------	0-2	27-35	0.2-0.6	0.08-0.12	6.1-8.4	<2	Moderate-----	0.15	5	8
Signal	2-39	35-55	0.06-0.2	0.07-0.12	6.6-9.0	<2	Moderate-----	0.15		
	39-48	3-8	6.0-20	0.03-0.05	7.9-9.0	<2	Low----------	0.10		
	48-60	15-25	0.6-2.0	0.08-0.11	7.9-9.0	<2	Low----------	0.10		
39*:										
Sonoita---------	0-14	5-15	2.0-6.0	0.13-0.15	6.1-7.3	<2	Low----------	0.24	5	3
	14-45	10-18	2.0-6.0	0.07-0.13	7.4-8.4	<2	Low----------	0.24		
	45-67	5-8	6.0-20	0.03-0.04	7.4-8.4	<2	Low----------	0.10		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				
39*:										
Bucklebar-------	0-7	10-18	2.0-6.0	0.11-0.13	6.6-8.4	<2	Low----------	0.24	5	3
	7-27	20-35	0.6-2.0	0.15-0.17	7.4-8.4	<2	Moderate-----	0.24		
	27-50	15-27	0.6-2.0	0.13-0.16	7.9-8.4	<2	Low----------	0.24		
	50-73	2-5	6.0-20	0.03-0.04	7.9-8.4	<2	Low----------	0.10		
40----------	0-3	25-30	0.6-2.0	0.10-0.14	7.4-8.4	<2	Low----------	0.20	5	8
Stellar	3-50	35-55	0.06-0.2	0.14-0.16	7.4-8.4	2-4	High---------	0.20		
	50-66	30-35	0.2-0.6	0.17-0.21	7.9-9.0	2-4	Moderate-----	0.20		
41*:										
Tapco----------	0-2	27-35	0.2-0.6	0.08-0.11	7.4-8.4	<2	Moderate-----	0.28	1	8
	2-10	45-60	0.06-0.2	0.12-0.14	7.4-9.0	<2	High---------	0.17		
	10-11	---	---	---	---	---	----------	----		
	11-60	---	---	---	---	---	----------	----		
Peloncillo------	0-1	15-28	0.2-0.6	0.05-0.08	7.9-8.4	<4	Low----------	0.17	1	8
	1-15	27-35	0.2-0.6	0.10-0.14	7.9-8.4	<4	Low----------	0.17		
	15-16	---	---	---	---	---	----------	----		
	16-60	---	---	---	---	---	----------	----		
42*:										
Torrifluvents.										
Riverwash.										
43*:										
Tres Hermanos---	0-2	20-25	0.2-0.6	0.11-0.14	7.4-8.4	<2	Low----------	0.24	5	8
	2-27	25-30	0.2-0.6	0.12-0.17	7.4-8.4	2-4	Moderate-----	0.24		
	27-60	15-25	0.6-2.0	0.08-0.12	7.9-8.4	2-4	Low----------	0.24		
Continental-----	0-2	25-35	0.2-0.6	0.11-0.15	6.1-7.3	<2	Moderate-----	0.15	5	6
	2-32	40-50	0.06-0.2	0.10-0.16	6.6-8.4	<2	High---------	0.20		
	32-60	10-15	0.2-0.6	0.05-0.08	7.4-8.4	<2	Low----------	0.10		
Nickel----------	0-2	10-18	2.0-6.0	0.05-0.08	7.4-9.0	<2	Low----------	0.17	5	8
	2-44	10-15	0.2-0.6	0.04-0.07	7.4-9.4	<2	Low----------	0.17		
	44-60	5-8	6.0-20	0.05-0.07	7.9-9.0	<2	Low----------	0.10		
44----------	0-5	15-25	0.6-2.0	0.10-0.14	6.6-7.8	<2	Low----------	0.37	2	6
Wampoo	5-16	40-55	0.06-0.2	0.13-0.16	6.6-8.4	<2	High---------	0.17		
	16-21	35-50	0.06-0.2	0.11-0.15	7.4-8.4	<2	High---------	0.32		
	21-22	---	---	---	---	---	----------	----		
	22-28	---	---	---	---	---	----------	----		
45*:										
Whitlock--------	0-10	10-15	2.0-6.0	0.11-0.13	7.9-8.4	<4	Low----------	0.24	5	3
	10-28	10-15	2.0-6.0	0.11-0.13	7.9-8.4	<4	Low----------	0.24		
	28-70	3-5	6.0-20	0.04-0.07	7.9-9.0	<4	Low----------	0.10		
Tres Hermanos---	0-2	10-15	2.0-6.0	0.05-0.07	7.4-8.4	<2	Low----------	0.20	5	8
	2-24	20-30	0.2-0.6	0.10-0.17	7.4-8.4	2-4	Moderate-----	0.24		
	24-60	18-30	0.6-2.0	0.07-0.10	7.9-8.4	2-4	Low----------	0.24		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SOIL AND WATER FEATURES

[See text for definitions of terms such as "rare" and "brief." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					In		In			
1*:										
Akela	D	None	---	---	4-15	Hard	---	---	High	Low.
Lehmans	D	None	---	---	9-20	Hard	---	---	High	Low.
Rock outcrop.										
2*:										
Anthony	B	Rare	---	---	>60	---	---	---	High	Low.
Gila	B	Rare	---	---	>60	---	---	---	High	Low.
3---------- Aravaipa	C	None	---	---	8-20	Soft	---	---	High	Low.
4---------- Artesia	D	None	---	---	>60	---	20-40	Thin	High	Low.
5---------- Bonita	D	None	---	---	>60	---	---	---	High	Low.
6*:										
Calciorthids		None	---	---	>60	---	40-60	Thick	High	Low.
Torriorthents		None	---	---	>60	---	---	---	High	Low.
7*:										
Comoro	B	Occasional	Very brief	Jul-Sep	>60	---	---	---	Moderate	Low.
Santo Tomas	B	Occasional	Very brief	Jul-Sep	>60	---	---	---	Moderate	Low.
8---------- Continental	C	None	---	---	>60	---	---	---	High	Low.
9*:										
Continental	C	None	---	---	>60	---	---	---	High	Low.
Dona Ana	B	None	---	---	>60	---	---	---	High	Low.
10*:										
Eba	C	None	---	---	>60	---	---	---	High	Low.
Pinaleno	B	None	---	---	>60	---	---	---	High	Low.
11*:										
Eloma	C	None	---	---	>60	---	---	---	High	Low.
Alsco	C	None	---	---	>60	---	---	---	High	Low.
12*:										
Eloma	C	None	---	---	>60	---	---	---	High	Low.
White House	C	None	---	---	>60	---	---	---	High	Low.
13*:										
Fallsam	C	None	---	---	>45	---	---	---	High	Low.
Cabezon	D	None	---	---	8-20	Hard	---	---	High	Low.
Rock outcrop.										

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					In		In			
14---------- Gila	B	Occasional	Brief-----	Jul-Sep	>60	---	---	---	High-----	Low.
15---------- Glendale	B	Occasional	Brief-----	Jul-Sep	>60	---	---	---	High-----	Low.
16*:										
Glendale---------	B	Rare--------	---	---	>60	---	---	---	High-----	Low.
Gila----------	B	Rare--------	---	---	>60	---	---	---	High-----	Low.
17---------- Guest	D	Occasional	Very brief	Jul-Sep	>60	---	---	---	High-----	Low.
18*:										
Guest----------	D	Rare--------	---	---	>60	---	---	---	High-----	Moderate.
Hantz----------	D	Rare--------	---	---	>60	---	---	---	High-----	Moderate.
19---------- Hantz	D	Rare--------	---	---	>60	---	---	---	High-----	Low.
20---------- Hap	B	None--------	---	---	>60	---	---	---	High-----	Low.
21*:										
Hap----------	B	None--------	---	---	>60	---	---	---	High-----	Low.
Pinaleno---------	B	None--------	---	---	>60	---	---	---	High-----	Low.
22*:										
Haplargids-------		None--------	---	---	>60	---	---	---	High-----	Low.
Torriorthents----		None--------	---	---	>60	---	---	---	High-----	Low.
23*:										
Limpia----------	C	None--------	---	---	>60	---	---	---	High-----	Low.
Graham----------	D	None--------	---	---	8-20	Hard	---	---	High-----	Low.
Rock outcrop.										
24---------- Maloy	B	None--------	---	---	>60	---	---	---	High-----	Low.
25---------- Peloncillo	D	None--------	---	---	>60	---	7-20	Thick	High-----	Low.
26*:										
Peloncillo-------	D	None--------	---	---	>60	---	7-20	Thick	High-----	Low.
Orthents.										
Pinaleno---------	B	None--------	---	---	>60	---	---	---	High-----	Low.
27---------- Pima	B	Occasional	Brief-----	Jul-Sep	>60	---	---	---	High-----	Low.
28---------- Pinaleno	B	None--------	---	---	>60	---	---	---	High-----	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					In		In			
29*:										
Pinaleno	B	None	---	---	>60	---	---	---	High	Low.
Whitlock	B	None	---	---	>60	---	---	---	High	Low.
Tres Hermanos	B	None	---	---	>60	---	---	---	High	Low.
30*:										
Pits.										
Dumps.										
31*:										
Rock outcrop.										
Atascosa	D	None	---	---	4-20	Hard	---	---	High	Low.
Graham	D	None	---	---	8-20	Hard	---	---	High	Low.
32*:										
Rock outcrop.										
Chiricahua Variant	C	None	---	---	20-40	Soft	---	---	Moderate	Low.
33*:										
Rock outcrop.										
Lampshire	D	None	---	---	4-20	Hard	---	---	Moderate	Low.
34*:										
Rock outcrop.										
Luzena	D	None	---	---	6-20	Hard	---	---	High	Low.
35*:										
Rock outcrop.										
Mokiak	B	None	---	---	50-80	Hard	---	---	High	Low.
36--Santo Tomas	B	Frequent	Very brief	Jul-Sep	>60	---	---	---	Moderate	Low.
37--Selevin	C	None	---	---	>60	---	---	---	High	Low.
38--Signal	C	None	---	---	>60	---	---	---	High	Low.
39*:										
Sonoita	B	None	---	---	>60	---	---	---	High	Low.
Bucklebar	B	None	---	---	>60	---	---	---	Moderate	Low.
40--Stellar	C	None	---	---	>60	---	---	---	High	Low.
41*:										
Tapco	D	None	---	---	>60	---	7-20	Thick	High	Low.
Peloncillo	D	None	---	---	>60	---	7-20	Thick	High	Low.
42*:										
Torrifluvents		Frequent	Very brief	Jul-Sep	>60	---	---	---	High	Low.
Riverwash		Frequent	Long	Jan-Dec	>60	---	---	---	High	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					In		In			
43*:										
Tres Hermanos	B	None	---	---	>60	---	---	---	High	Low.
Continental	C	None	---	---	>60	---	---	---	High	Low.
Nickel	B	None	---	---	>60	---	---	---	High	Low.
44---------- Wampoo	D	None	---	---	>60	---	20-30	Thick	High	Low.
45*:										
Whitlock	B	None	---	---	>60	---	---	---	High	Low.
Tres Hermanos	B	None	---	---	>60	---	---	---	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Akela	Loamy-skeletal, mixed (calcareous), thermic Lithic Torriorthents
Alsco	Loamy-skeletal, mixed, thermic Ustollic Haplargids
Anthony	Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents
Aravaipa	Clayey-skeletal, mixed, thermic, shallow Aridic Argiustolls
Artesia	Clayey-skeletal, mixed, thermic Haplic Durargids
Atascosa	Loamy-skeletal, mixed, thermic Lithic Argiustolls
Bonita	Fine, montmorillonitic, thermic Typic Chromusterts
Bucklebar	Fine-loamy, mixed, thermic Typic Haplargids
Cabezon	Clayey, montmorillonitic, mesic Lithic Argiustolls
Chiricahua Variant	Clayey-skeletal, mixed, thermic Ustollic Haplargids
Comoro	Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents
Continental	Fine, mixed, thermic Typic Haplargids
Dona Ana	Fine-loamy, mixed, thermic Typic Haplargids
Eba	Clayey-skeletal, mixed, thermic Typic Haplargids
Eloma	Clayey-skeletal, mixed, thermic Ustollic Haplargids
Fallsam	Clayey-skeletal, montmorillonitic, mesic Pachic Argiustolls
Gila	Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents
Glendale	Fine-silty, mixed (calcareous), thermic Typic Torrifluvents
Graham	Clayey, montmorillonitic, thermic Lithic Argiustolls
Guest	Fine, mixed (calcareous), thermic Vertic Torrifluvents
Hantz	Fine, mixed (calcareous), thermic Vertic Torrifluvents
Hap	Fine-loamy, mixed, thermic Typic Haplargids
Lampshire	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Lehmans	Clayey, montmorillonitic, thermic Lithic Haplargids
Limpia	Clayey-skeletal, mixed, thermic Pachic Argiustolls
Luzena	Clayey, montmorillonitic, mesic Lithic Argiustolls
Maloy	Loamy-skeletal, mixed, thermic Ustollic Haplargids
Mokiak	Loamy-skeletal, mixed, mesic Aridic Argiustolls
Nickel	Loamy-skeletal, mixed, thermic Typic Calciorthids
Peloncillo	Loamy-skeletal, mixed, thermic, shallow Typic Durargids
Pima	Fine-silty, mixed (calcareous), thermic Typic Torrifluvents
Pinaleno	Loamy-skeletal, mixed, thermic Typic Haplargids
Santo Tomas	Loamy-skeletal, mixed, thermic Pachic Haplustolls
Selevin	Clayey-skeletal, montmorillonitic, thermic Ustollic Paleargids
Signal	Clayey-skeletal, montmorillonitic, thermic Aridic Paleustolls
Sonoita	Coarse-loamy, mixed, thermic Typic Haplargids
Stellar	Fine, mixed, thermic Ustollic Haplargids
Tapco	Clayey, montmorillonitic, thermic, shallow Abruptic Durargids
Tres Hermanos	Fine-loamy, mixed, thermic Typic Haplargids
Wampoo	Fine, montmorillonitic, thermic Aridic Argiustolls
White House	Fine, mixed, thermic Ustollic Haplargids
Whitlock	Coarse-loamy, mixed, thermic Typic Calciorthids

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MAP UNITS*

SOILS ON FLOOD PLAINS AND ALLUVIAL FANS

1 — Guest-Gila-Glendale: Deep, well drained, nearly level to gently sloping, clayey, silty, and loamy soils; on flood plains and alluvial fans

SOILS ON FAN TERRACES AND HILLSIDES

2 — Hap-Continental-Sonoita: Deep, well drained, gently sloping to rolling, loamy and clayey soils; on fan terraces

3 — Haplargids-Calciorthids-Torriorthents: Deep, well drained, moderately sloping to very steep, loamy to clayey soils; on highly dissected hills

4 — Tres Hermanos-Pinaleno-Whitlock: Deep, well drained, gently sloping to moderately steep, very gravelly and loamy soils; on fan terraces and hillsides

5 — Peloncillo-Tapco-Artesia: Very shallow to moderately deep, well drained, gently sloping to moderately steep, loamy, very gravelly, and clayey soils; on fan terraces

6 — Signal-Bonita-Wampoo: Deep and moderately deep, well drained, gently sloping to steep, clayey and very gravelly soils; on fan terraces and hillsides

SOILS ON HILLSIDES AND FAN TERRACES

7 — Eloma-Alsco-Selevin: Deep, well drained, gently sloping to very steep, extremely cobbly and very stony, clayey and loamy soils; on hillsides and fan terraces

WARM SOILS ON MOUNTAINS

8 — Limpia-Graham-Atascosa: Very shallow, and deep, well drained, moderately sloping to very steep, clayey, loamy, and very gravelly soils; on mountains

9 — Aravaipa-Rock outcrop-Lampshire: Very shallow and shallow, well drained, moderately sloping to very steep, very gravelly and extremely gravelly, clayey and loamy soils, and Rock outcrop; on mountains

COOL SOILS ON MOUNTAINS

10 — Rock outcrop-Fallsam-Luzena: Rock outcrop, and very shallow to deep, well drained, moderately sloping to very steep, extremely cobbly and clayey soils; on mountains

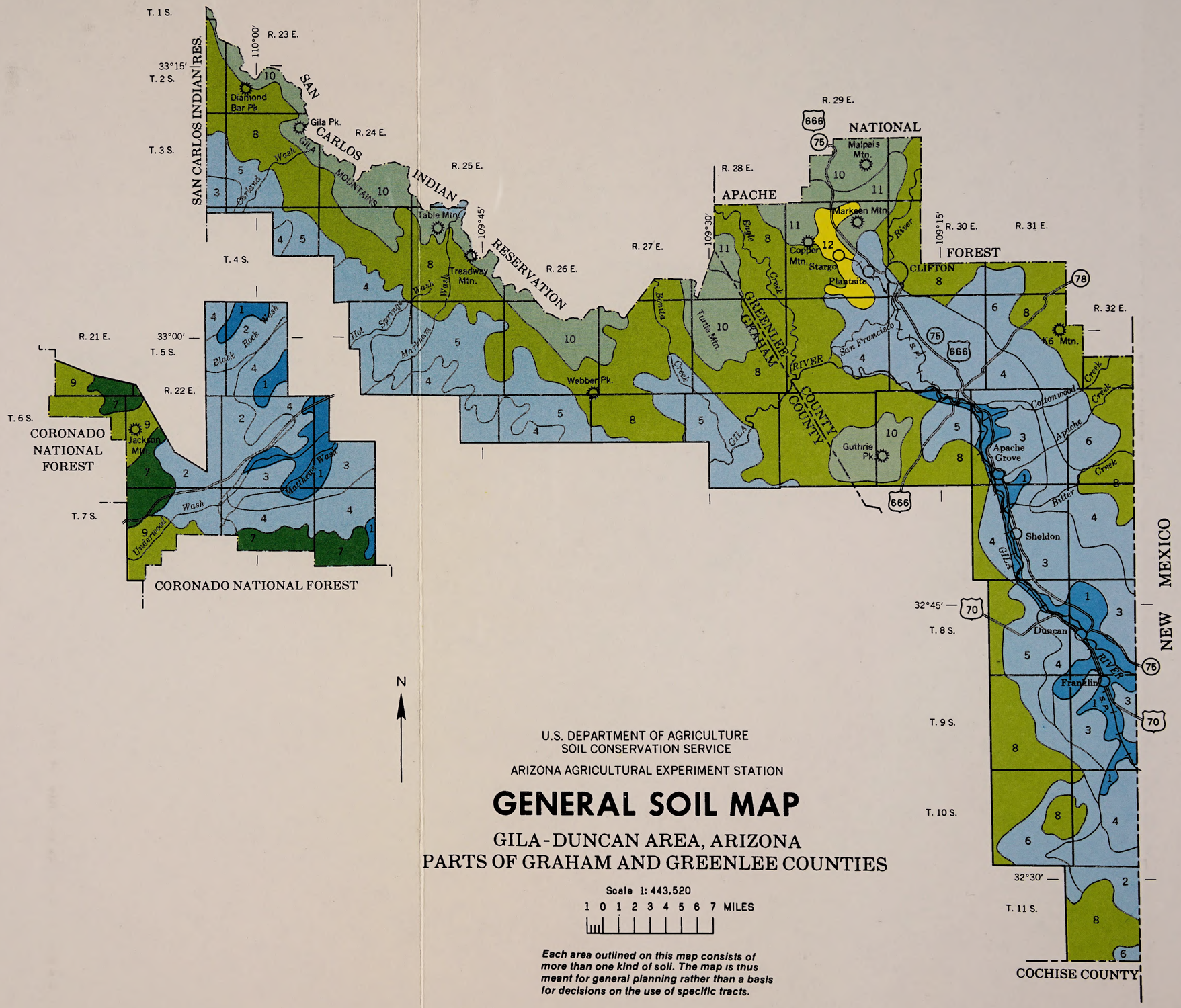
11 — Rock outcrop-Mokiak: Rock outcrop, and moderately deep, well drained, steep to very steep, very gravelly loamy soils; on mountains

MISCELLANEOUS AREAS

12 — Pits-Dumps: Open pit mine, sandy mine tailings, tailings ponds, extremely stony mine wastes, and other areas disturbed in mining

*Terms for texture refer to the dominant texture of the surface layer of the major soils.

Compiled 1980



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

ARIZONA AGRICULTURAL EXPERIMENT STATION

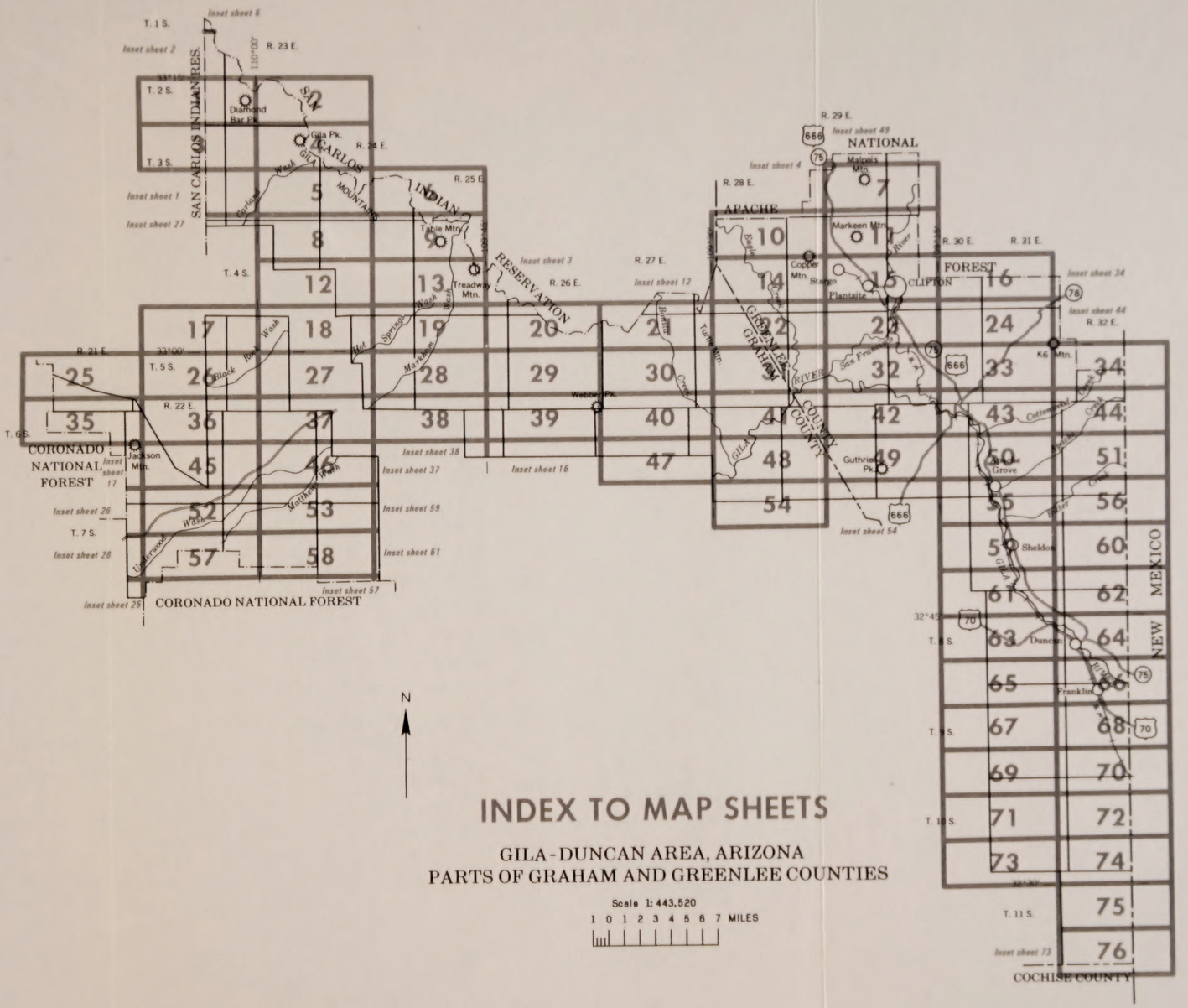
GENERAL SOIL MAP

GILA-DUNCAN AREA, ARIZONA
PARTS OF GRAHAM AND GREENLEE COUNTIES

Scale 1: 443,520

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.



