United States
Department of
Agriculture

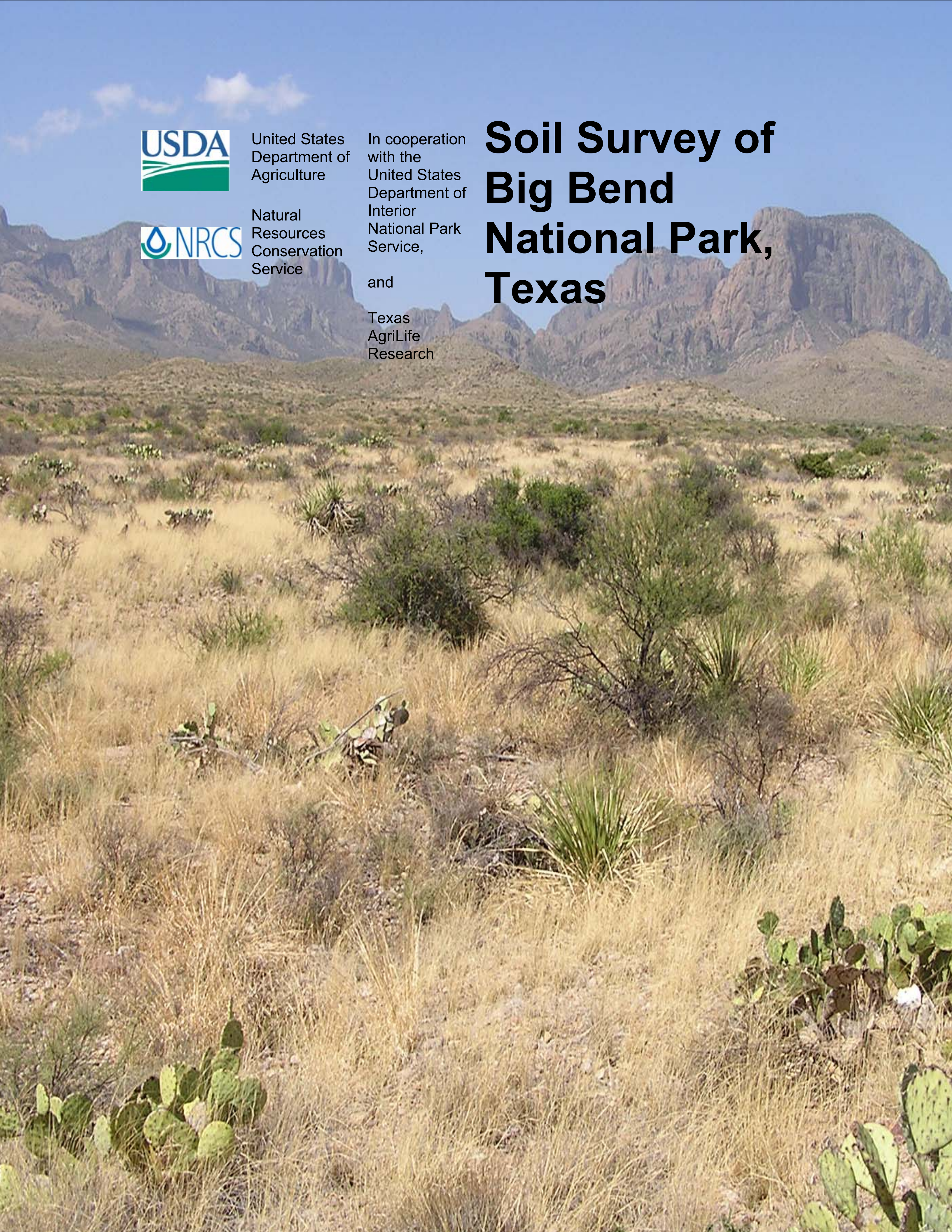
Natural
Resources
Conservation
Service

In cooperation
with the
United States
Department of
Interior
National Park
Service,