INDEX TO MAP SHEETS

GILA-DUNCAN AREA, ARIZONA
PARTS OF GRAHAM AND GREENLEE COUNTIES

SOIL LEGEND

SYMBOL	NAME
1	Akela-Lehmans-Rock outcrop complex, 9 to 60 percent slopes
2	Anthony-Gila complex, 0 to 5 percent slopes
3	Aravaipa extremely gravelly loam, 5 to 40 percent slopes
4	Artesia extremely cobbly sandy clay loam, 0 to 8 percent slopes
5	Bonita very cobbly silty clay, 2 to 8 percent slopes
6	Calciorthids and Torriorthents, 10 to 90 percent slopes*
7	Comoro-Santo Tomas complex, 2 to 8 percent slopes
8	Continental gravelly clay loam, 2 to 15 percent slopes
9	Continetnal-Dona Ana complex, 2 to 15 percent slopes
10	Eba-Pinaleno complex, 2 to 40 percent slopes
11	Eloma-Alsco complex, 15 to 70 percent slopes
12	Eloma-White House association, 10 to 60 percent slopes
13	Fallsam-Cabezon-Rock outcrop complex, 9 to 70 percent slopes
14	Gila fine sandy loam, 0 to 2 percent slopes**
15	Glendale silty clay loam, 0 to 2 percent slopes**
16	Glendale-Gila complex, 0 to 5 percent slopes, severely eroded
17	Guest silty clay, 0 to 2 percent slopes**
18	Guest-Hantz complex, 0 to 5 percent slopes, severely eroded
19	Hantz silty clay, 0 to 2 percent slopes**
20	Hap gravelly sandy loam, 2 to 8 percent slopes
21	Hap-Pinaleno association, 9 to 60 percent slopes
22	Haplargids-Torriorthents complex, 5 to 40 percent slopes*
23	Limpia-Graham-Rock outcrop complex, 9 to 50 percent slopes
24	Maloy extremely stony sandy loam, 2 to 15 percent slopes
25	Peloncillo extremely cobbly sandy clay loam, 2 to 10 percent slopes
26	Peloncillo-Orthents-Pinaleno complex, 20 to 90 percent slopes
27	Pima silty clay loam, 0 to 2 percent slopes**
28	Pinaleno very cobbly loam, 5 to 30 percent slopes
29	Pinaleno-Whitlock-Tres Hermanos complex, 2 to 30 percent slopes
30	Pits-Dumps association
31	Rock outcrop-Atascosa-Graham complex, 9 to 70 percent slopes
32	Rock outcrop-Chiricahua Variant complex, 5 to 90 percent slopes
33	Rock outcrop-Lampshire complex, 20 to 90 percent slopes
34	Rock outcrop-Luzena complex, 20 to 90 percent slopes
35	Rock outcrop-Mokiak complex, 20 to 90 percent slopes
36	Santo Tomas extremely stony sandy loam, 2 to 10 percent slopes
37	Selevin extremely stony loam, 2 to 15 percent slopes
38	Signal very cobbly clay loam, 10 to 40 percent slopes
39	Sonoita-Bucklebar complex, 2 to 10 percent slopes
40	Stellar gravelly sandy clay loam, 0 to 5 percent slopes
41	Tapco-Peloncilio association, 2 to 15 percent slopes
42	Torrifluvents-Riverwash complex, 1 to 5 percent slopes
43	Tres Hermanos-Continental-Nickel complex, 2 to 45 percent slopes
44	Wampoo gravelly loam, 2 to 10 percent slopes
45	Whitlock-Tres Hermanos complex, 2 to 20 percent slopes

*These units are more broadly defined than others in the survey area.

**These units were mapped at order 2 intensity, more detailed than most others in the survey.

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
- Corral
- 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 — SvE 107

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

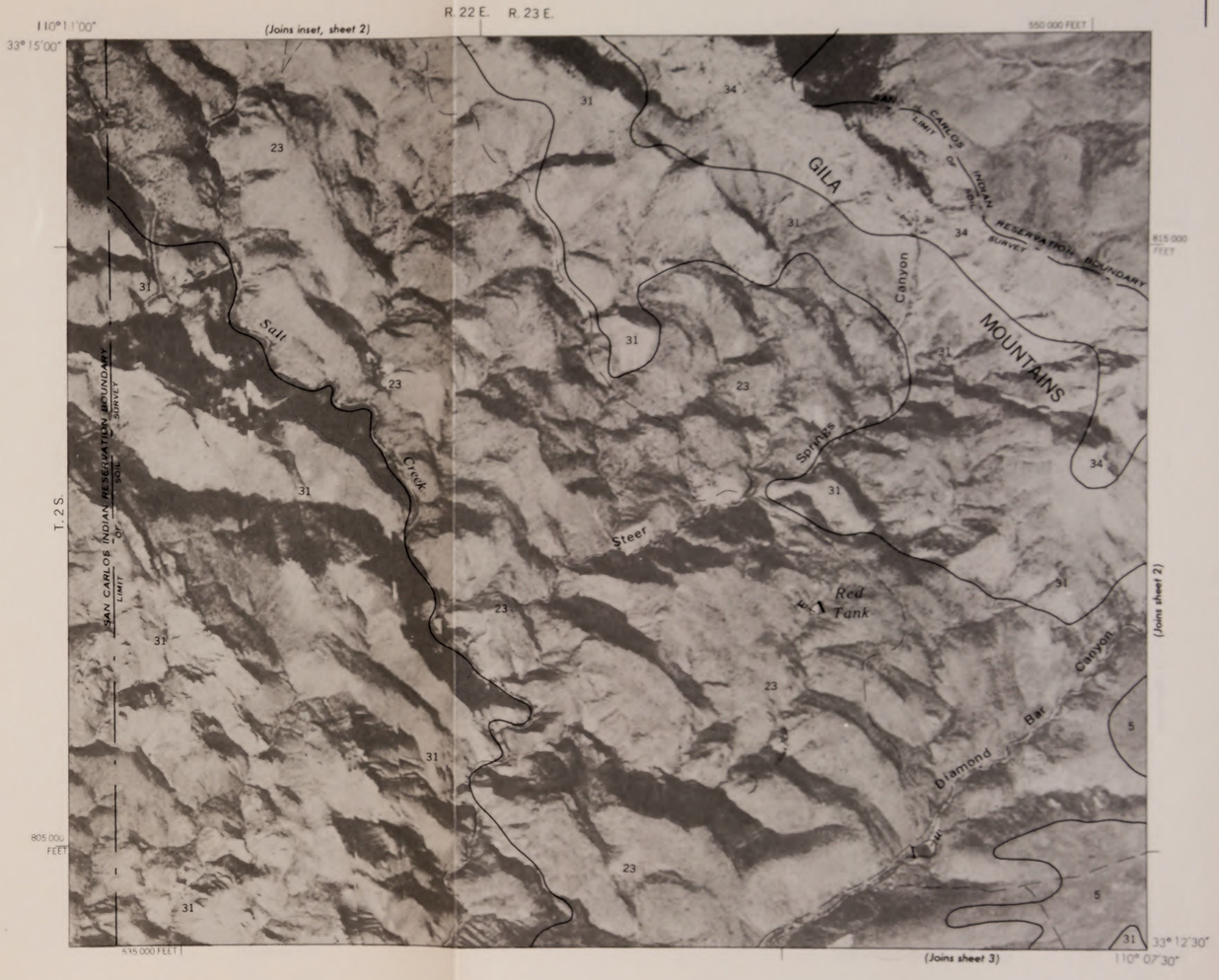
SOIL SAMPLE SITE (normally not shown)

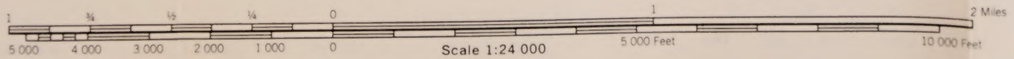
MISCELLANEOUS

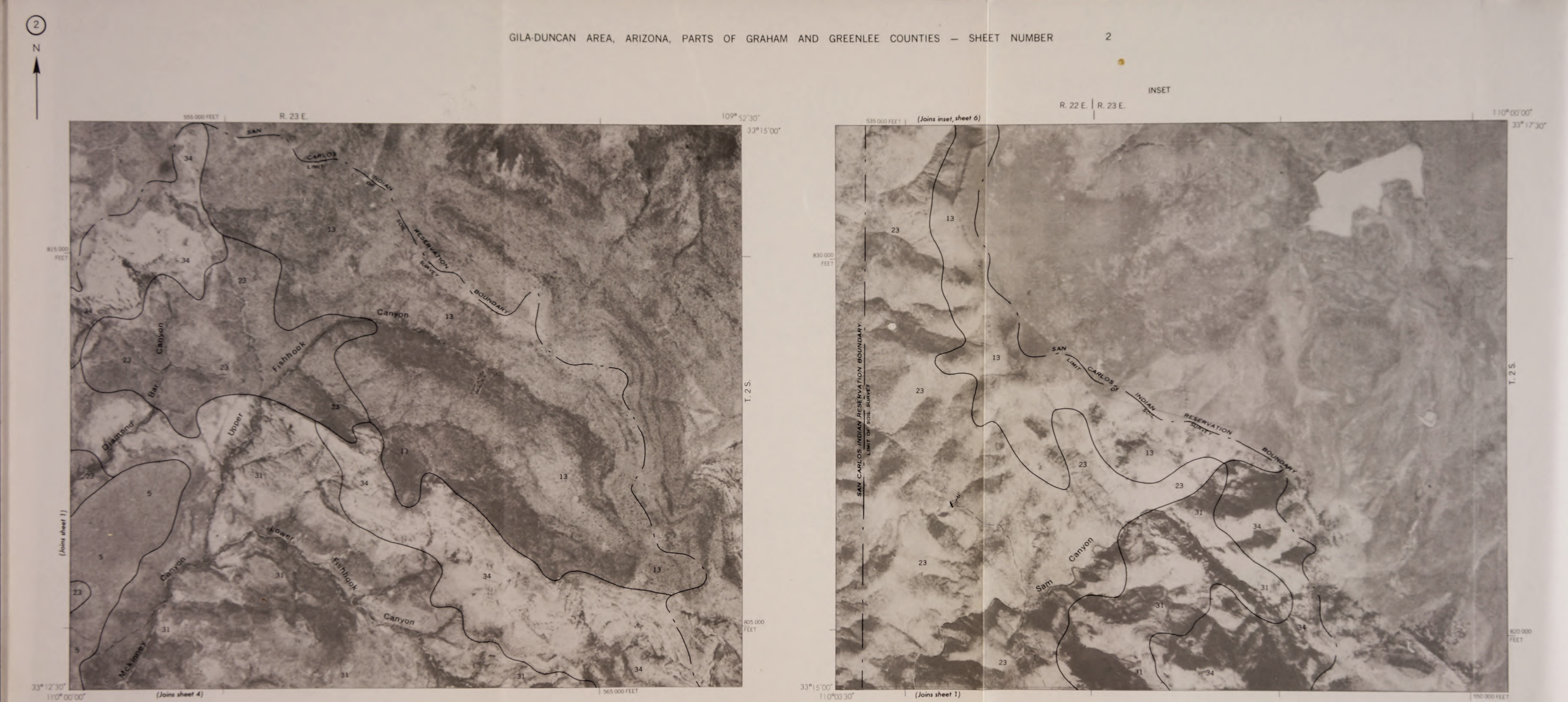
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot — 0

INSET


110°11'00"
33°15'00"
R. 23 E.
(Joins sheet 3)
550 000 FEET
785 000 FEET
T. 3 S.
SAN CARLOS INDIAN RESERVATION BOUNDARY
SOIL SURVEY
LIMIT OF
(Joins sheet 5)
775 000 FEET
535 000 FEET
(Joins inset, sheet 27)
33°07'30"
110°07'30"
Wash
Carland


R. 22 E.
R. 23 E.
110°11'00"
33°15'00"
(Joins inset, sheet 2)
550 000 FEET
815 000 FEET
T. 2 S.
SAN CARLOS INDIAN RESERVATION BOUNDARY
SOIL SURVEY
LIMIT OF
805 000 FEET
835 000 FEET
(Joins sheet 2)
(Joins sheet 3)
33°12'30"
110°07'30"
GILA
CARLOS INDIAN RESERVATION BOUNDARY
SURVEY
LIMIT OF
Canyon
MOUNTAINS
Salt
Creek
Springs
Steer
Red
Tank
Diamond
Bar
Canyon

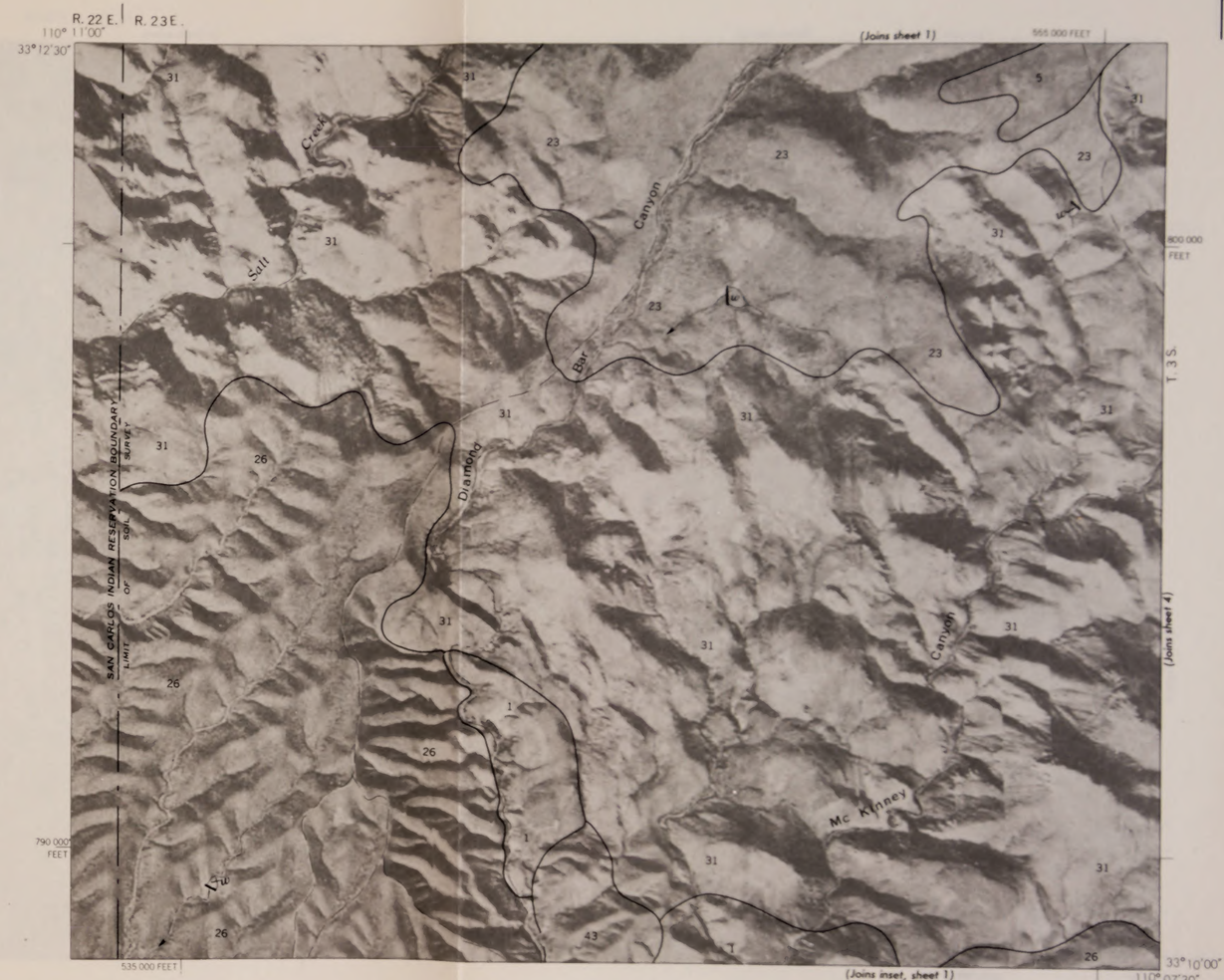

1
¾
½
¼
0
1
2 Miles
5 000
4 000
3 000
2 000
1 000
0
5 000 Feet
10 000 Feet
Scale 1:24 000

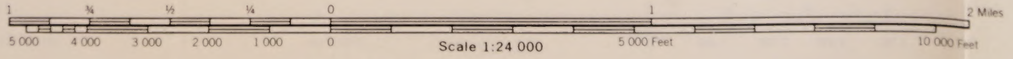

N
INSET
R. 23 E.
R. 22 E.
555 000 FEET
565 000 FEET
535 000 FEET
550 000 FEET
109° 52'30"
110° 00'00"
110° 03'30"
33° 15'00"
33° 12'30"
33° 17'30"
815 000 FEET
805 000 FEET
830 000 FEET
820 000 FEET
T. 2 S.
(Joins sheet 1)
(Joins sheet 4)
(Joins inset, sheet 6)
(Joins sheet 1)
SAN CARLOS INDIAN RESERVATION BOUNDARY
LIMIT OF SOIL SURVEY
SAN CARLOS INDIAN RESERVATION BOUNDARY
LIMIT OF SOIL SURVEY
Diamond Bar Canyon
Upper Fishhook Canyon
Lower Fishhook Canyon
McKinney Canyon
Sam Canyon
Canyon
13
23
34
31
5
Scale 1:24 000
2 Miles
5 000 Feet
10 000 Feet
5 000
4 000
3 000
2 000
1 000
0

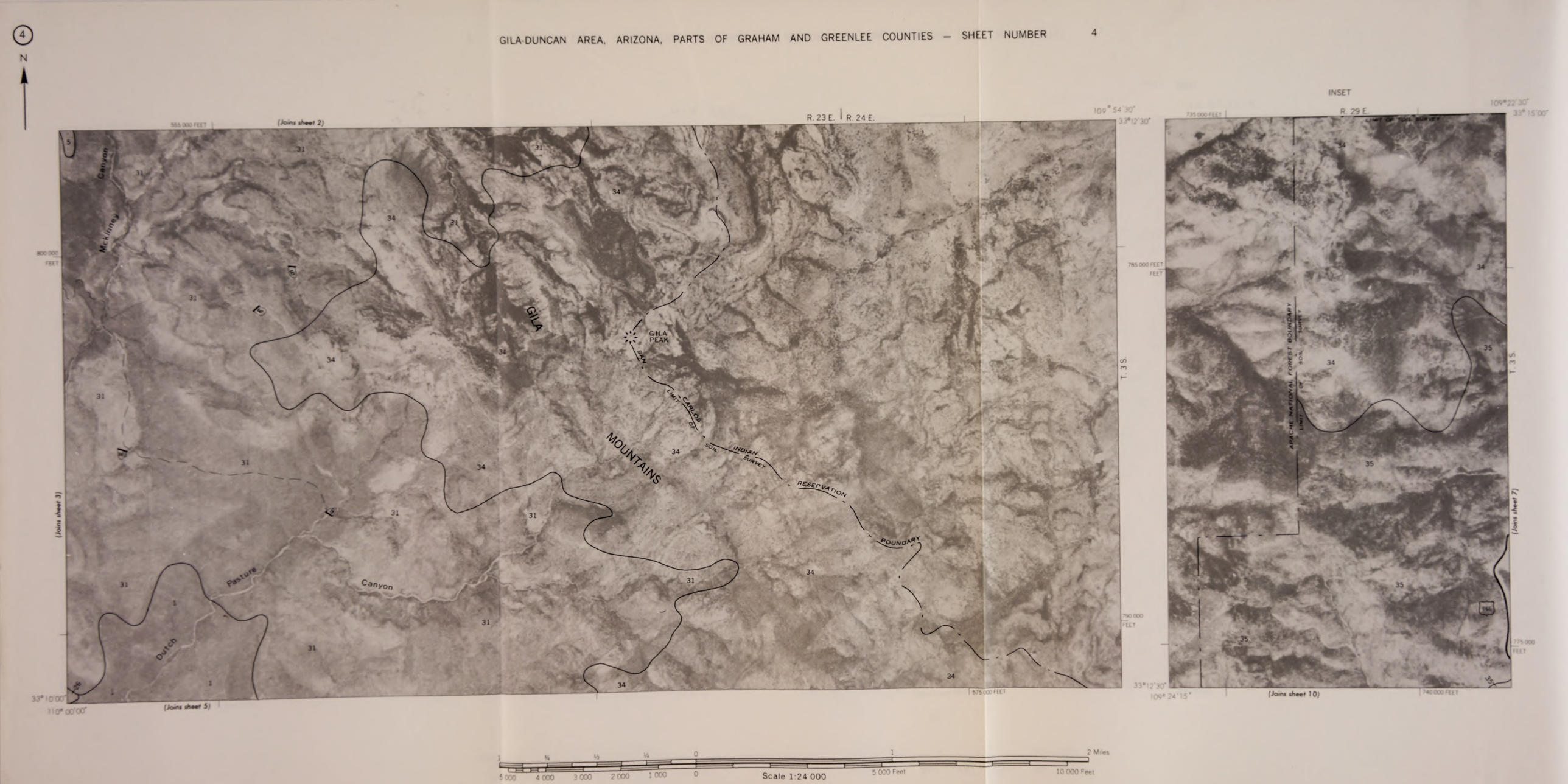
N

INSET


109° 45'00"
33° 05'00"
R. 25 E.
R. 26 E.
645 000 FEET
755 000 FEET
T. 5 S.
T. 4 S.
(Joins sheet 13)
745 000 FEET
630 000 FEET
(Joins sheet 20)
(Joins sheet 20)
33° 02'30"
109° 41'30"
SAN CARLOS INDIAN RESERVATION BOUNDARY
SOIL SURVEY
Limit of
INDIAN LIMIT
26 25
35 36


R. 22 E.
R. 23 E.
110° 11'00"
33° 12'30"
(Joins sheet 1)
555 000 FEET
800 000 FEET
T. 3 S.
(Joins sheet 4)
790 000 FEET
535 000 FEET
(Joins inset, sheet 1)
33° 10'00"
110° 07'30"
SAN CARLOS INDIAN RESERVATION BOUNDARY
SOIL SURVEY
Limit of
Salt Creek
Canyon
Bar
Diamond
Canyon
Mc Kinney


1
¾
½
¼
0
1
2 Miles
5 000
4 000
3 000
2 000
1 000
0
5 000 Feet
10 000 Feet
Scale 1:24 000

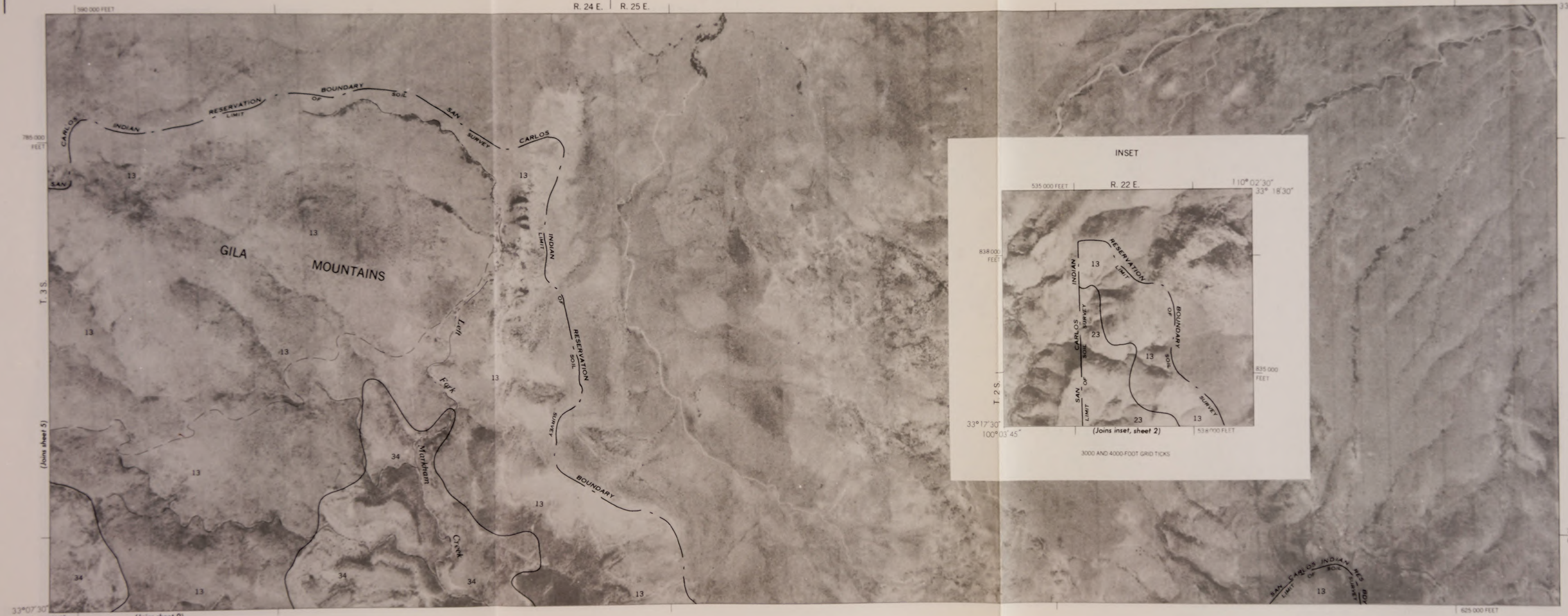

4
N
555 000 FEET
(Joins sheet 2)
R. 23 E.
R. 24 E.
109° 54' 30"
33° 12' 30"
INSET
R. 29 E.
109° 22' 30"
33° 15' 00"
735 000 FEET
785 000 FEET
800 000 FEET
790 000 FEET
775 000 FEET
740 000 FEET
T. 3 S.
McKinney Canyon
GILA
GILA PEAK
SAN CARLOS INDIAN RESERVATION BOUNDARY
LIMIT OF SOIL SURVEY
APACHE NATIONAL FOREST BOUNDARY
MOUNTAINS
Pasture Canyon
Dutch
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 10)
33° 10' 00"
110° 00' 00"
109° 24' 15"
575 000 FEET
1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

N

Scale 1:24 000

1 ⅘ ⅗ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

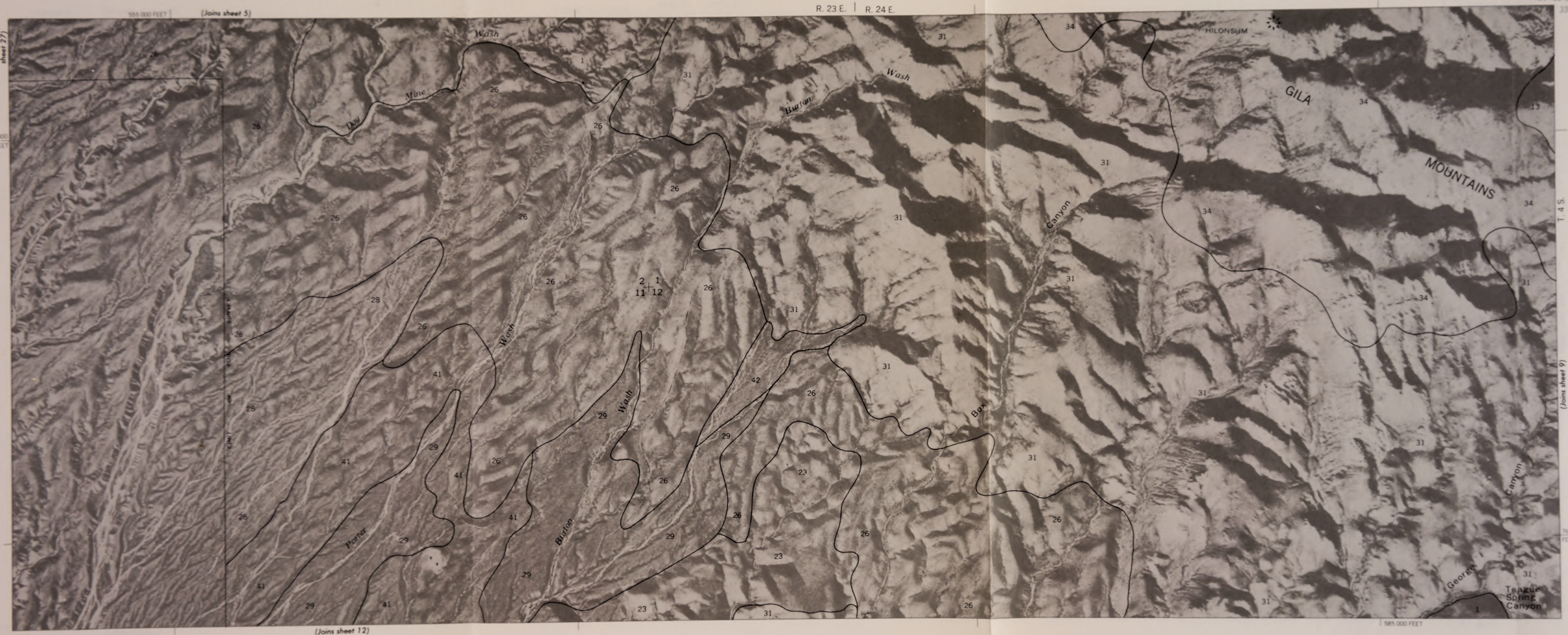
N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

GILA-DUNCAN AREA, ARIZONA, PARTS OF GRAHAM AND GREENLEE COUNTIES — SHEET NUMBER 8



2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

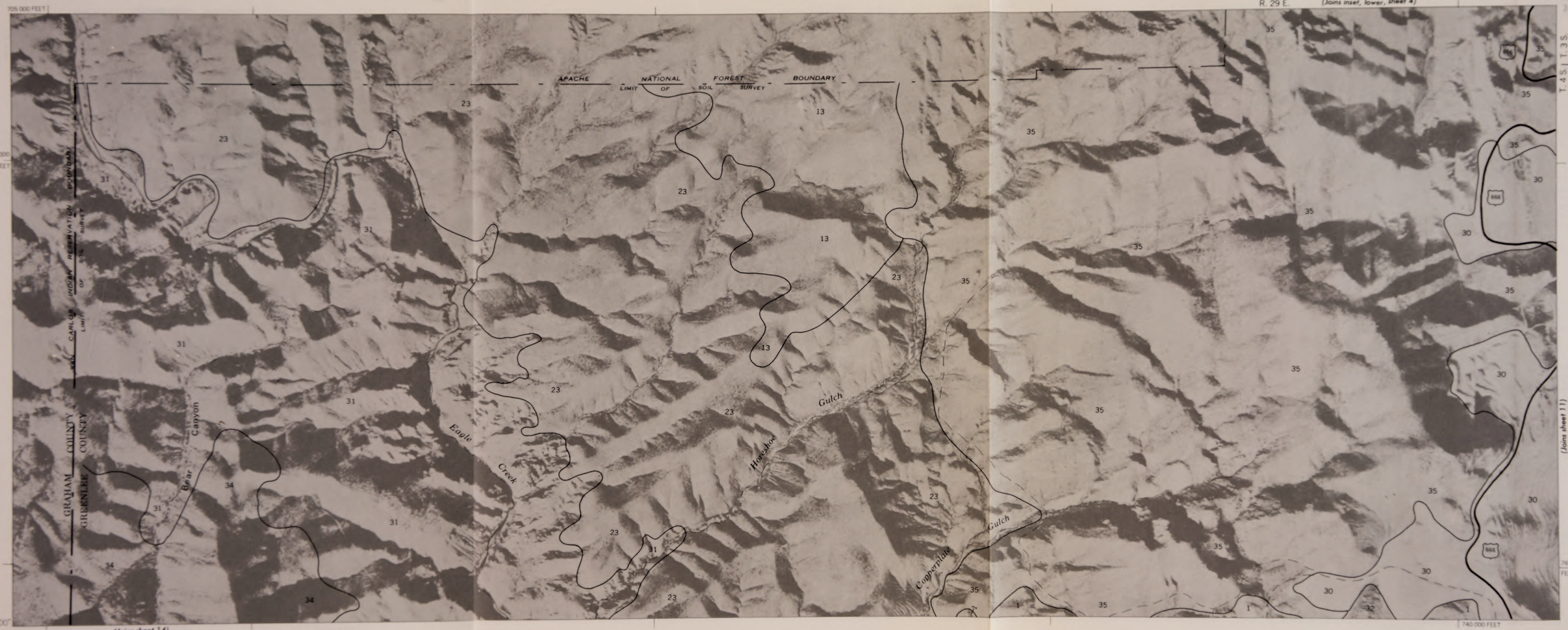
Scale 1:24 000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000



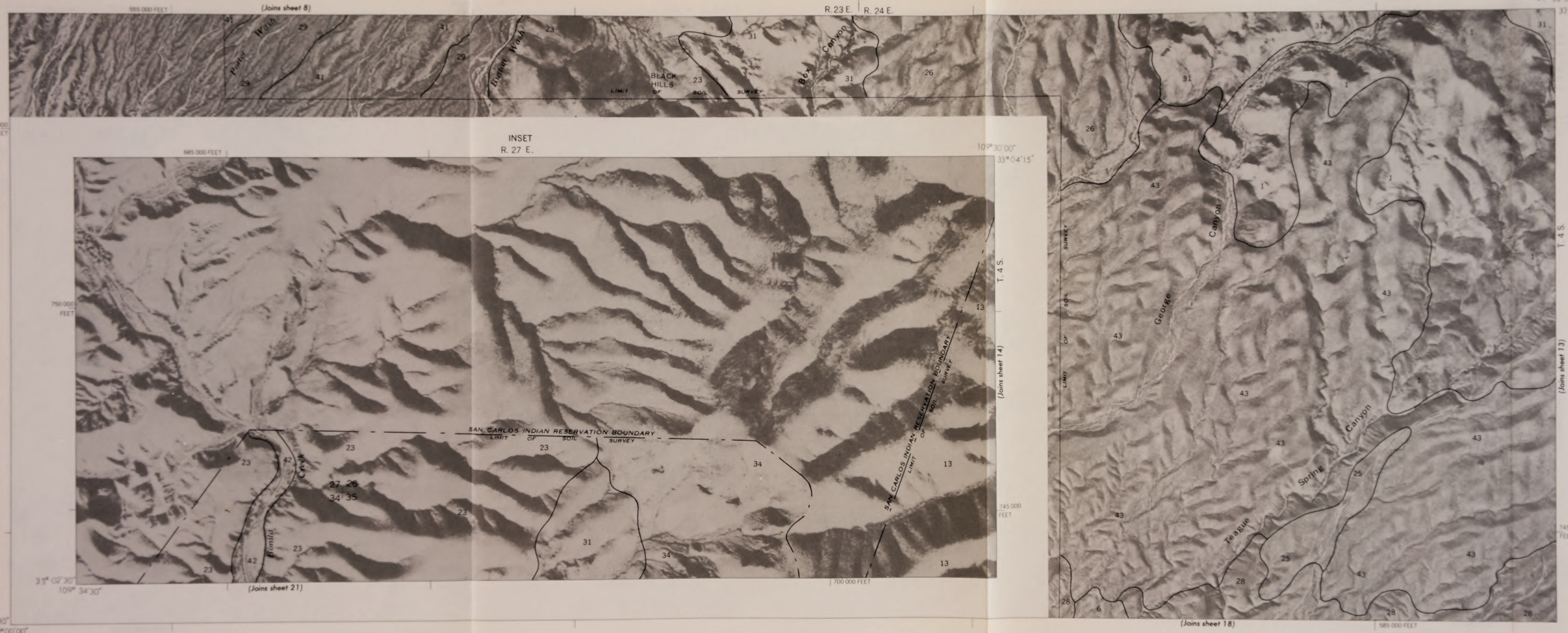
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

N

1 ⅘ ⅗ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

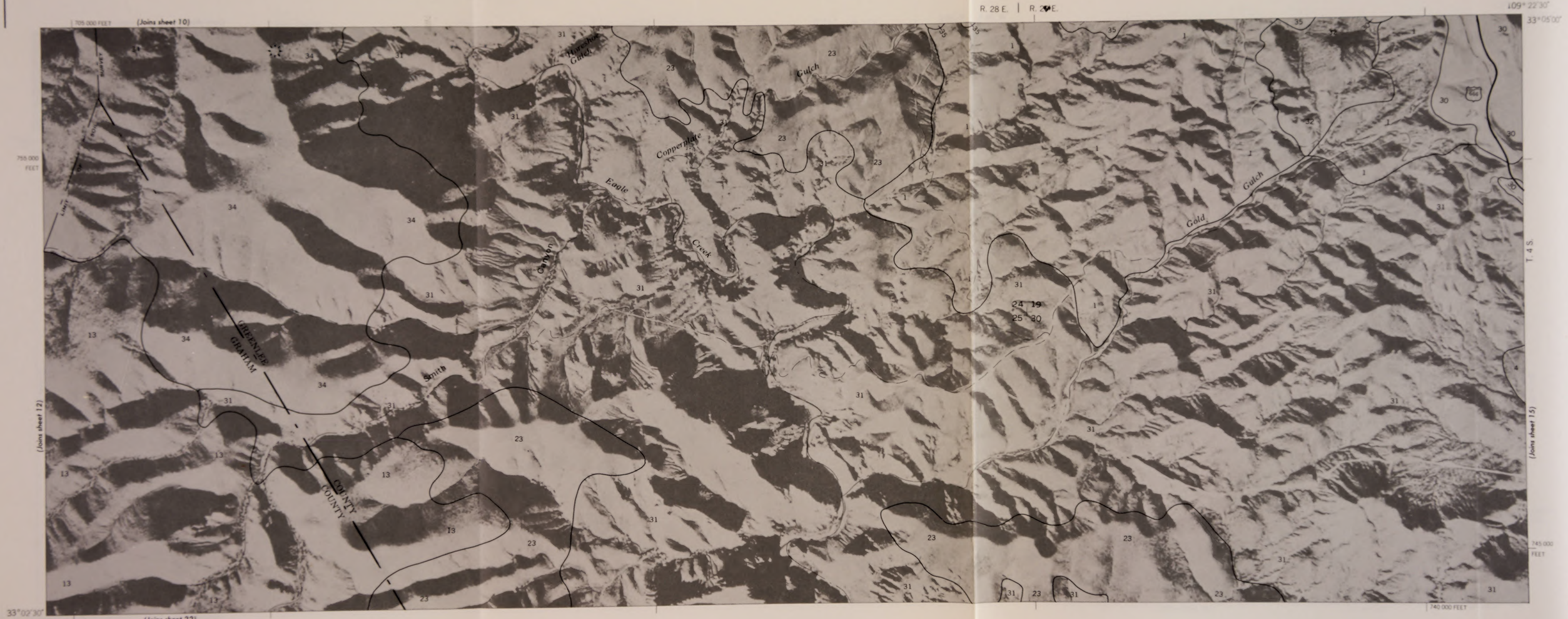

N
555 000 FEET
(Joins sheet 8)
R. 23 E.
R. 24 E.
109° 52'30"
33°05'00"
Porter Wash
Duncan Wash
Box Canyon
BLACK HILLS
LIMIT OF SOIL SURVEY
755 000 FEET
INSET
R. 27 E.
585 000 FEET
109°30'00"
33°04'15"
T. 4 S.
George Canyon
LIMIT OF SOIL SURVEY
750 000 FEET
SAN CARLOS INDIAN RESERVATION BOUNDARY
LIMIT OF SOIL SURVEY
Bonita Creek
745 000 FEET
(Joins sheet 14)
(Joins sheet 13)
Spring Canyon
Teague
700 000 FEET
33° 02'30"
109° 34'30"
(Joins sheet 21)
33° 02'30"
110°00'00"
(Joins sheet 18)
585 000 FEET
2 Miles
5 000 4 000 3 000 2 000 1 000 0
Scale 1:24 000
5 000 Feet
10 000 Feet

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000



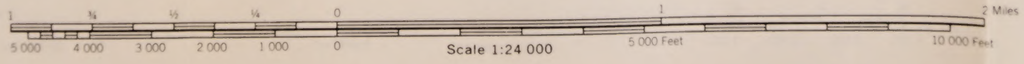
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

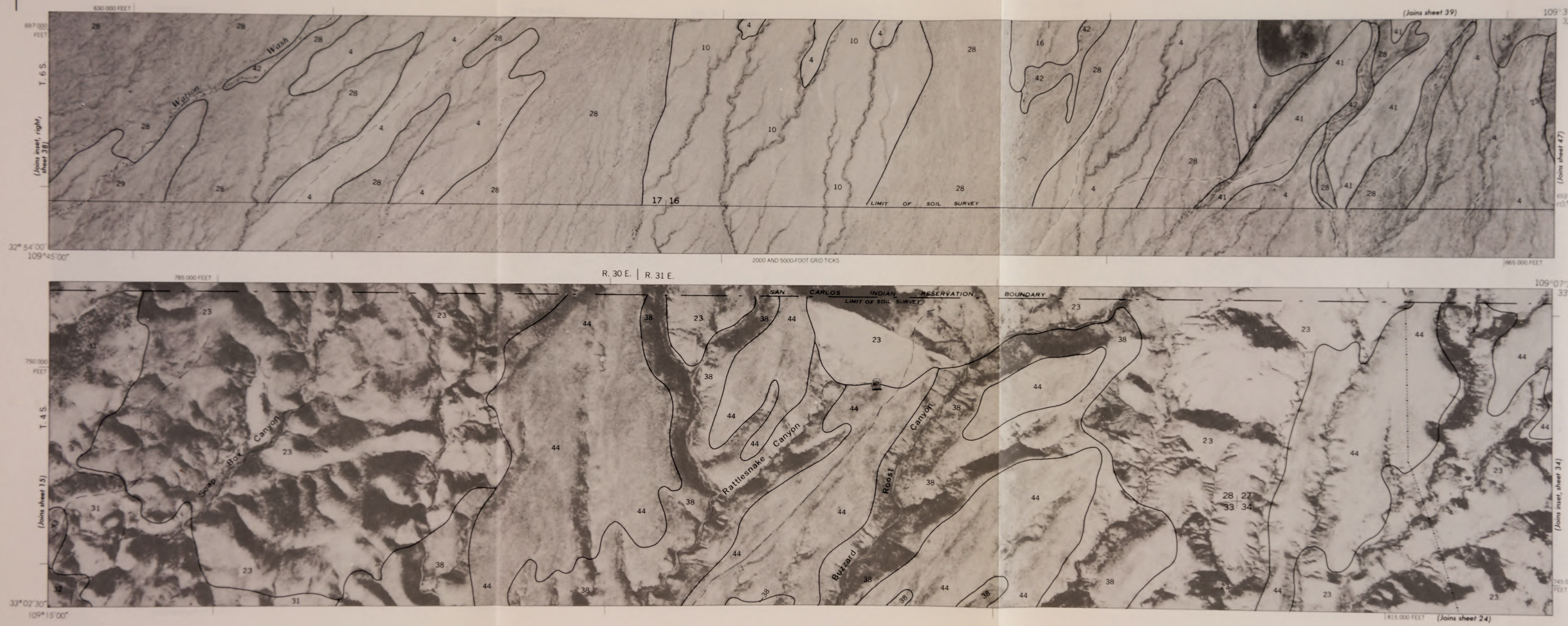
N


109° 22'30"
33°06'00"
R. 29 E.
R. 30 E.
(Joins sheet 11)
780 000 FEET
PHELPS DODGE
MORENCI OPEN PIT
T. 4 S.
(Joins sheet 14)
Chase
Creek
666
SAN FRANCISCO RIVER
APACHE NATIONAL FOREST BOUNDARY
LIMIT OF SOIL SURVEY
water
TAILINGS POND
Morenci
CLIFTON
SOUTHERN PACIFIC
755 000 FEET
(Joins sheet 16)
745 000 FEET
745 000 FEET
(Joins sheet 23)
33° 02'30"
109°15'00"


1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

N

INSET
R. 26 E.