and

Texas
AgriLife
Research

Soil Survey of Big Bend National Park, Texas



How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

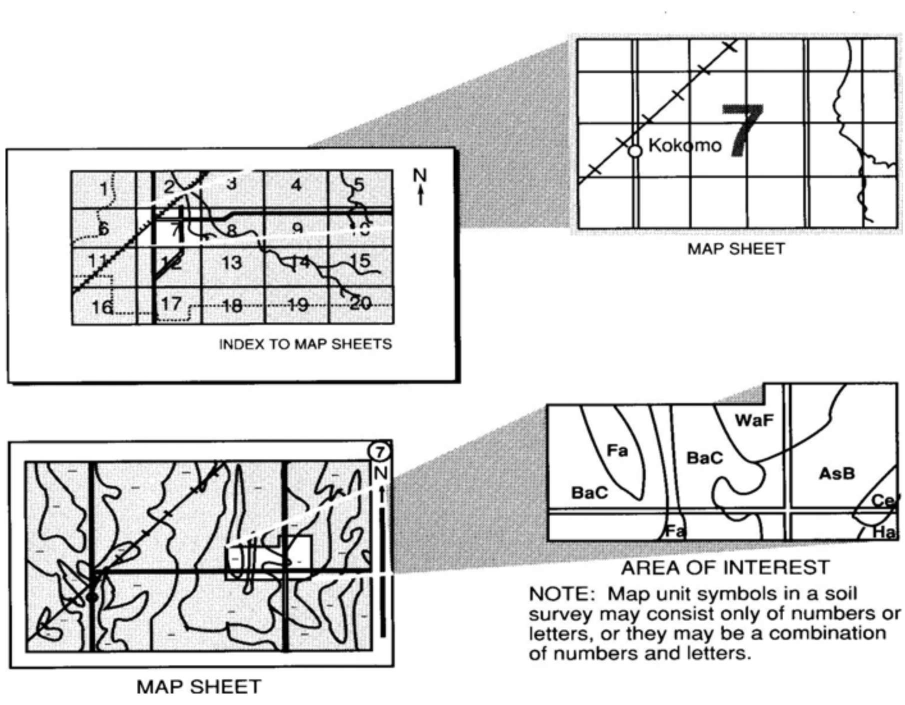
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Go to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



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 Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 2006. The soil names and descriptions were approved in 2010. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2009. This survey was made cooperatively by the Natural Resources Conservation Service and the Texas AgriLife Research. The survey is part of the technical assistance furnished to the National Park Service, Big Bend National Park Unit. 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: A healthy plant community, about one year after a prescribed fire, of black grama, Texas prickly pear, and skeletonleaf goldeneye occupy this area of Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes. Abundant summer precipitation following the fire allowed the vegetation to recover. Some mortality of pricklypear is evident in the foreground. Rock outcrop-Brewster complex, 20 to 70 percent slopes, is mapped on the Chisos Mountains in the background.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is *http://www.nrcs.usda.gov*

Contents

Issued 2011

Foreword

This soil survey was developed in conjunction with the National Park Service Inventory and Monitoring Program and is intended to serve as the official source document for soils occurring within Big Bend National Park.

This soil survey contains information that affects current and future land use planning in the park. It contains predictions of soil behavior for selected land uses. The surveys highlight soil limitations, actions needed to overcome the limitations, and the impact of selected land uses on the environment. This soil survey is designed to meet the needs of the National Park Service and their partners to better understand the various soil properties present in the park and their affect on various natural ecological properties to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the users identify and reduce the effects of soil limitations on various land uses. The user is responsible for identifying and complying with existing laws and regulations. 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 map unit is shown on the detailed soil maps. Each soil in the survey area is described, and information on specific uses is given. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or at Big Bend National Park.

Salvador Salinas

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Acting State Conservationist
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Big Bend National Park
Part of Brewster County, Texas

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United States Department of Agriculture, Natural Resources Conservation Service
In cooperation with
United States Department of Interior, National Park Service

This soil survey updates the soil survey of Big Bend National Park, Part of Brewster County, Texas, published in 1985. (USDA SCS, 1985). It provides additional soils information and detail on soil properties and interpretations. It also has larger maps, which show the soils in greater detail.

The survey area is in the Trans-Pecos region of west Texas in southern Brewster County. The survey covers an area of 812,733 acres. The survey area is bordered by Brewster County, Texas, along the northern half and the Rio Grande River along the southern half.

The survey area includes portions of Major Land Resource Areas (MLRA) Southern Desertic Basins, Plains, and Mountains—MLRA 42, and Southern Edwards Plateau—MLRA 81D.

There are no perennial streams located in the park although there are numerous intermittent streams fed by flash floods. The most consistent source of water is the Rio Grande River along the southern border of the park.

Elevations in the park range from 1,700 feet at the Rio Grand River flood plain to 7,835 feet on top of Mount Emory.

General Nature of the Survey Area

This section provides general information about the county. It describes the history and climate, as well as how this survey was made.

History

The following section is from the Texas Online Handboook
http://www.tsha.utexas.edu/handbook/online/articles/BB/gkb2.html

Big Bend National Park, the first national park in Texas, comprises more than 1,250 square miles (about the size of Rhode Island) in the Big Bend of the Rio Grande along more than 100 miles of the Texas-Chihuahua-Coahuila border southeast of El Paso in Brewster County. It has been described as a land of “killing heat and freezing cold; deadly drought and flash flood; arid lowland and moist mountain woodland; and a living river winding its way across the desert.”

The Rio Grande flows for 107 miles on the park's southern boundary, through Santa Elena, (fig. 1) Mariscal, and Boquillas Canyons, the deepest gorges on the river. In 1978 the United States Congress designated a 191-mile section of the Rio Grande a Wild and Scenic River, sixty-nine miles of which lie on the park boundary. Most Big Bend acreage is arid alluvial plains, the most representative example of the Chihuahuan Desert in North America.

The Chisos Mountains, the southernmost range in the continental United States and are completely enclosed in the park, rise over 7,800 feet above sea level. They support relict forests from the late Pleistocene era of ponderosa pine, Douglas fir, Arizona cypress, quaking aspen, and bigtooth maple. The popular Basin, (fig. 2) a topographic depression in the Chisos range, offers visitors a cool respite from the desert heat and spectacular panoramic vistas. Annual precipitation in the arid to semiarid climate ranges from ten inches in the desert to twenty-six inches in the mountains. The National Park Service considers Big Bend "one of the outstanding geological laboratories and classrooms of the world." Geological processes readily visible at the park are sedimentation, deformation, and volcanism. Recovered fossil forms of ancient plants and animals include a bivalve, three feet wide and four feet long, the largest known pterosaur (a flying dinosaur), and the skull of a chamosaurus, a horned dinosaur, all of which help make Big Bend an invaluable resource for paleontological research and preservation.

The topographical and climatic extremes provide habitats for a varied flora and fauna, including over 1,000 species of plants, 78 mammals, 56 reptiles, 10 amphibians, 35 fish,

Figure 1.—A view of Santa Elena Canyon and the Rio Grande River. The flood plain area is the Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded. The canyon consists of Blackgap-Rock outcrop complex, 20 to 70 percent slopes.