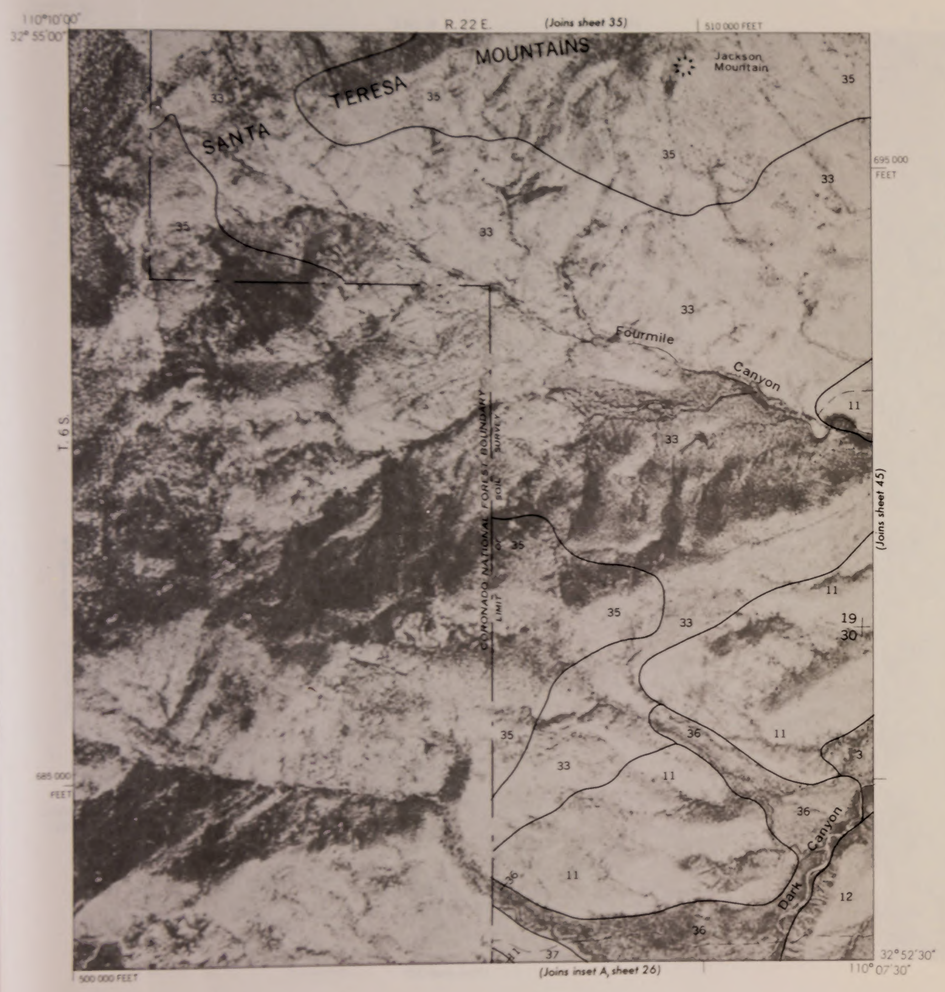
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

N

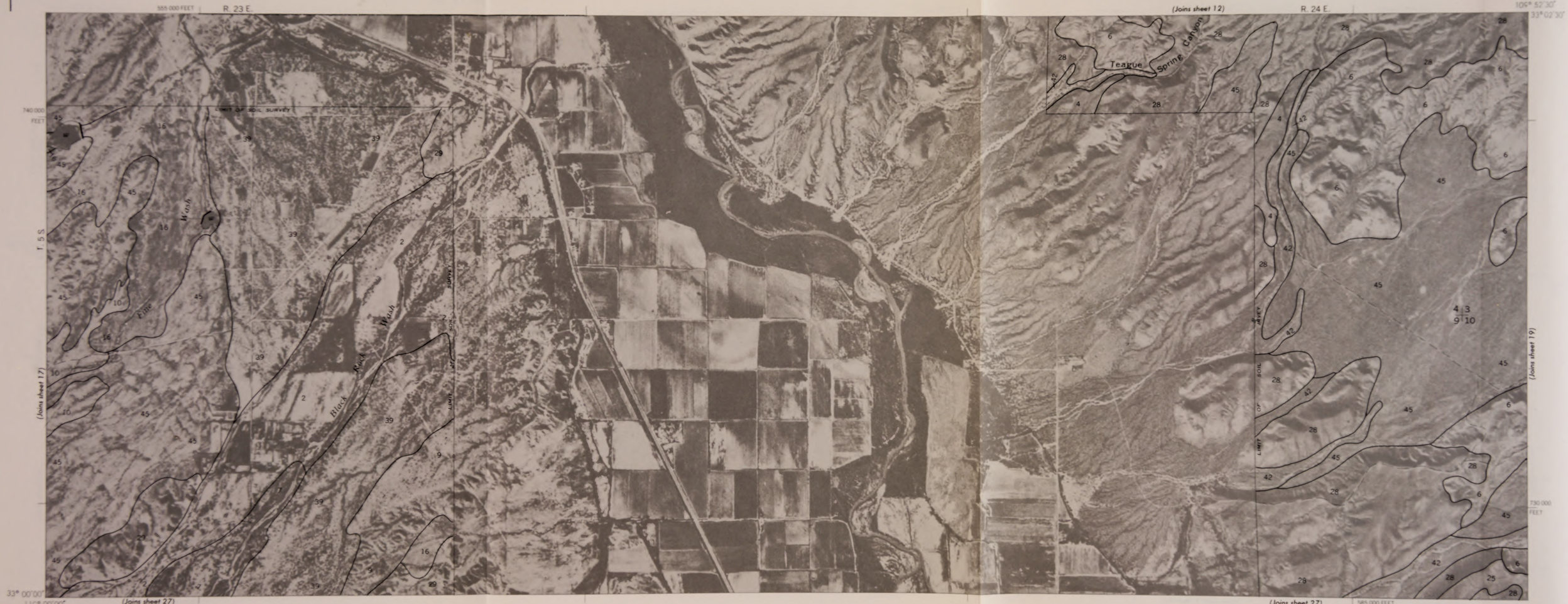
INSET



1 ⅗ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

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 Feet 10 000 Feet

Scale 1:24 000

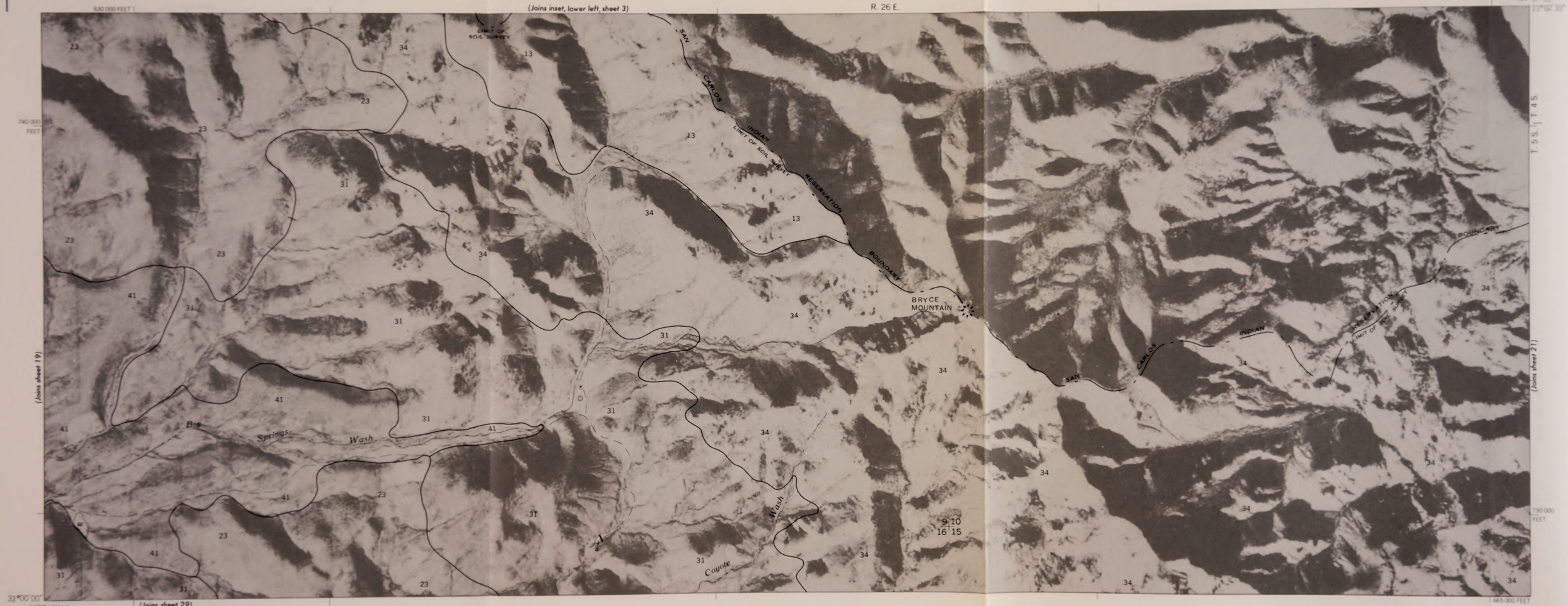
N

Scale 1:24 000

1 Mile 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

N

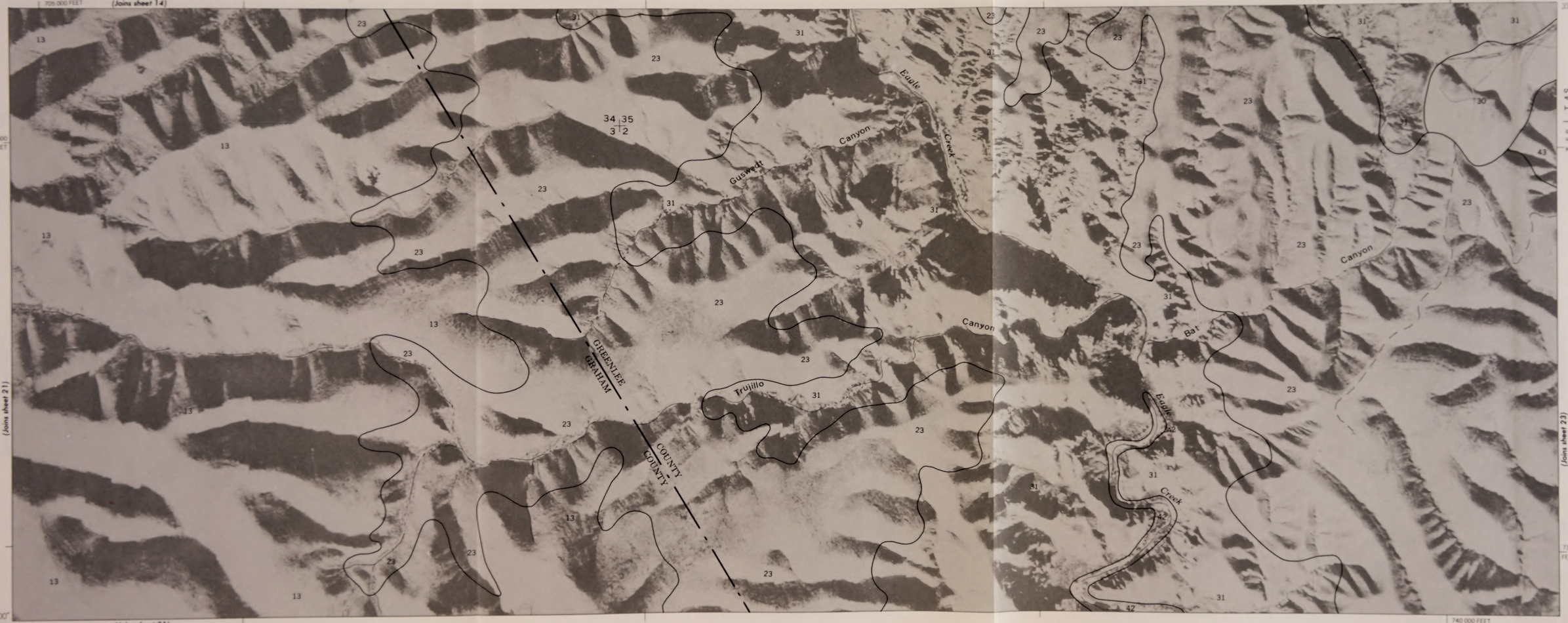


Scale 1:24 000

N

1 ¾ ½ ¼ 0 1 2 Miles

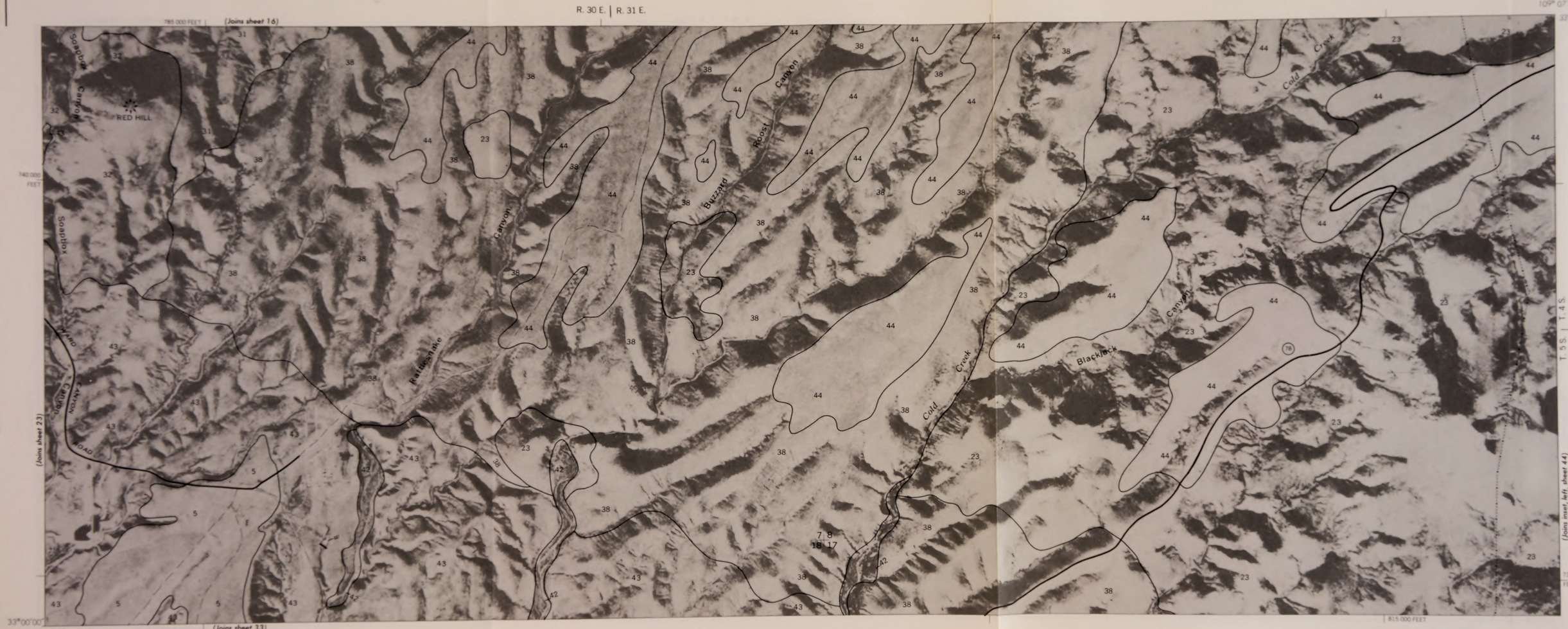
5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet

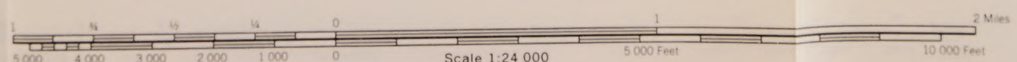

22
N
705 000 FEET
(Joins sheet 14)
R. 28 E. | R. 29 E.
109°22'30"
33°02'30"
740 000 FEET
34
35
3
2
Euale
Canyon
Creek
Guswelt
T. 5 S. | T. 4 S.
Canyon
Bar
GREENLEE
GRAHAM
COUNTY
COUNTY
Truijllo
Euale
Creek
(Joins sheet 21)
(Joins sheet 23)
730 000 FEET
740 000 FEET
33°00'00"
109°30'00"
(Joins sheet 31)
2 Miles
5 000 4 000 3 000 2 000 1 000 0
5 000 Feet
10 000 Feet
Scale 1:24 000


109°22'30"
33°02'30"
R. 29 E.
R. 30 E.
T. 5 S.
T. 4 S.
(Joins sheet 15)
780 000 FEET
740 000 FEET
730 000 FEET
745 000 FEET
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 32)
33°00'00"
109°15'00"
TAILINGS POND
TAILINGS POND
SOUTHERN PACIFIC
SOUTHERN PACIFIC
WARD CANYON ROAD
WARD CANYON ROAD
CEMETERY
SAN FRANCISCO RIVER
TUNNEL
TUNNEL
666
N
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

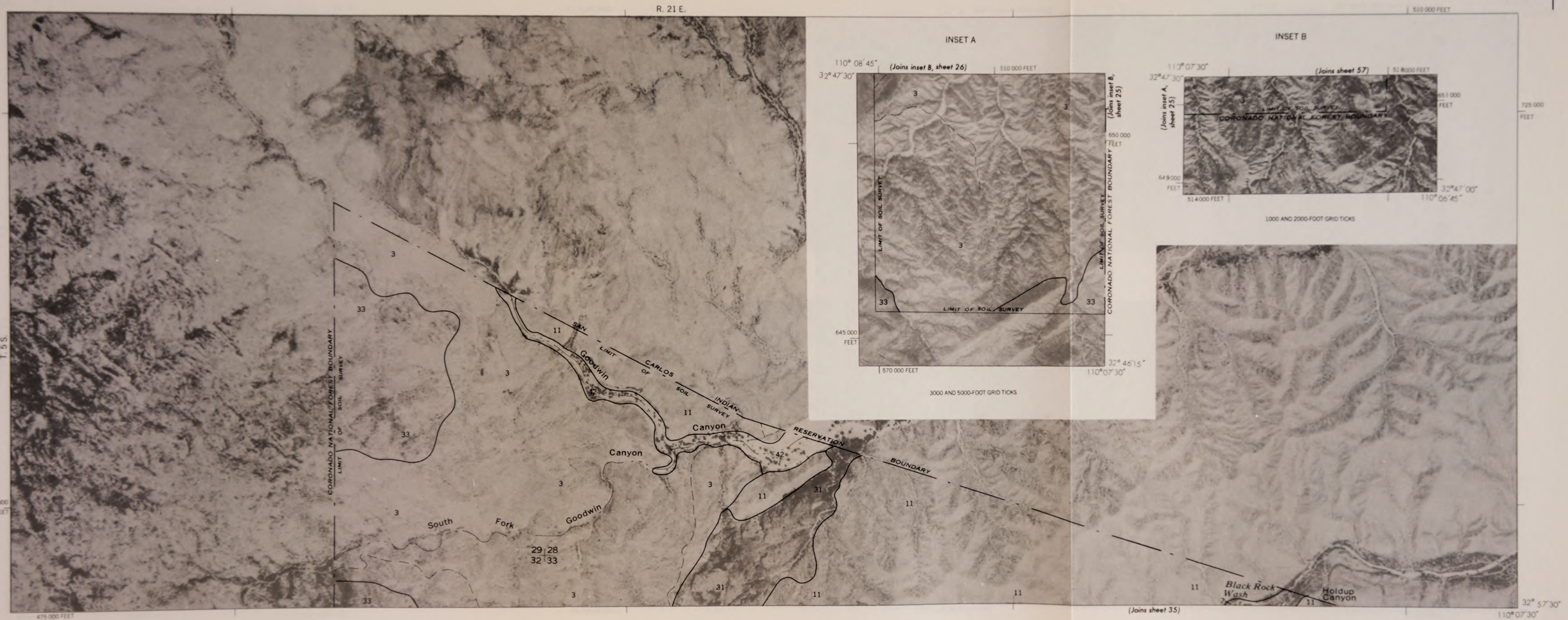
GILA-DUNCAN AREA, ARIZONA, PARTS OF GRAHAM AND GREENLEE COUNTIES — SHEET NUMBER 24

N





N



INSET A

3000 AND 5000-FOOT GRID TICKS

INSET B

1000 AND 2000-FOOT GRID TICKS

1 ¾ ½ ¼ 0 1 2 Miles

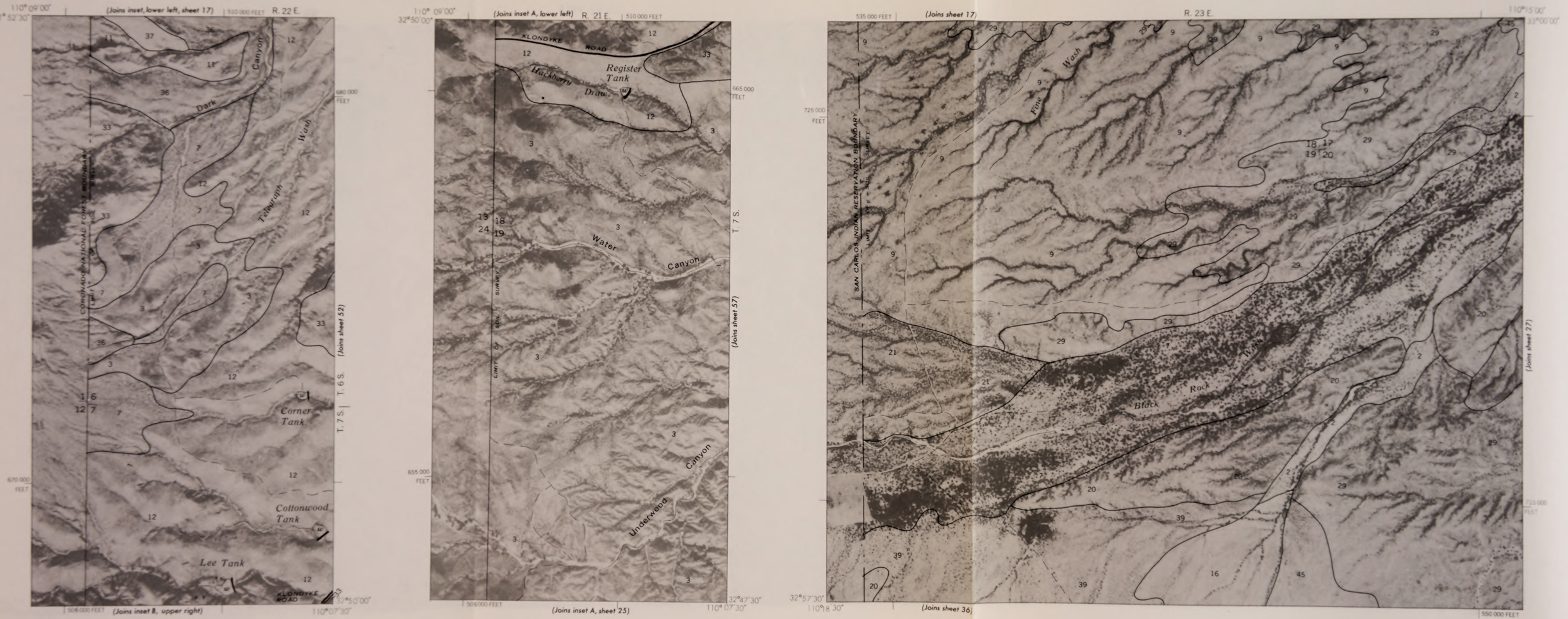
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

N

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 Feet 10 000 Feet

Scale 1:24 000

N

1 ⅔ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

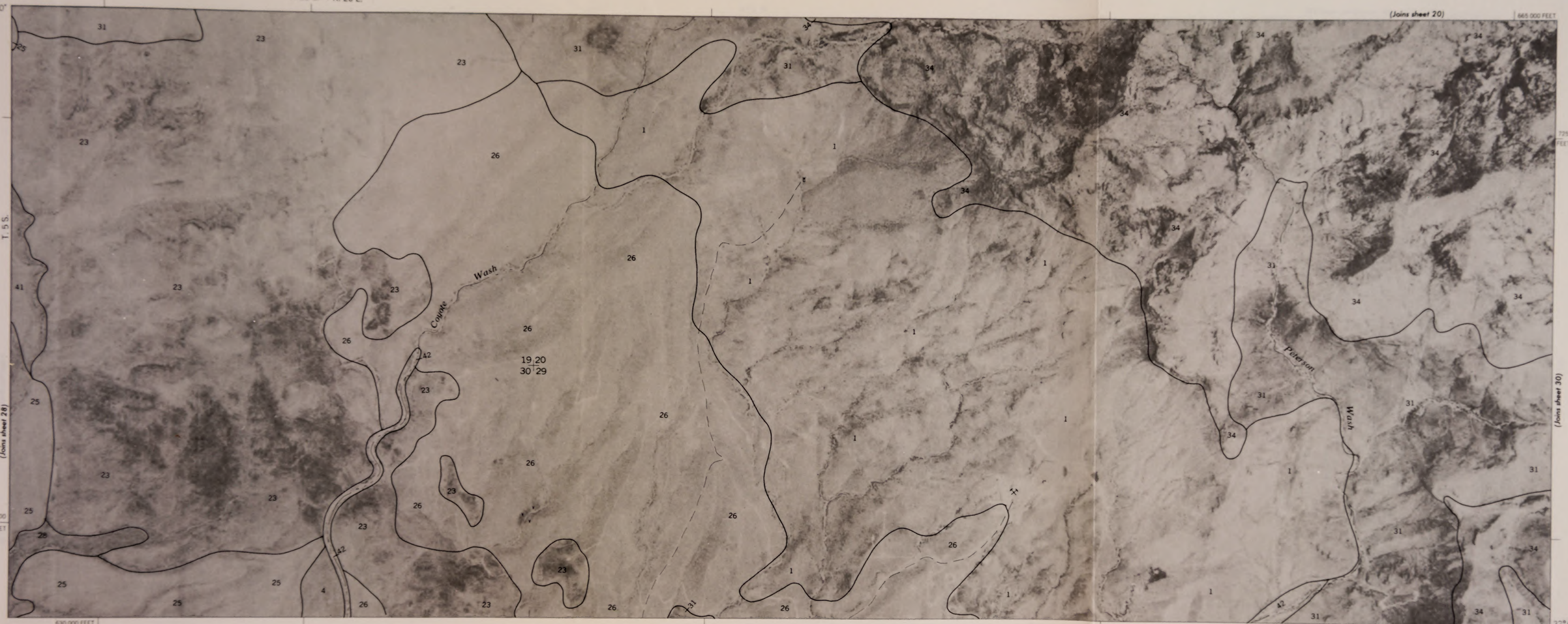
Scale 1:24 000

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 Feet 10 000 Feet

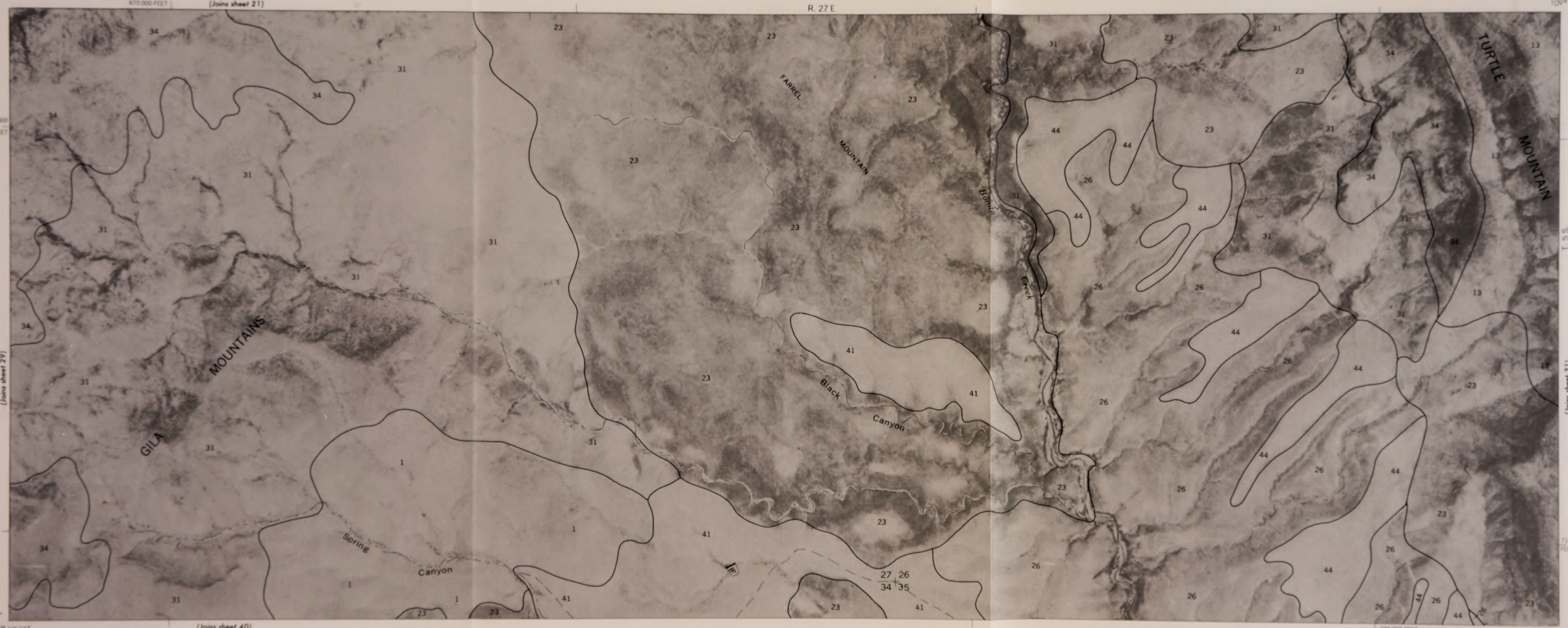
N



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000


N
670 000 FEET
(Joins sheet 21)
R. 27 E
109° 30' 00"
33° 00' 00"
725 000 FEET
FARREL MOUNTAIN
Bonita Creek
TURTLE MOUNTAIN
T. 5 S.
GILA MOUNTAINS
Black Canyon
Spring Canyon
(Joins sheet 29)
(Joins sheet 31)
715 000 FEET
32° 57' 30"
109° 37' 30"
(Joins sheet 40)
700 000 FEET
27 26
34 35
1 Mile
2 Miles
5 000 4 000 3 000 2 000 1 000 0
Scale 1:24 000
5 000 Feet
10 000 Feet

GILA-DUNCAN AREA, ARIZONA, PARTS OF GRAHAM AND GREENLEE COUNTIES — SHEET NUMBER 31

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

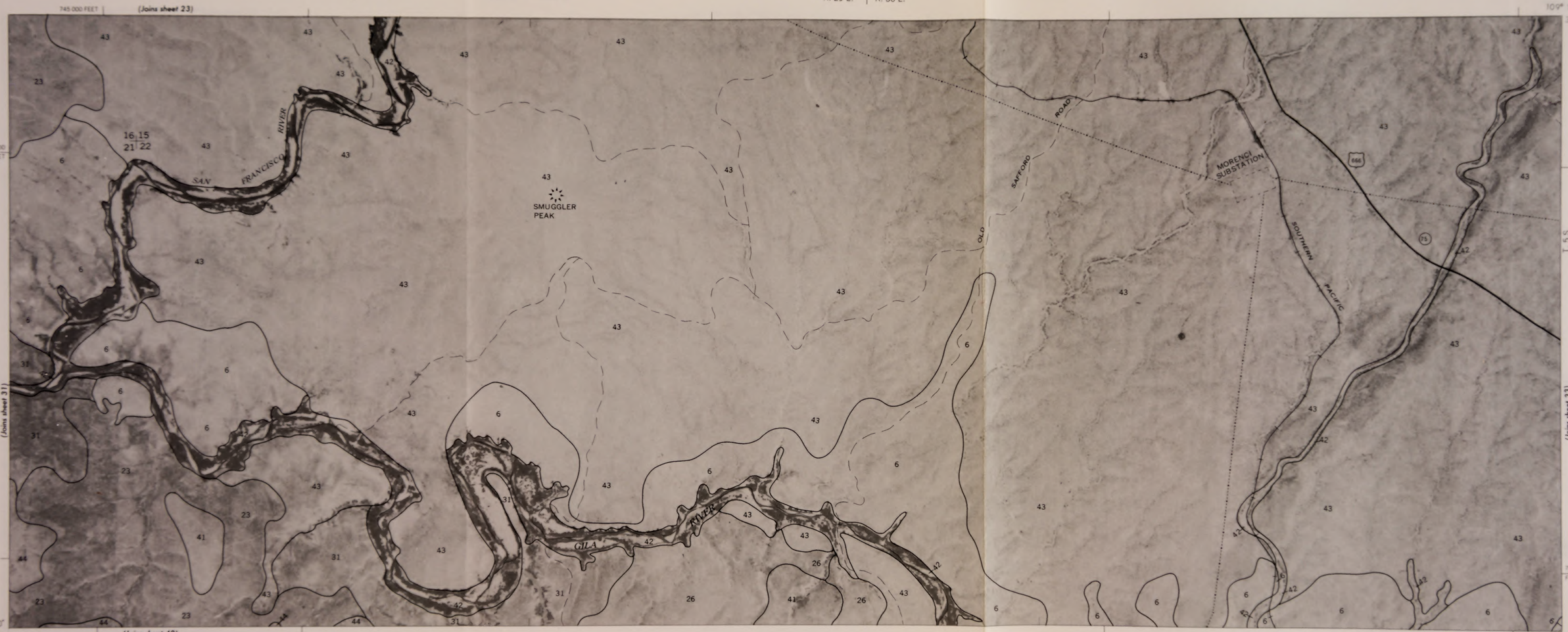
31

N

N

GILA-DUNCAN AREA, ARIZONA, PARTS OF GRAHAM AND GREENLEE COUNTIES — SHEET NUMBER 32

R. 29 E. | R. 30 E.



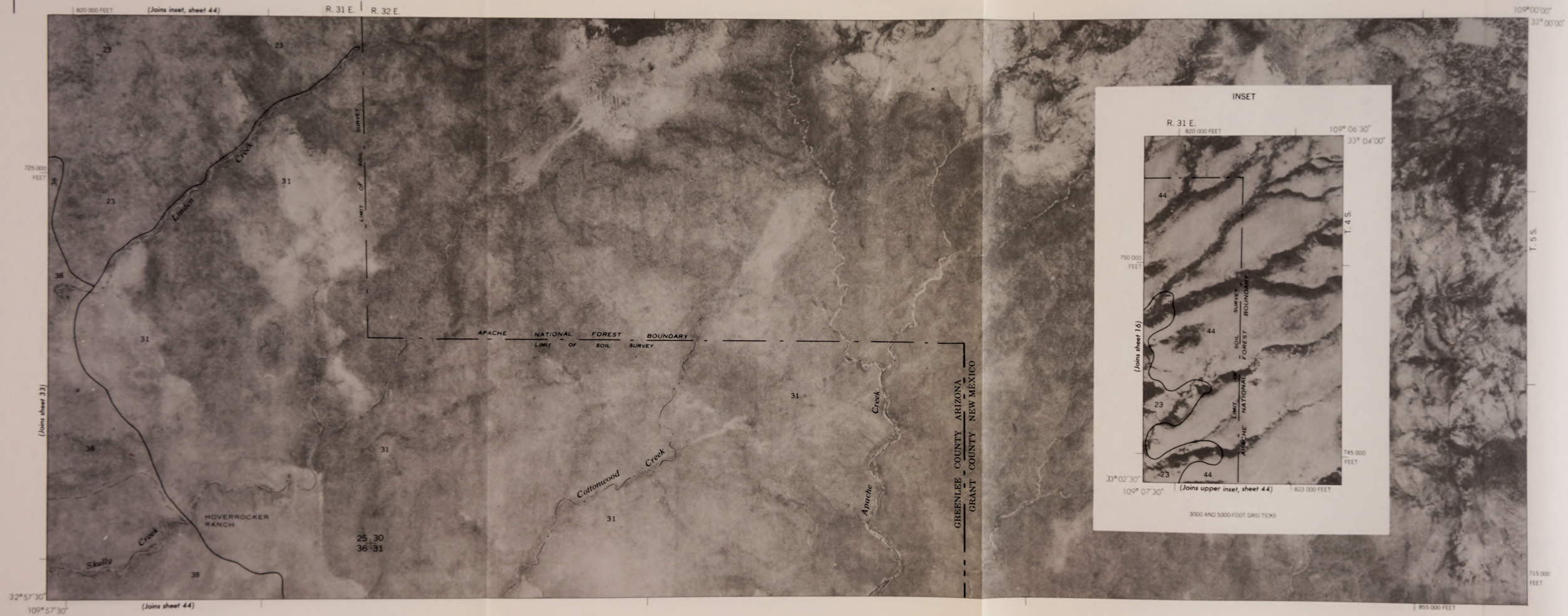
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

N


109°15'00"
33°00'00"
R. 30 E.
R. 31 E.
815 000 FEET
(Joins sheet 24)
T. 5 S.
(Joins sheet 32)
725 000 FEET
(Joins sheet 34)
715 000 FEET
785 000 FEET
(Joins sheet 43)
32° 57'30"
109° 07'30"
Rattlesnake Canyon
Buzzard Roost Canyon
Cold Creek
Willow Creek
Lee Ear Creek
Linden Creek
Skully Creek
19 20
30 29
Greenlee Substation
TG AND E REACTOR STATION #1
AIR STRIP
GUTHRIE ROAD
78
666
1 3/4 1/2 1/4 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

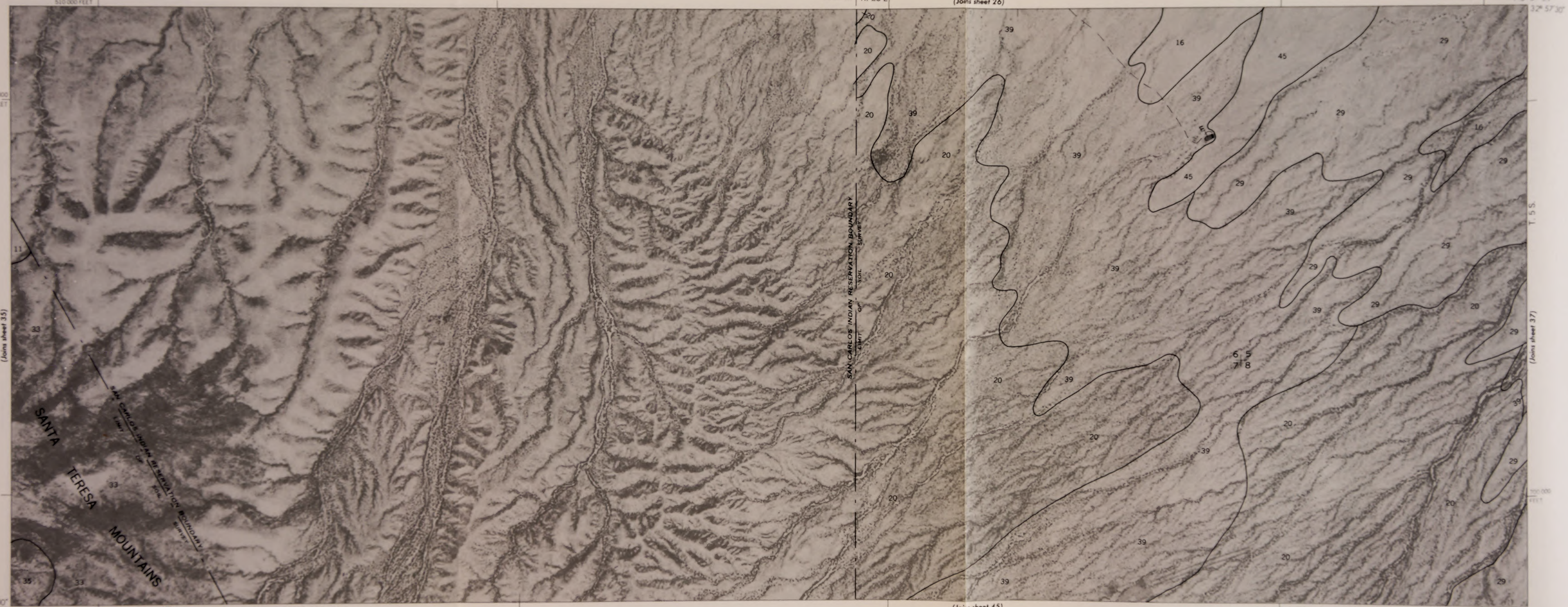

N
820 000 FEET
(Joins inset, sheet 44)
R. 31 E.
R. 32 E.
109°00'00"
33°00'00"
725 000 FEET
LIMIT OF SOIL SURVEY
Creek
Limdon
APACHE NATIONAL FOREST BOUNDARY
LIMIT OF SOIL SURVEY
GREENLEE COUNTY ARIZONA
GRANT COUNTY NEW MEXICO
Cottonwood Creek
Apache Creek
HOVERROCKER RANCH
Skully Creek
25 30
36 31
(Joins sheet 33)
32°57'30"
109°57'30"
(Joins sheet 44)
715 000 FEET
855 000 FEET
INSET
R. 31 E.
820 000 FEET
109° 06'30"
33° 04'00"
T. 4 S.
T. 5 S.
750 000 FEET
(Joins sheet 16)
SOIL SURVEY
NATIONAL FOREST BOUNDARY
LIMIT
APACHE
745 000 FEET
33°02'30"
109° 07'30"
(Joins upper inset, sheet 44)
823 000 FEET
3000 AND 5000-FOOT GRID TICKS
2 Miles
1
¾
½
¼
0
1
5 000
4 000
3 000
2 000
1 000
0
5 000 Feet
10 000 Feet
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 Feet 10 000 Feet