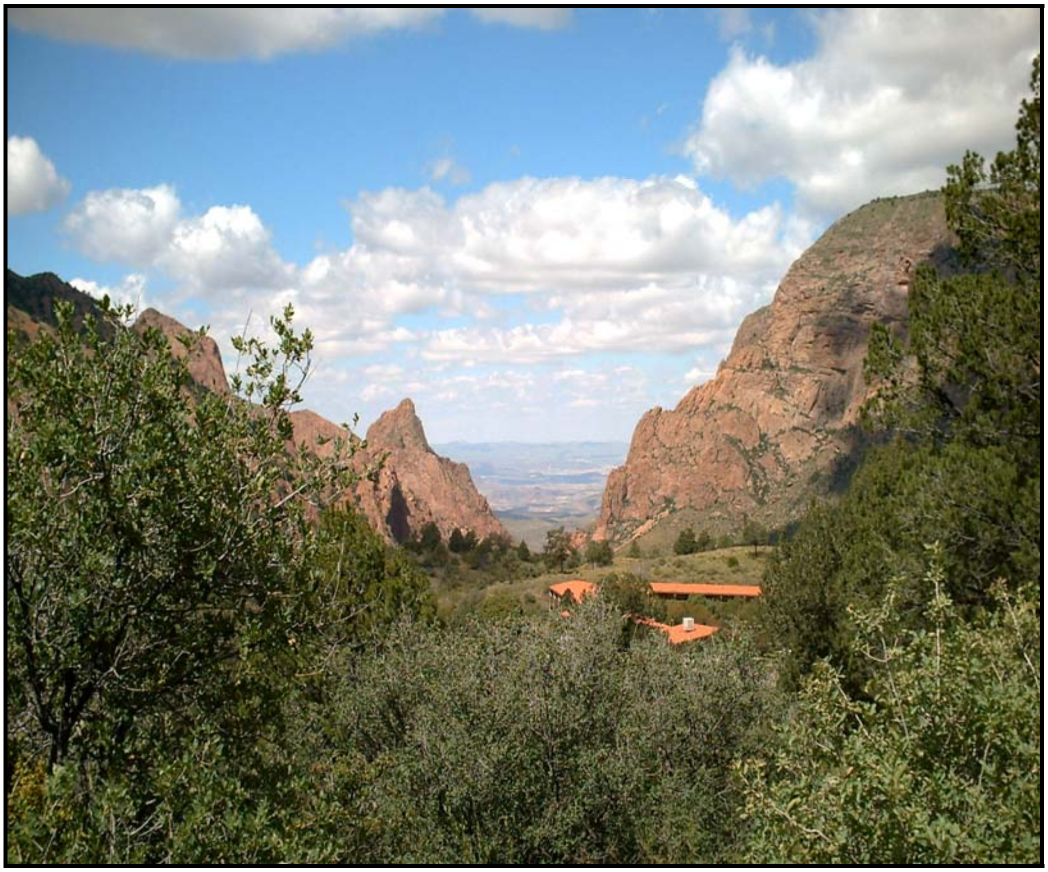

Figure 2.—A view of The Basin, Big Bend National Park. The soils in the foreground are areas of Hurds very cobbly loam, 10 to 30 percent slopes. Areas of Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes are in the background.

and 434 birds (more than any other United States park and more than half the species of birds in North America). Endangered species found at Big Bend are the peregrine falcon, black-capped vireo, Mexican long-nosed bat, and Big Bend gambusia (a tiny fish found only in the park). There are several species in the United States that can only be found in Big Bend: Del Carmen white-tail deer, olima warbler, Mexican drooping juniper. The Chisos agave lives nowhere else in the world. In 1976 the United Nations Educational, Scientific, and Cultural Organization designated Big Bend a “Man and the Biosphere” international reserve, one of only twenty-eight in the United States. Cooperative research and educational programs subsequently began with Mexico. Although human beings came late, the park contains archeological and historical sites representing more than 10,000 years of inhabitants, including Jornado Mogollón, Jumanos, Chisos, Mescalero Apache, and Comanche Indians; Spanish explorers and missionaries; and farming, ranching, mining, and military activities of the last two centuries. Nine National Register archeological and historic sites or districts document the Indian and Anglo-Mexican presence at Castolon Historic District (trading post), Hot Springs Historic District (recreational and therapeutic springs), Mariscal Mining District, Homer Wilson Ranch Site, Rancho Estelle, Luna’s Jacal (a Mexican goatherd’s abode) (fig. 3), Burro Mesa Archaeological Site, and two additional archeological sites. There are also exhibits in the visitor centers as well as recreational opportunities, including hiking, river rafting, horseback riding, birding, and back-country camping. Park Service staff schedule interpretive programs throughout the year.

Figure 3.—Historic Luna's jacal is on an area of Ninepoint clay loam, 0 to 3 percent slopes. During the early 1900's, Mr. Luna raised vegetable crops on this soil map unit, irrigating with summer floodwaters diverted from Alamo Creek.