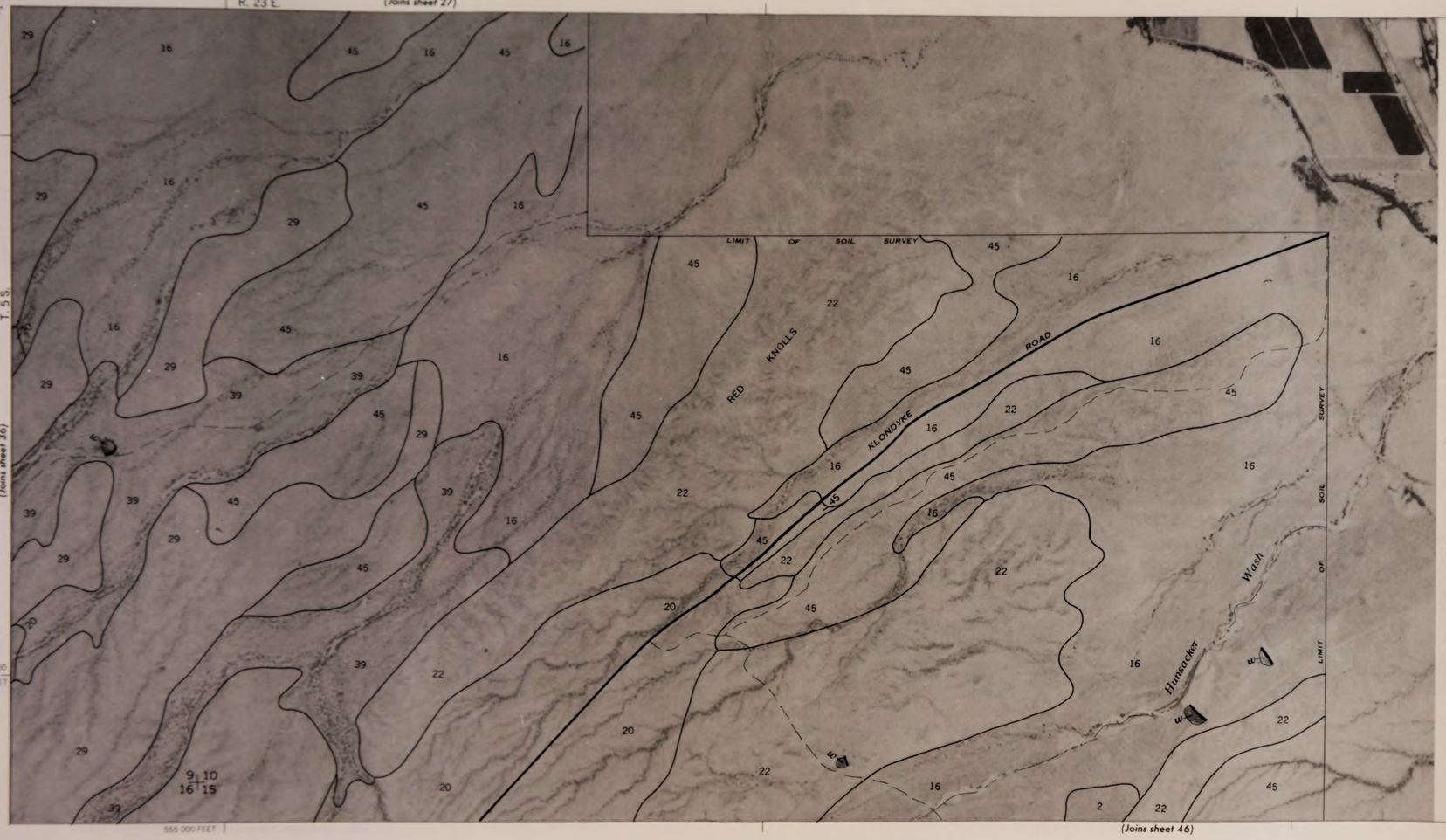
Scale 1:24 000

N

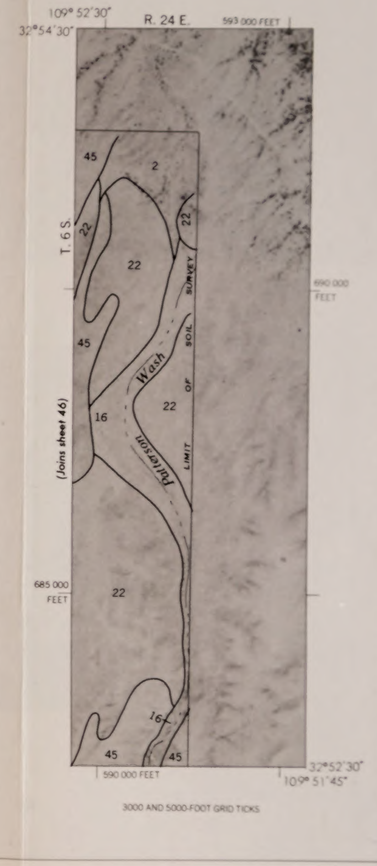


Scale 1:24 000

N



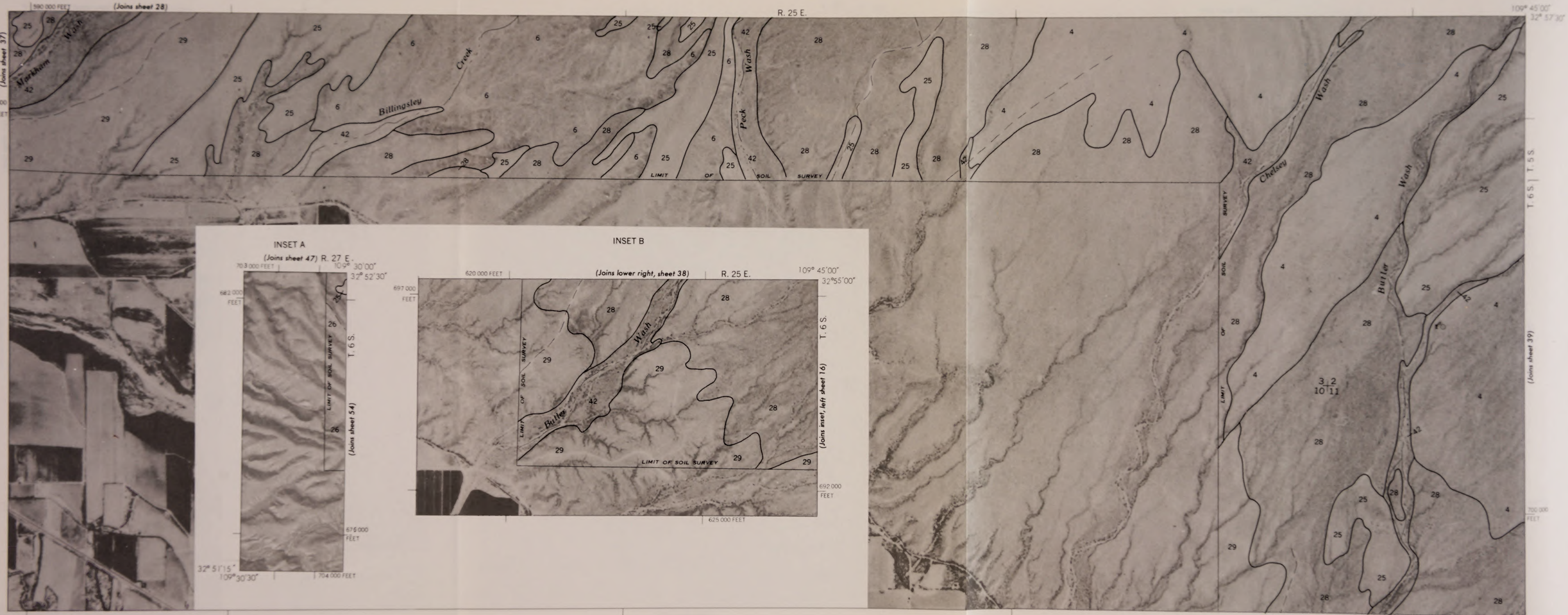
INSET



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

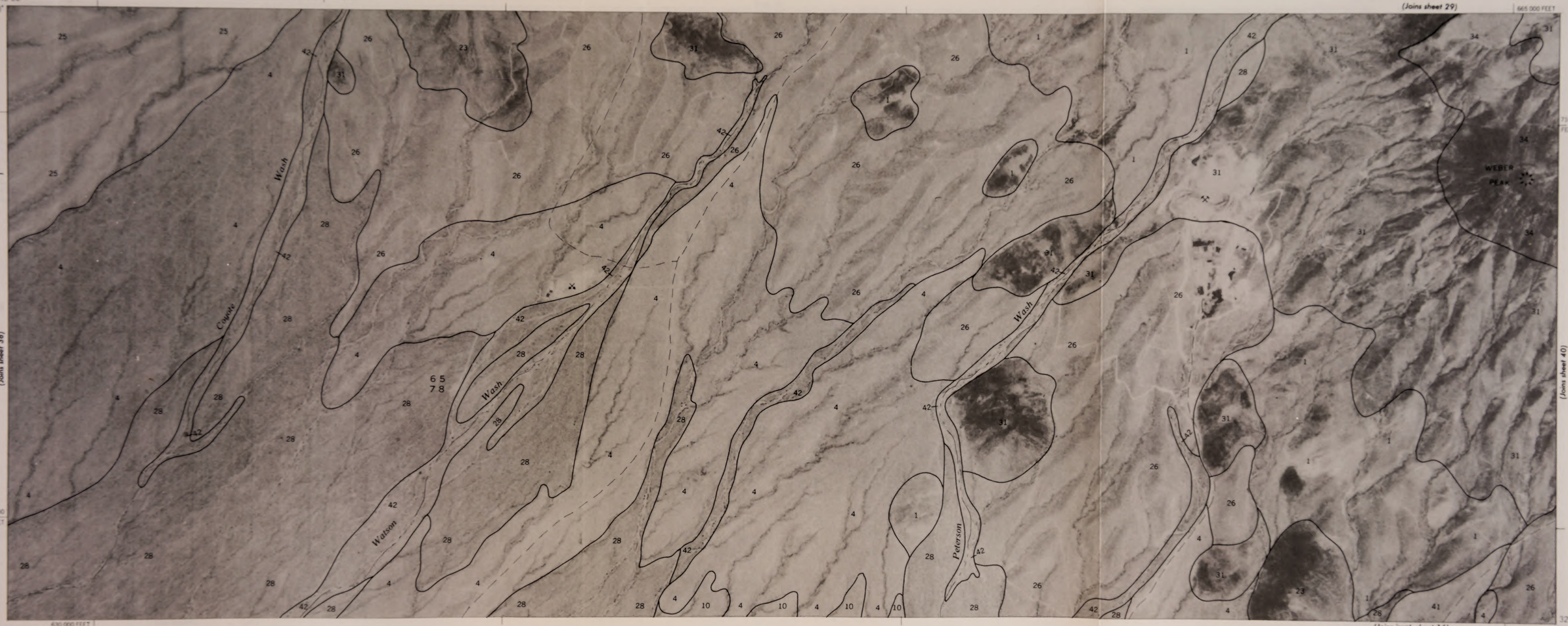
Scale 1:24 000



1 ⅛ ½ ⅛ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

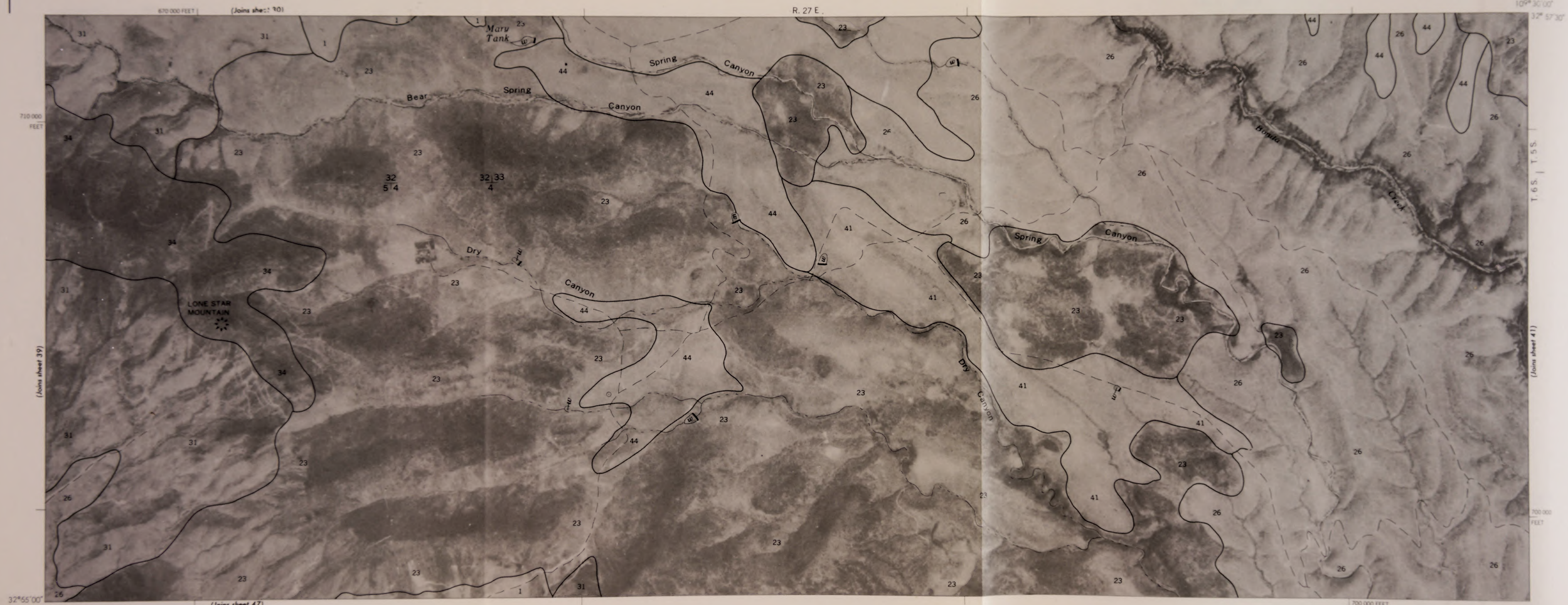
Scale 1:24 000

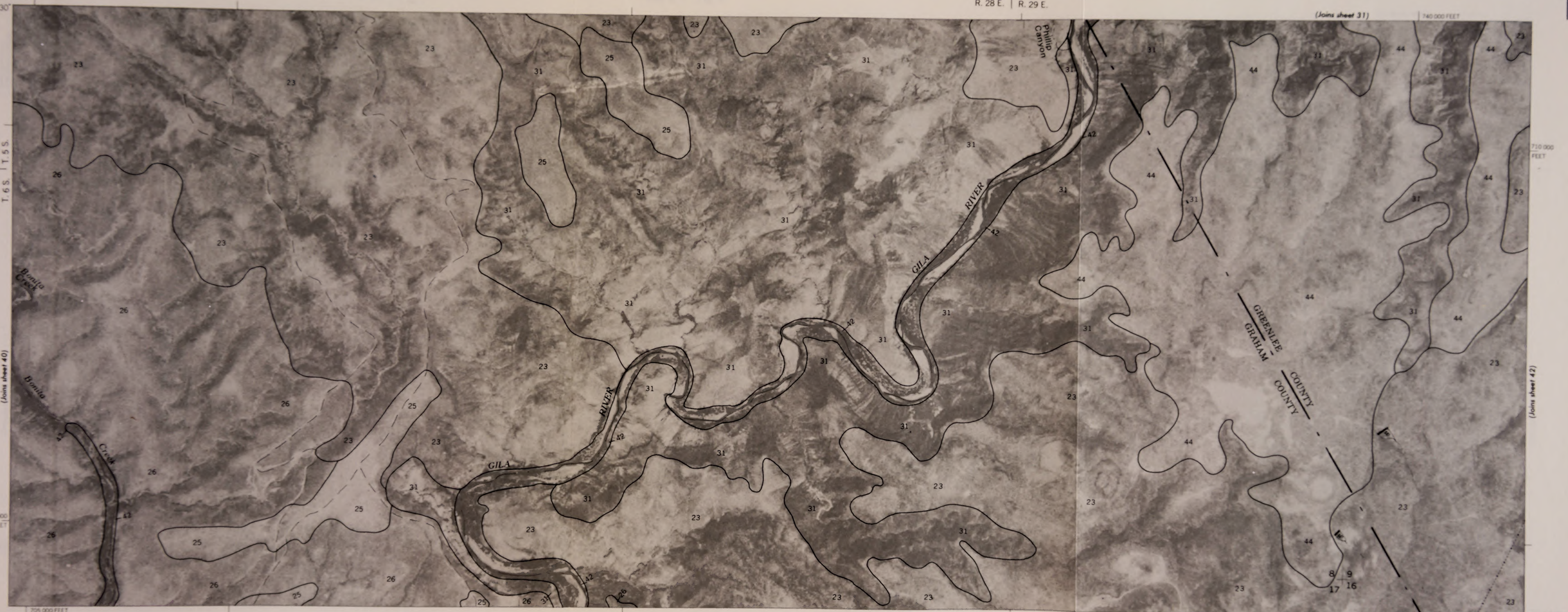


1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000


N
670 000 FEET
(Joins sheet 70)
R. 27 E.
109°30'00"
32°57'30"
710 000 FEET
Mary Tank
Spring Canyon
Bear Spring Canyon
Dry Canyon
LONE STAR MOUNTAIN
Spring Canyon
Bonita Creek
Dry Canyon
T. 6 S. | T. 5 S.
(Joins sheet 39)
(Joins sheet 41)
700 000 FEET
32°55'00"
109°37'30"
(Joins sheet 47)
700 000 FEET
2 Miles
1 ¾ ½ ¼ 0 1
5 000 4 000 3 000 2 000 1 000 0
Scale 1:24 000
5 000 Feet
10 000 Feet



Scale 1:24 000

1 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet


R. 29 E.
R. 30 E.
T. 6 S.
T. 5 S.
745 000 FEET
(Joins sheet 32)
109°15'00"
32°57'30"
710 000 FEET
WILKERSON RANCH
SOUTHERN PACIFIC
Rattlesnake Canyon
GILA RIVER
GUTHRIE
GUTHRIE ROAD
GUTHRIE MOUNTAIN
Oak Canyon
ROAD
Canyon
SAFFORD
OLD
Pumroy
Canyon
Guthrie
Buck
Canyon
(Joins sheet 41)
(Joins sheet 43)
700 000 FEET
32°55'00"
109°22'30"
(Joins sheet 49)
780 000 FEET
Scale 1:24 000
5 000 Feet
10 000 Feet
2 Miles


109°15'00"
32° 37'30"
R. 30 E.
R. 31 E.
T. 6 S.
T. 5 S.
815 000 FEET
(Joins sheet 33)
710 000 FEET
700 000 FEET
785 000 FEET
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 50)
32°35'00"
109°07'30"
CLIFTON AIRPORT
Rattlesnake Canyon
Buzzard Roost Canyon
Cold Creek
Three Way
Willow Creek
C A Bar Canyon
Stanley Creek
GILA
SOUTHERN PACIFIC
RIVER
Buck Canyon
Tollhouse Canyon
Cottonwood Wash
Greaser Wash
7 18
18 17
1 ⅜ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

N

R. 31 E. | R. 32 E.

820 000 FEET

(Joins sheet 34)

109° 02'30"

32° 37'30"

T. 6 S. | T. 5 S.

710 000 FEET

(Joins sheet 43)

32° 35'00"

109° 07'30"

(Joins sheet 51)

700 000 FEET

845 000 FEET

ARIZONA | NEW MEXICO

GREENLEE COUNTY | GRANT COUNTY

LIMIT OF SOIL SURVEY

APACHE NATIONAL FOREST BOUNDARY

Cottonwood Creek

Grease Wash

Apache Creek

38 31 44 34 23

6 5
7 8

INSET

R. 31 E. | R. 32 E.

820 000 FEET

(Joins lower inset sheet 34)

109° 05'30"

33° 02'30"

T. 5 S

740 000 FEET

(Joins sheet 24)

33° 00'00"

109° 07'30"

(Joins sheet 34)

825 000 FEET

730 000 FEET

Blackjack Canyon

Ear Canyon

Lop

APACHE NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

23 44

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

N


110°07'30"
32°55'00"
(Joins sheet 36)
R. 22 E.
R. 23 E.
(Joins sheet 36)
550 000 FEET
695 000 FEET
T. 6 S.
(Joins inset, sheet 17)
685 000 FEET
515 000 FEET
(Joins sheet 46)
(Joins sheet 52)
32°52'30"
110°00'00"
SANTA TERESA MOUNTAINS
SAN CARLOS INDIAN RESERVATION BOUNDARY
Telegraph Wash
Fibrimile Canyon
Dark Canyon
West
Telegraph
TRIBAL BOUNDARY
SAN CARLOS INDIAN RESERVATION BOUNDARY
SAN CARLOS INDIAN RESERVATION BOUNDARY
LIMIT OF SOIL SURVEY
18 17
19 20
KLONDYKE ROAD
Trough and Underground
Tanks
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
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 Feet 10 000 Feet

Scale 1:24 000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000


N
R. 28 E.
R. 29 E.
705 000 FEET
(Joins sheet 41)
109° 22'30"
32° 55'00"
695 000 FEET
Bonita Creek
GILA RIVER
GILA RIVER
GREENLEE COUNTY
GRAHAM COUNTY
T 6 S.
18 17
19 20
(Joins sheet 47)
(Joins sheet 49)
685 000 FEET
OLD SAFFORD ROAD
OLD SAFFORD ROAD
740 000 FEET
32° 52'30"
108° 30'00"
(Joins sheet 54)
2 Miles
1 ¾ ½ ¼ 0 1
5 000 4 000 3 000 2 000 1 000 0
Scale 1:24 000
5 000 Feet
10 000 Feet

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

N

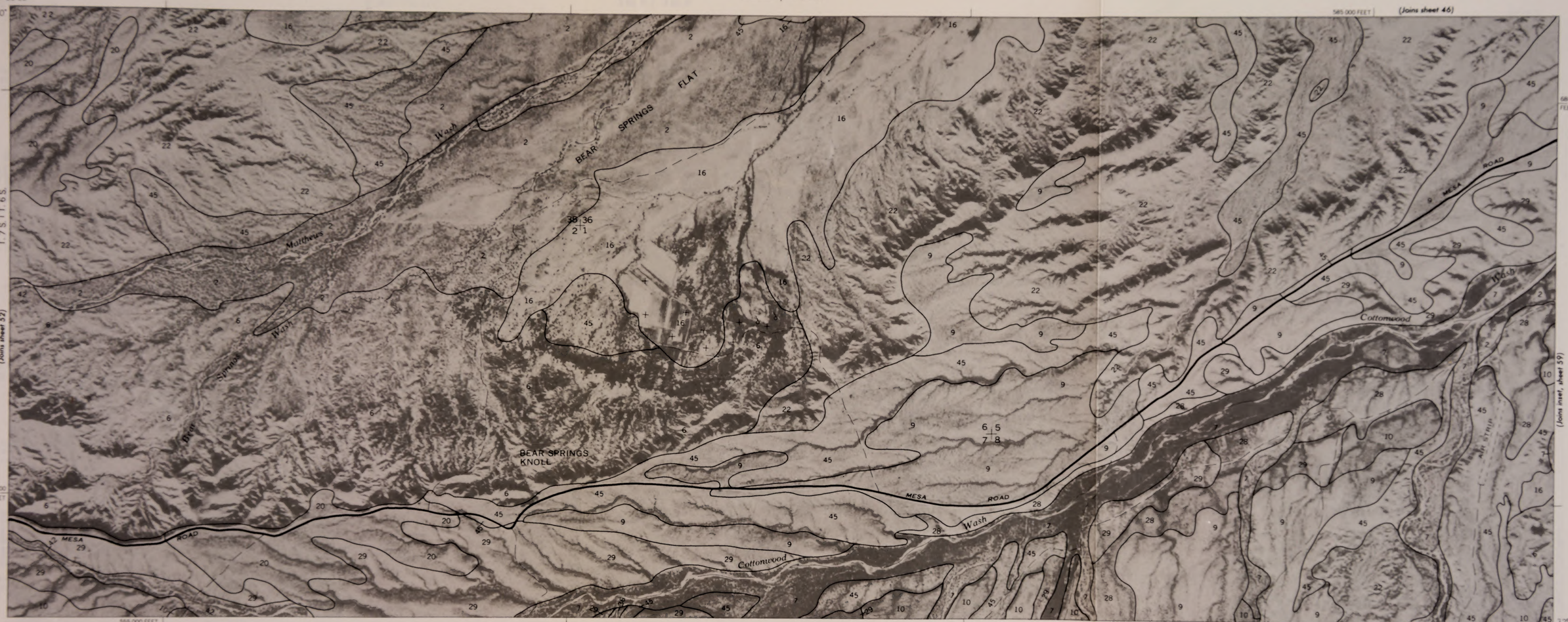
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet

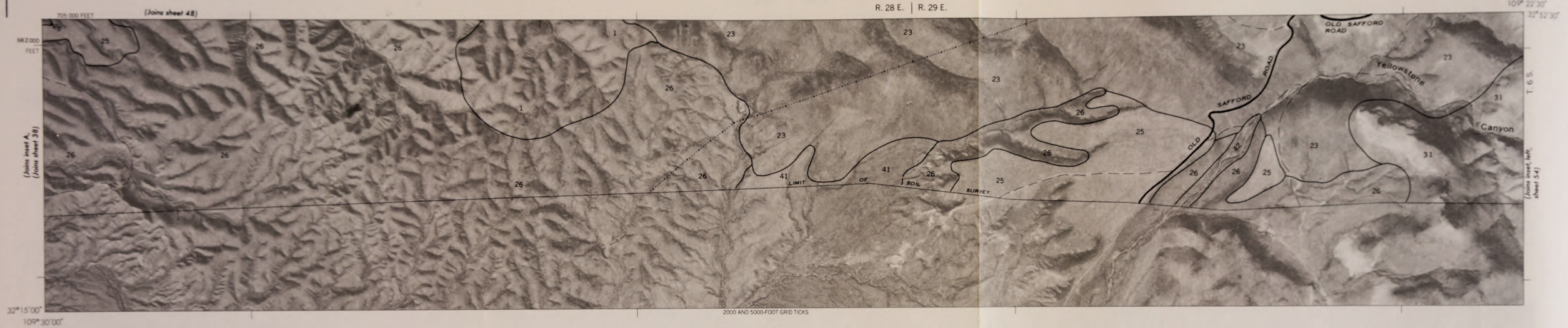
N



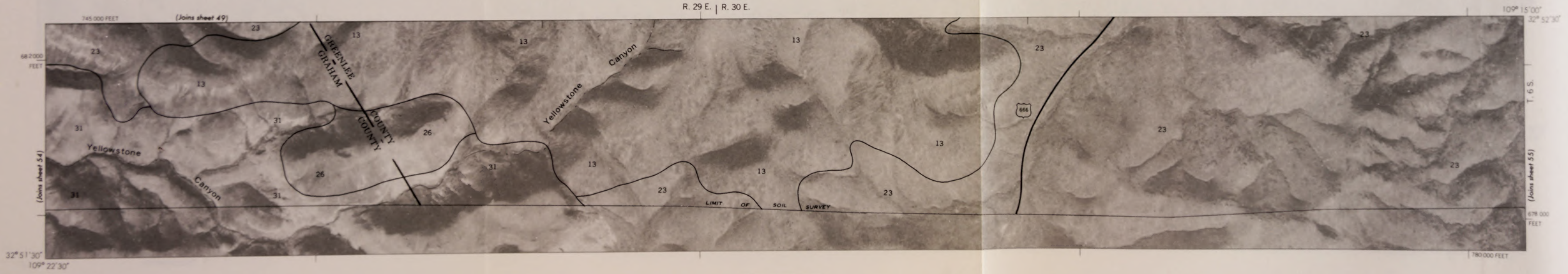
Scale 1:24 000

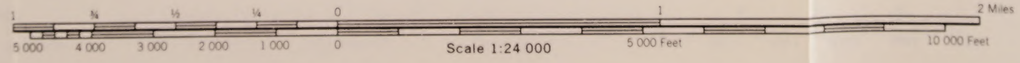
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet


R. 28 E. | R. 29 E.
109° 22'30"
32° 52'30"
705 000 FEET
(Joins sheet 48)
682000 FEET
(Joins inset A, (Joins sheet 38)
T. 6 S.
(Joins inset, left, sheet 54)
OLD SAFFORD ROAD
SAFFORD
OLD
Yellowstone
Canyon
LIMIT OF SOIL SURVEY
32° 15'00"
109° 30'00"
2000 AND 5000-FOOT GRID TICKS

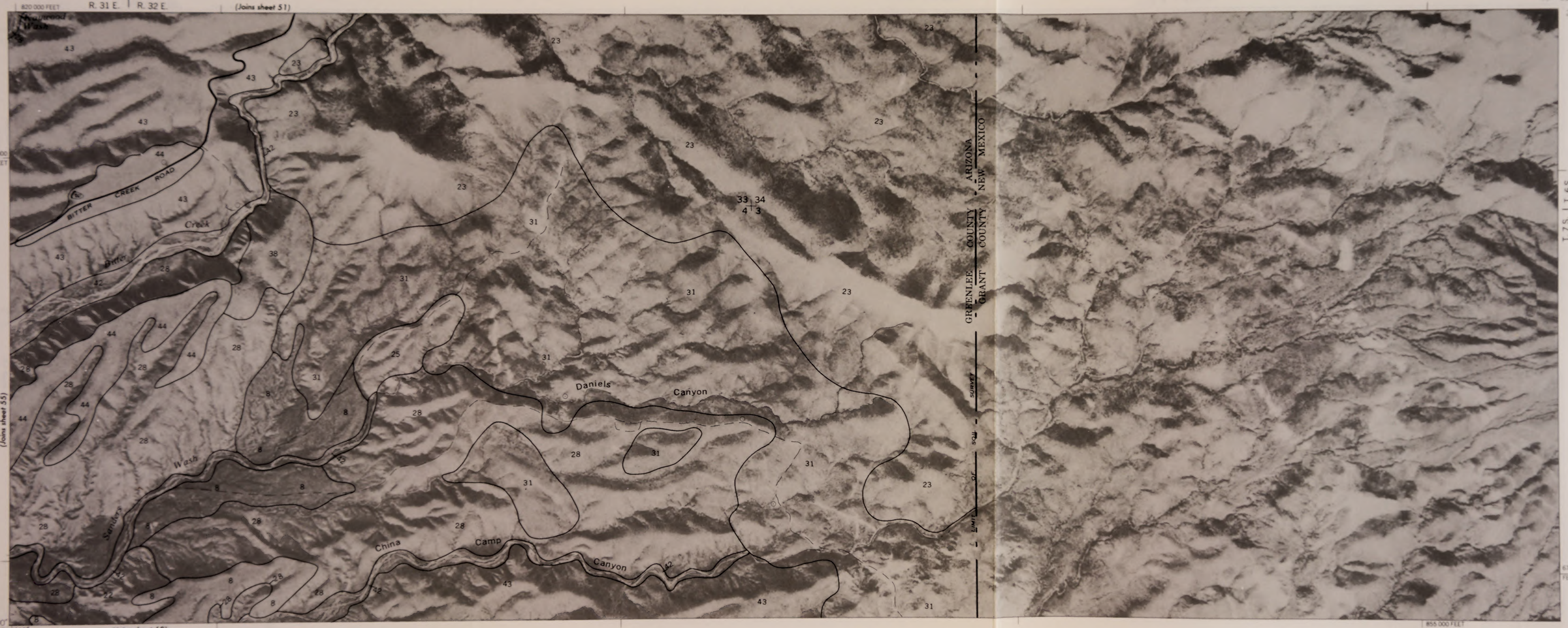
INSET


R. 29 E. | R. 30 E.
109° 15'00"
32° 52'30"
745 000 FEET
(Joins sheet 49)
682000 FEET
(Joins sheet 54)
T. 6 S.
(Joins sheet 55)
678 000 FEET
GREENLEE COUNTY
GRAHAM COUNTY
Yellowstone
Canyon
666
LIMIT OF SOIL SURVEY
32° 51'30"
109° 22'30"
780 000 FEET
2000 AND 5000-FOOT GRID TICKS

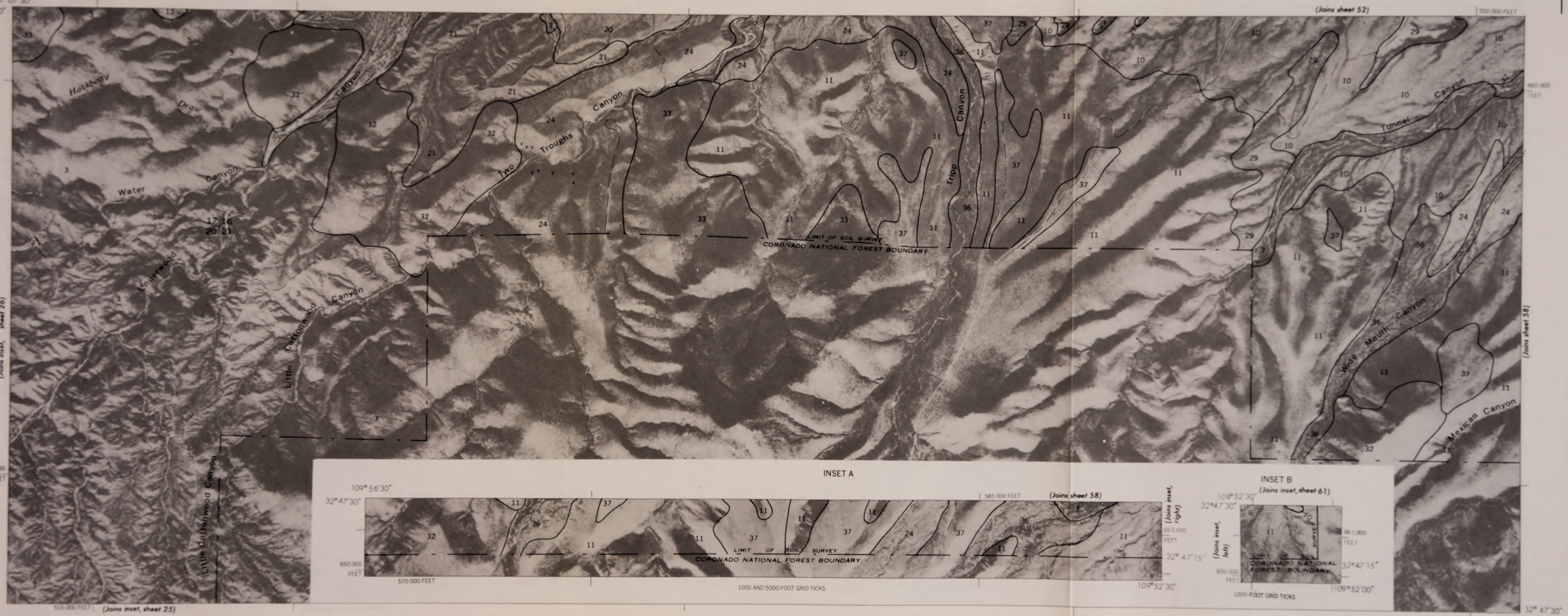

2 Miles
5 000 Feet
10 000 Feet
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet


820 000 FEET
R. 31 E.
R. 32 E.
(Joins sheet 51)
109° 00' 00"
32° 52' 30"
680 000 FEET
BITTER CREEK ROAD
Bitter Creek
Daniels Canyon
China Camp Canyon
Sandbar Wash
(Joins sheet 55)
32° 50' 00"
109° 07' 30"
(Joins sheet 60)
GREENLEE COUNTY, ARIZONA
GRANT COUNTY, NEW MEXICO
T 7 S. | T 6 S.
670 000 FEET
855 000 FEET
5 000 4 000 3 000 2 000 1 000 0
Scale 1:24 000
5 000 Feet
1 ¾ ½ ¼ 0 1 2 Miles
10 000 Feet

N



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000


R. 23 E.
R. 24 E.
T. 7 S.
(Joins sheet 53)
(Joins sheet 57)
(Joins inset, sheet 61)
(Joins inset, A, sheet 57)
550 000 FEET
585 000 FEET
665 000 FEET
655 000 FEET
32°55'00"
110°00'00"
109°52'30"
32°57'30"
Mexican Canyon
North Taylor Canyon
Middle Wash
Sand Wash
Left Hand Canyon
GOAT HILL
COYOTE KNOLL
LIMIT OF NATIONAL FOREST BOUNDARY
CORONADO
SOIL SURVEY BOUNDARY
Scale 1:24 000
5 000 Feet
10 000 Feet
2 Miles

N

INSET

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

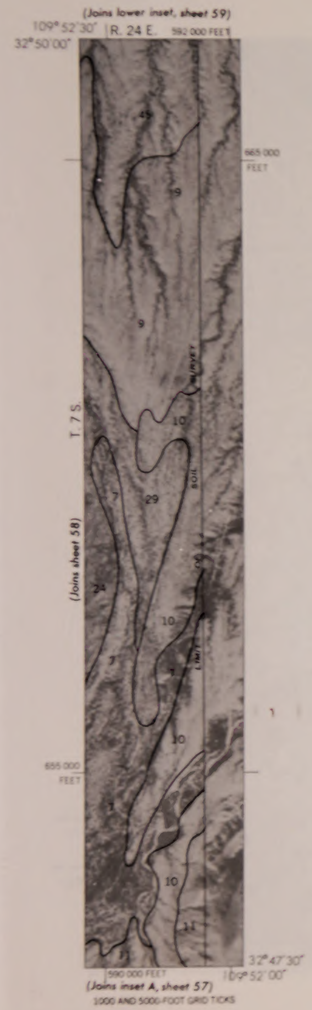
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

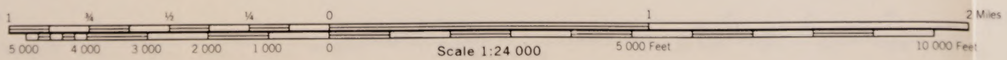
Scale 1:24 000

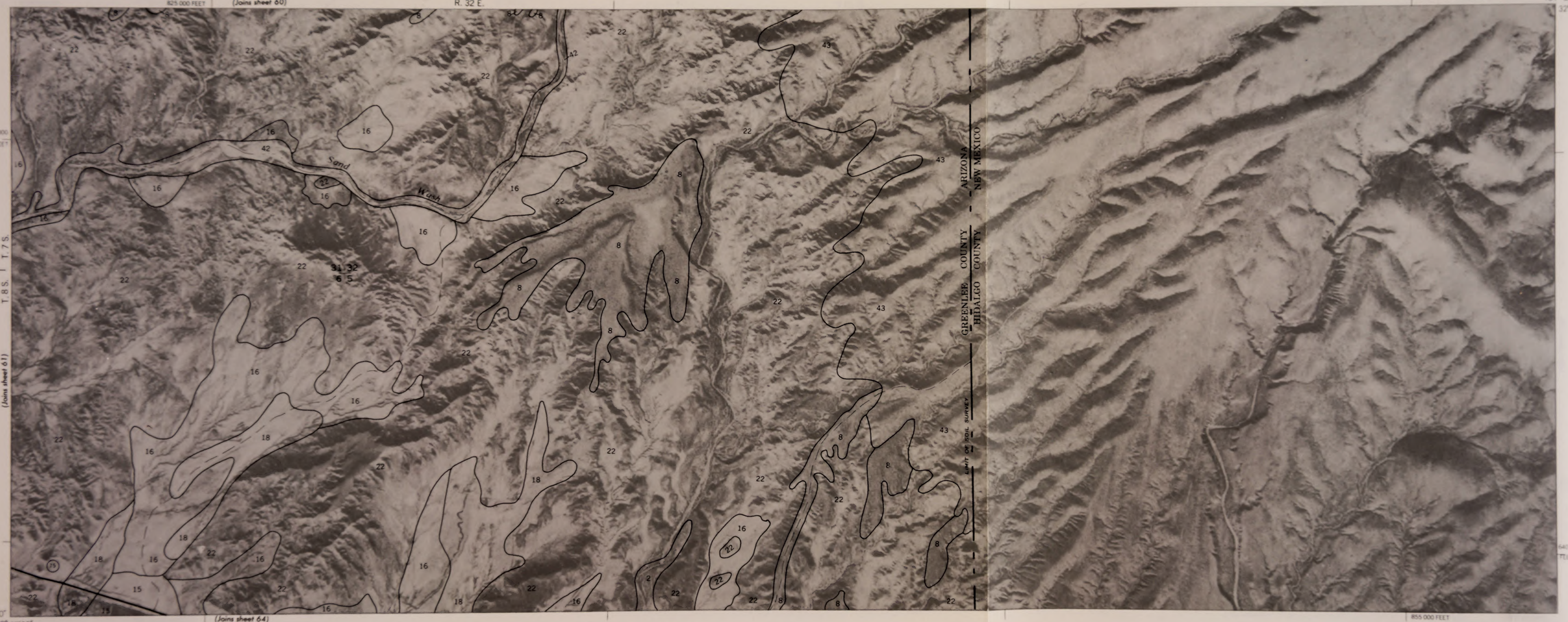
N

INSET


(Joins lower inset, sheet 59)
109°52'30"
32°50'00"
R. 24 E.
592 000 FEET
665 000 FEET
655 000 FEET
T. 7 S.
(Joins sheet 58)
590 000 FEET
32°47'30"
109°52'00"
(Joins inset A, sheet 57)
1000 AND 5000-FOOT GRID TICKS


109°15'00"
32°47'30"
R. 31 E.
(Joins sheet 59)
820 000 FEET
650 000 FEET
640 000 FEET
790 000 FEET
T. 8 S.
T. 7 S.
(Joins sheet 62)
(Joins sheet 63)
Ash Peak Canyon
Peak
Canyon
Sand Wash
Little Sand Wash
SOUTHERN PACIFIC
GILA RIVER
SOIL SURVEY
LIMIT OF SOIL SURVEY


1
½
½
¼
0
1
2 Miles
5 000
4 000
3 000
2 000
1 000
0
5 000 Feet
10 000 Feet
Scale 1:24 000



1 ⅔ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet

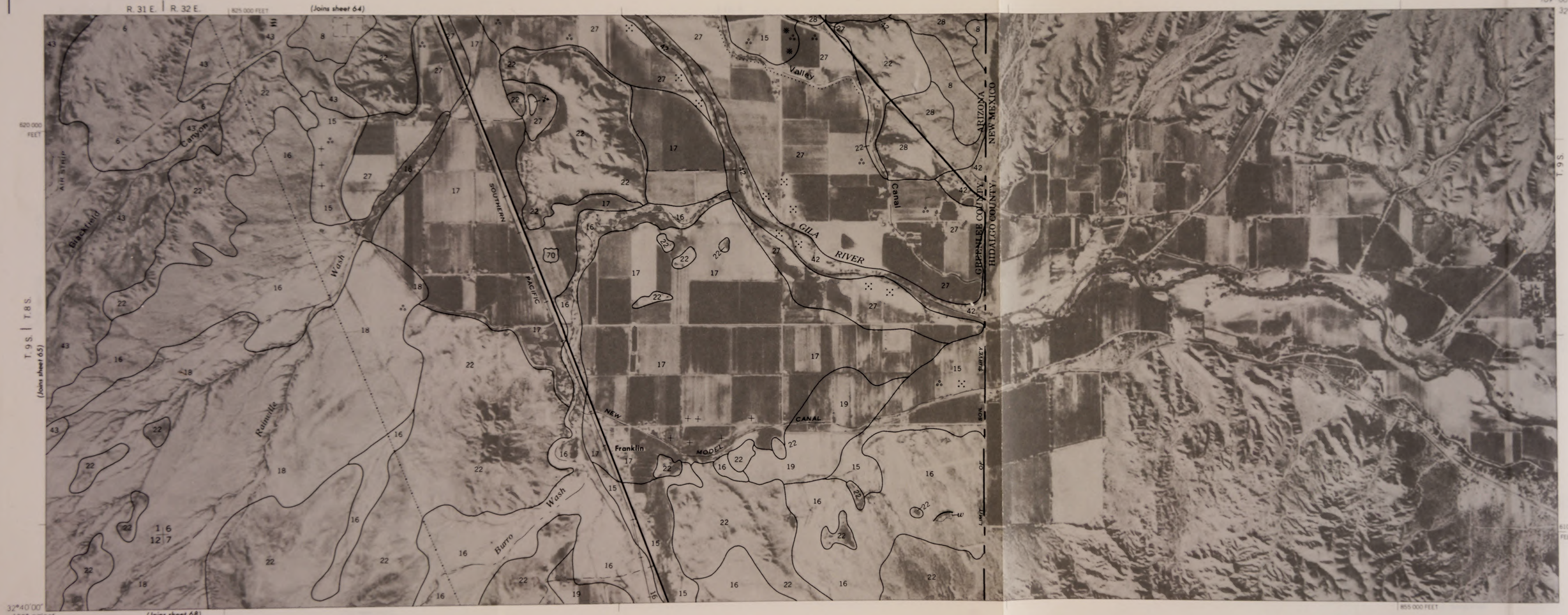
5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 1 2 Miles 10 000 Feet