The legislative history of the park began in 1933, when the Texas legislature inaugurated Texas Canyons State Park on fifteen sections of land in the vicinity of Santa Elena, Mariscal, and Boquillas canyons on the Rio Grande in southern Brewster County. Later that year the name was changed to Big Bend State Park and the Chisos Mountains were added to the park acreage. The National Park Service investigated the site in January 1934 and recommended establishment of both a Civilian Conservation Corps[qv] camp and a national park. The NPS regarded Big Bend as "decidedly the outstanding scenic area of Texas." President Franklin D. Roosevelt took a personal interest in Big Bend because of a proposed international, or companion, park in Mexico (still being discussed decades later). The United States Congress passed the enabling legislation on June 20, 1935, stipulating that acquisition of the park acreage "shall be secured…only by public and private donations." By 1942 most of the land was purchased with a $1.5 million appropriation from the Forty-seventh Texas Legislature. Although several thousand acres remained in private hands, the park opened to the public in 1944. In 1972 the Congress appropriated $300,375 for the last 8,561.75 acres, finally placing the entire original park area of 708,118.40 acres in federal ownership. Subsequent additions have increased the park acreage to 812,733 acres, of which 776,693.22 acres are federal land.

In 1944 the park had a staff of five and received a modest appropriation of $15,000. That first year only 1,409 people visited Big Bend. Visitors averaged more than 230,000 annually from 1981 to 1990; in 1976, a record 456,201 visited Big Bend. The appropriation likewise has increased. In the 1990s it exceeded $2.5 million annually. The park has more than 100 full-time staff positions supplemented by temporary employees, interns, and volunteers. Development of the isolated desert park has evolved slowly. Mission 66, a decade-long project begun in the 1950s to upgrade a neglected national-park system that had suffered through inadequate funding during World War II[qv] and the Cold War, pumped $14 million into Big Bend for roads, bridges, trails, campsites, and a lodge, restaurant, and cabins in the Chisos Basin. The NPS, however, has never advocated extensive improvements. The vast majority of the park acreage is managed as natural zones to "remain largely unaltered by human activity."

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John Jameson

The following, adapted from the *Chicago Manual of Style*, 15th edition, is the preferred citation for this article.

> *Handbook of Texas Online*, s.v. ",” http://www.tsha.utexas.edu/handbook/online/articles/BB/gkb2.html (accessed November 15, 2007).

Climate

Prepared by the Natural Resources Conservation Service National Water and Climate Center, Portland, Oregon.

Climate tables are created from climate stations Boquillas Ranger Station, Chisos Basin, and Panther Junction, Texas, all in Brewster County and within Big Bend National Park. These stations represent the major climate sections in the Park, located at 1,880, 5,300, and 3,740 feet elevation, respectively.

Thunderstorm days, relative humidity, percent sunshine, and wind information are estimated from First Order stations El Paso and Midland, Texas.

Table 1, Table 4, and Table 7 provide data on temperature and precipitation for the survey area as recorded at these three stations in the period 1971 to 2000. Table 2, Table 5, and Table 8 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3, Table 6, and Table 9 provide data on the length of the growing season.

In winter, average temperatures at Boquillas, Chisos Basin, and Panther Junction are 52 degrees F, 49 degrees F, and 50 degrees F, respectively. The average daily minimum temperatures in winter are: 33 degrees F, 38 degrees F, and 37 degrees F, respectively. The lowest temperatures on record were: 4 degrees F at Boquillas on December 23, 1989; -3 degrees F at Chisos Basin on January 30, 1949; and 4 degrees F at Panther Junction on December 25, 1983.

In summer, average temperatures at Boquillas, Chisos Basin, and Panther Junction are 87 degrees F, 74 degrees F, and 80 degrees F, respectively. Average daily maximum temperatures in summer are: 103 degrees F, 84 degrees F, and 92 degrees F, respectively. The highest temperatures on record were: 117 degrees F at Boquillas on June 4, 1998; 103 degrees F at Chisos Basin on June 28, 1972; and 109 degrees F at Panther Junction on June 29, 1994.

Growing degree days are shown in Tables 1, 4, and 7. 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 (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The average annual total precipitation is somewhat variable across the Park, and is primarily dependent on elevation. Elevations above 4,000 feet receive between 14 and 20 inches of precipitation annually, including about 19 inches at Chisos Basin. At lower elevations near the Rio Grande River precipitation is around 10 inches per year. In general, precipitation increases by about 2.5 inches per 1,000 feet of elevation, from the Rio Grande River to the highest elevations. Of these average annual amounts, about 80 to 90 percent usually falls in the March through November growing season. The heaviest 1-day rainfalls during the periods of record were: 2.69 inches at Boquillas on June 21, 1966; and 4.29 inches at Chisos Basin and 3.29 inches at Panther Junction, both on October 5, 1966. Thunderstorms occur on about 36 days each year, and most occur in July and August.

Average seasonal snowfall is quite light in Big Bend NP, even at higher elevations. At Chisos Basin the annual average is just 2 inches, and it is less than 1 inch elsewhere below 5,000 feet. Highest elevations may receive about 3 to 5 inches of snow annually. The greatest snow depths at any one time during the periods of record were: 3 inches at Boquillas, on January 13, 1985; 9 inches at Chisos Basin on January 23, 1958; and 11 inches at Panther Junction on January 8, 1986. On average, less than one day each year has at least 1 inch of snow on the ground at all locations. The heaviest 1-day snowfalls on record were: 2 inches at Boquillas on February 8, 1973; 9 inches at Chisos Basin on January 23, 1958; and 11 inches at Panther Junction on January 8, 1986.

The average relative humidity in mid-afternoon is about 25 percent. Humidity is higher at night, and the average at dawn is about 57 percent. The sun shines 81 percent of the time in summer and 75 percent in winter. The prevailing wind is from the south, but significant terrain-induced winds exist across this mountainous terrain. Average wind speed is highest, around 11 miles per hour, in March and April.

How This Survey Was Made

This section defines soil survey, and describes the rationale and methods used by soil scientists to create this soil survey of Big Bend National Park.

A soil survey includes the field and laboratory investigations necessary to (a) describe the characteristics of the soils in a given area; (b) classify the soils according to a standard system of classification; (c) plot the boundaries of the soils on maps; with the final purpose of (d) making predictions about the behavior of the soils. The soil survey report provides descriptions, laboratory data, and other information about properties of the soils. From these basic data, interpretations are made about potentials, suitabilities, and limitations of the soils for range, forest, wildlife habitat, recreation, engineering, and other uses. (Soil Survey Staff, 1951; Soil Survey Staff, 1993)

A soil map is a map designed to show the distribution of soil types or other soil map units in relation to other prominent physical and cultural features of the earth's surface. It delineates areas occupied by different kinds of soil, each of which has a unique set of interrelated properties characteristic of the material from which it formed, its environment, and it history. (Soil Survey Staff 1951; Soil Survey Staff 1993)

Two previous soil surveys exist for Big Bend National Park. The surveys were produced during two different eras (1920’s and 1980’s) in order to meet the natural resource information needs of land users and managers. Soil scientists used the concepts, methods, and tools available at the time to make the surveys. As time progressed, the natural resource information needs of land users have changed, as well as the concepts, methods, and tools available to make soil surveys.

Within the area that would become Big Bend National Park, the 1928 survey recognized fifteen map units. Major soils were assigned to five soil series, and two miscellaneous land types were acknowledged. (Bureau of Chemistry and Soils, 1928)

The 1985 survey acknowledged twenty-six soil map units. Map unit components were assigned to twenty-four soil series and two miscellaneous areas, namely rock outcrop and badland. (USDA SCS, 1985)

The 1985 soil survey encompassed some 708,281 acres. The present survey covers that area, plus an additional 100,000 acres added to Big Bend National Park in 1990.

The Current Survey

The soil cover in Big Bend National Park is characterized by relatively large areas where soil properties change little over distance (soil-landscape continua) separated by narrow zones where soil properties change rapidly with distance (soil-landscape boundaries). Landscape boundaries occur where two or more soil forming factors change significantly. The contrast across a boundary may vary from abrupt to diffuse. In Big Bend National Park, boundaries between areas with different parent material and relief are easily located on the ground and on aerial photographs.

The approach in the present Big Bend National Park soil survey was (a) to define map unit concepts, boundaries, and soil-landscape models during legend building; (b) to use the landscape model coupled with remotely sensed surface features and limited contact sensing to locate and document boundaries, and to identify and label the continua; and (c) to document soil properties and taxonomic composition of map units by observing soil properties in transects. In legend building, soil scientists selected the most significant discontinuities to define map unit concepts. During mapping they delineated the boundaries that define soil-landscape continua, and in transecting they determined the properties and taxonomic composition of the continua.