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000



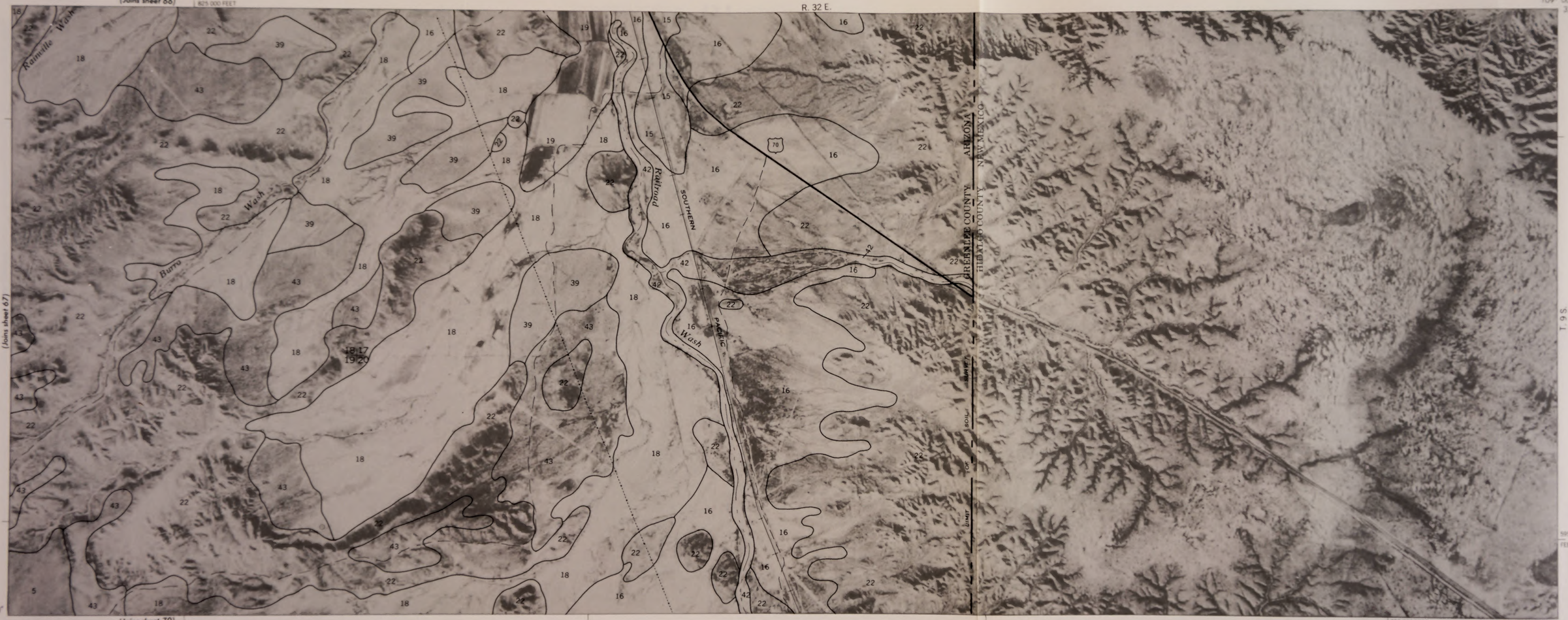
2 Miles
5 000 Feet
10 000 Feet
Scale 1:24 000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

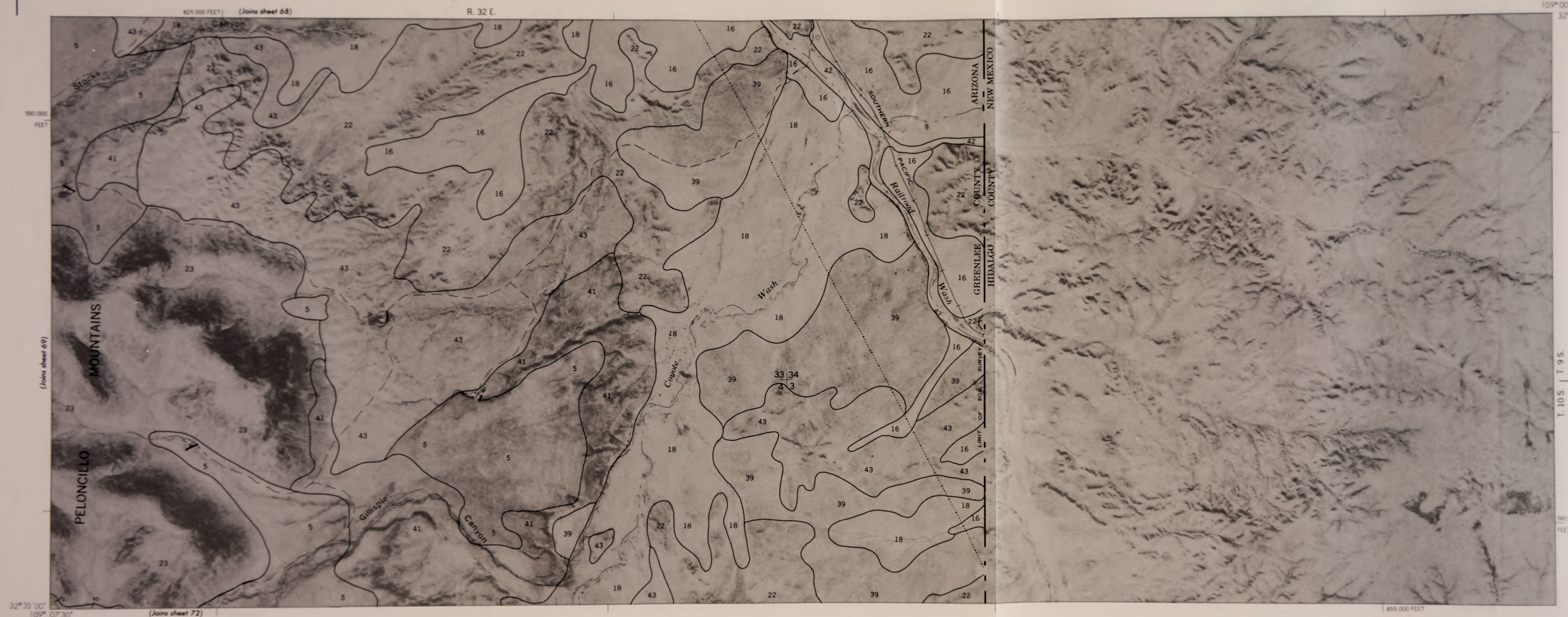
Scale 1:24 000


N
(Joins sheet 66)
825 000 FEET
R. 32 E.
109° 00'00"
32°40'00"
Ramsite Wash
Burro Wash
Railroad
SOUTHERN PACIFIC
Wash
GREENLEE COUNTY, ARIZONA
HIDALGO COUNTY, NEW MEXICO
T. 9 S.
595 000 FEET
(Joins sheet 67)
(Joins sheet 70)
32° 07'30"
109° 07'30"
855 000 FEET
5 000 4 000 3 000 2 000 1 000 0
Scale 1:24 000
5 000 Feet
10 000 Feet
1 ½ ½ ¼ 0 1 2 Miles

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

N

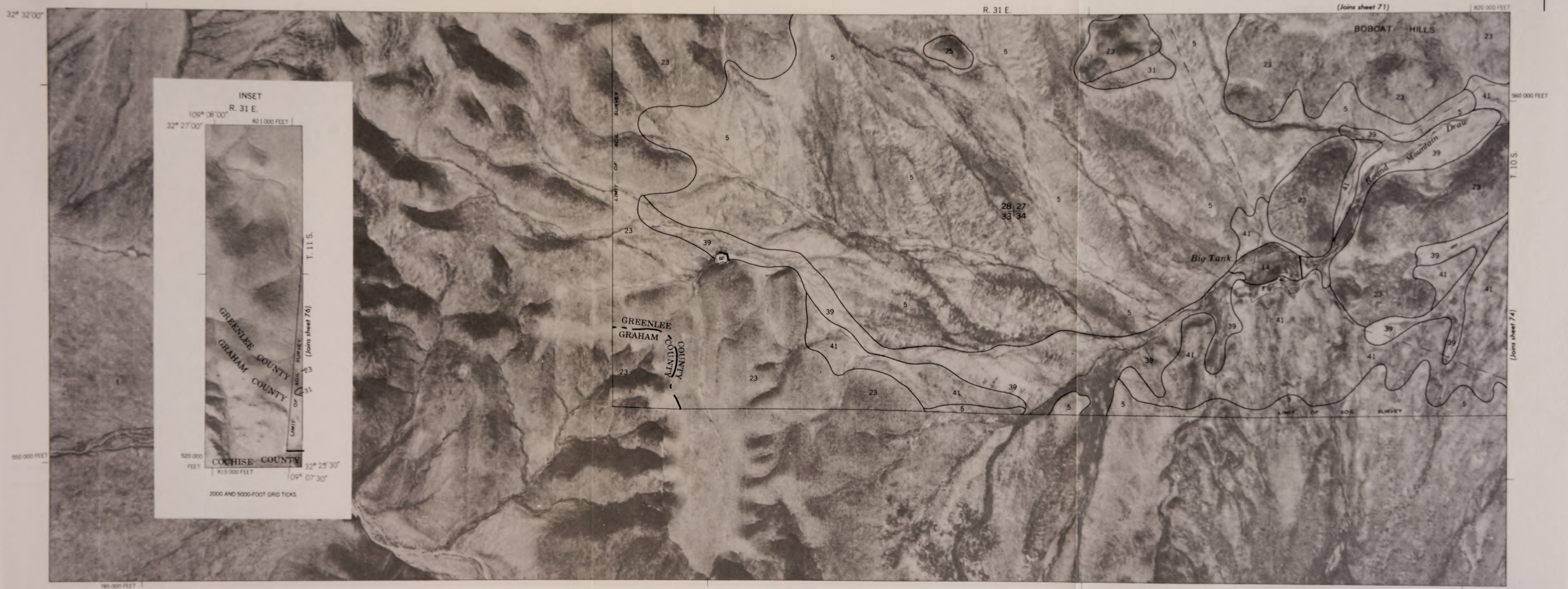
1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000


N
825 000 FEET
(Joins sheet 70)
R. 32 E.
109°00'00"
32°35'00"
575 000 FEET
Gillispie Canyon
Coyote Wash
HILLS
BOBCAT
AIR STRIP
LAZY B RANCH
Round Mountain Draw
Round Mountain Dam
ROUND MOUNTAIN
GREENLEE COUNTY, ARIZONA
HIDALGO COUNTY, NEW MEXICO
SOIL SURVEY
LIMIT OF
T. 10 S.
565 000 FEET
855 000 FEET
(Joins sheet 71)
(Joins sheet 72)
32°32'30"
109°07'30"
2 Miles
10 000 Feet
5 000 Feet
Scale 1:24 000
5 000
4 000
3 000
2 000
1 000
0

N

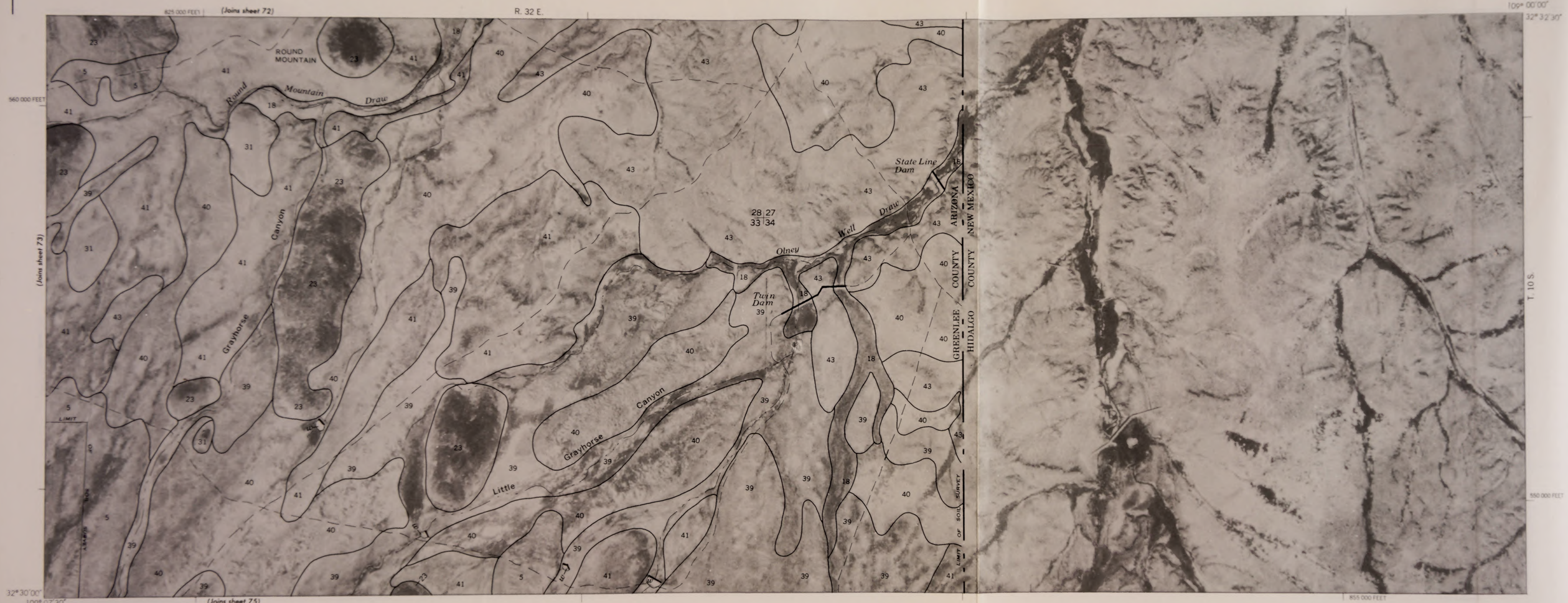


1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

GILA-DUNCAN AREA, ARIZONA, PARTS OF GRAHAM AND GREENLEE COUNTIES — SHEET NUMBER 74



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000


N
109° 07'30"
32° 30'00"
R. 32 E.
(Joins sheet 74)
855 000 FEET
545 000 FEET
T. 11 S.
535 000 FEET
825 000 FEET
(Joins sheet 76)
32° 27'30"
109° 00'00"
Little Grayhorse Canyon
PELONCILLO MOUNTAINS
Antelope Canyon
Willow Springs Canyon
ARIZONA
NEW MEXICO
GREENLEE COUNTY
HIDALGO COUNTY
BOUNDARY SURVEY
LIMIT OF
9 10
16 15
5 4
1 2
5 000 4 000 3 000 2 000 1 000 0
Scale 1:24 000
1 ¾ ½ ¼ 0 1 2 Miles
5 000 Feet
10 000 Feet

N

825 000 FEET (Joins sheet 75)

R. 32 E.

109° 00'00"
32° 00'00"

530 000 FEET

T. 11 S.

(Joins inset, sheet 73)

32°25'00"
109°07'30"

520 000 FEET

855 000 FEET

PELONCILLO MOUNTAINS

WILLOW SPRINGS RANCH

Little Grayhorse Canyon

Antelope Canyon

Willow Springs Canyon

Grayhorse Canyon

GREENLEE COUNTY — ARIZONA
HIDALGO COUNTY — NEW MEXICO

GREENLEE COUNTY
COCHISE COUNTY

GREENLEE COUNTY
GRAHAM COUNTY

COCHISE COUNTY

SOIL SURVEY LIMIT

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 Feet 10 000 Feet

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, GRAVEL PIT, 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 (50)
- County, farm or ranch (123)

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)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Corral
- 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)
- Intermittent (int)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (SvE 107)

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

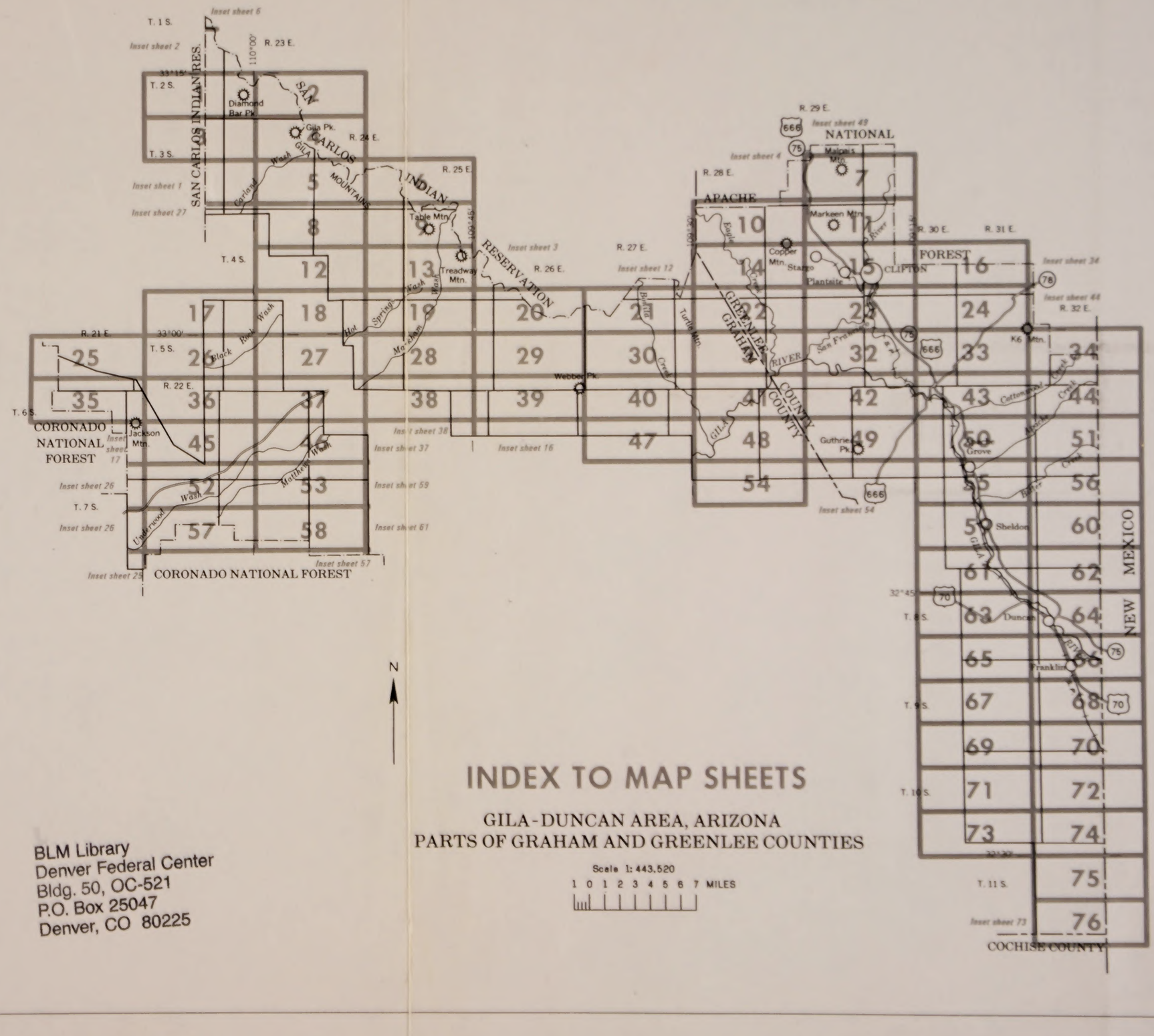
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot (0)

SOIL LEGEND

SYMBOL	NAME
1	Akela-Lehmans-Rock outcrop complex, 9 to 60 percent slopes
2	Anthony-Gila complex, 0 to 5 percent slopes
3	Aravaipa extremely gravelly loam, 5 to 40 percent slopes
4	Artesia extremely cobbly sandy clay loam, 0 to 8 percent slopes
5	Bonita very cobbly silty clay, 2 to 8 percent slopes
6	Calciorthids and Torriorthents, 10 to 90 percent slopes*
7	Comoro-Santo Tomas complex, 2 to 8 percent slopes
8	Continental gravelly clay loam, 2 to 15 percent slopes
9	Continetnal-Dona Ana complex, 2 to 15 percent slopes
10	Eba-Pinaleno complex, 2 to 40 percent slopes
11	Eloma-Alsco complex, 15 to 70 percent slopes
12	Eloma-White House association, 10 to 60 percent slopes
13	Fallsam-Cabezon-Rock outcrop complex, 9 to 70 percent slopes
14	Gila fine sandy loam, 0 to 2 percent slopes**
15	Glendale silty clay loam, 0 to 2 percent slopes**
16	Glendale-Gila complex, 0 to 5 percent slopes, severely eroded
17	Guest silty clay, 0 to 2 percent slopes**
18	Guest-Hantz complex, 0 to 5 percent slopes, severely eroded
19	Hantz silty clay, 0 to 2 percent slopes**
20	Hap gravelly sandy loam, 2 to 8 percent slopes
21	Hap-Pinaleno association, 9 to 60 percent slopes
22	Haplargids-Torriorthents complex, 5 to 40 percent slopes*
23	Limpia-Graham-Rock outcrop complex, 9 to 50 percent slopes
24	Maloy extremely stony sandy loam, 2 to 15 percent slopes
25	Peloncillo extremely cobbly sandy clay loam, 2 to 10 percent slopes
26	Peloncillo-Orthents-Pinaleno complex, 20 to 90 percent slopes
27	Pima silty clay loam, 0 to 2 percent slopes**
28	Pinaleno very cobbly loam, 5 to 30 percent slopes
29	Pinaleno-Whitlock-Tres Hermanos complex, 2 to 30 percent slopes
30	Pits-Dumps association
31	Rock outcrop-Atascosa-Graham complex, 9 to 70 percent slopes
32	Rock outcrop-Chiricahua Variant complex, 5 to 90 percent slopes
33	Rock outcrop-Lampshire complex, 20 to 90 percent slopes
34	Rock outcrop-Luzena complex, 20 to 90 percent slopes
35	Rock outcrop-Mokiak complex, 20 to 90 percent slopes
36	Santo Tomas extremely stony sandy loam, 2 to 10 percent slopes
37	Selevin extremely stony loam, 2 to 15 percent slopes
38	Signal very cobbly clay loam, 10 to 40 percent slopes
39	Sonoita-Bucklebar complex, 2 to 10 percent slopes
40	Stellar gravelly sandy clay loam, 0 to 5 percent slopes
41	Tapco-Peloncillo association, 2 to 15 percent slopes
42	Torrifluvents-Riverwash complex, 1 to 5 percent slopes
43	Tres Hermanos-Continental-Nickel complex, 2 to 45 percent slopes
44	Wampoo gravelly loam, 2 to 10 percent slopes
45	Whitlock-Tres Hermanos complex, 2 to 20 percent slopes

*These units are more broadly defined than others in the survey area.

**These units were mapped at order 2 intensity, more detailed than most others in the survey.



INDEX TO MAP SHEETS

GILA-DUNCAN AREA, ARIZONA
PARTS OF GRAHAM AND GREENLEE COUNTIES

Scale 1:443,520