Planning and Preparation

This survey was made in conjunction with the National Park Service's Soil Inventory and Monitoring Program to provide information about the soils and miscellaneous areas within Big Bend National Park. A scoping meeting was held in April, 2001 with park staff to identify their soil resource information needs and to relate those needs to the development of the park soil survey. Of particular interest to park staff was what are the potential vegetation communities for the various soil types in the park, and which of these soil types currently do not support their potential vegetation community because of past land use, climate change, or other anthropogenic stressors. Park staff were also interested in any relationships between soil types and various threatened and endangered species known to occur within the park. Following the meeting, additional interviews were conducted to identify particular geographic areas of concern. This process identified several soil map units of the 1985 survey and other areas that required additional documentation.

Copies of pertinent maps and literature that describe the rocks, landforms, and vegetation of Big Bend National Park were gathered. Digital mapping materials were obtained from various sources. A digitized shapefile of 1985 soil survey was obtained from the Cartographic Section at the USDA-NRCS State Office. For photographic base maps, 1968 and 1996 vintage digital orthophoto mosaics were obtained from the USDA-NRCS Geospatial Data Gateway and the National Park Service, respectively. Mosaics of Landsat imagery were downloaded from the Global Land Cover Facility server hosted by the University of Maryland and NASA. Topographic data in the form of digital topographic maps (DRGs) and digital elevation models (DEMs) were obtained form the USDA-NRCS Geospatial Data Gateway 2005 imagery.

Two different versions of digital geology maps for Big Bend National Park were acquired to help identify soil parent materials. Shapefiles depicting geology and faults for the Emory Peak-Presidio sheet of Geologic Atlas of Texas were acquired from University of Texas-Bureau of Economic Geology. (UT-BEG, 1979) A shapefile representing Geology of Big Bend National Park was downloaded from National Park Service GIS server. Digital representations (shapefiles) of the road and trail networks were acquired from NRCS and NPS sources, respectively.

Field Investigations

Soil forms a continuum over the landscape. To create the soil survey of Big Bend National Park, soil scientists formulated a soil-landscape model to predict soil properties from above-ground features visible at the surface supplemented by a limited number of subsurface observations and descriptions. The soil-landscape model provides structure to interpret and extrapolate the limited information gained by physically impinging on the soil (contact sensing) within the context of information from remote sensing, which is more easily acquired and does not need physical contact.

Legend Building

To develop a predictive model, soil scientists identified the particular factors that governed the distribution of soils on the landscape. They travelled the network of park roads and trails, observing the kinds, amounts, and patterns of variation in landforms, vegetation, rock fragments, and other features on the soil surface and on the aerial photograph. They focused on soil-landscape surface features, looking for discontinuities and continua on the landscape and for the corresponding discontinuities and continua on the aerial image. Through this process, they identified relationships between surface features and aerial photo features.

When they detected a boundary in surface features, soil scientists determined which soil-forming factor(s) was responsible. They sketched a line on the map and continue on into the next continuum. Within areas of uniform surface features (a soil-landscape continuum), they observed soil properties by contact and remote sensing, taxonomically identified the soil, and formulated, tested, and established relationships among soil properties, surface features, and aerial photo signatures.

Soil scientists delineated the obvious discontinuities first. Next they searched for less prominent discontinuities to subdivide a heterogeneous continuum into homogeneous segments with interpretive significance.

Soil landscapes contain more boundaries than can be clearly displayed on a map, boundaries are not equally significant to land use and management, and some continua are more homogeneous than others. Map unit design depends on the existing and expected land use, the anticipated information needs of decision-makers, map scale, and soil-landscape complexity. For these reasons, soil scientists evaluated the significance of each boundary relative to land use and management. On that basis, they decided which boundaries to recognize as map unit boundaries and which to disregard. By doing this they also determined which continua to recognize as mono-taxa map units and which to combine into multi-taxa map units. Boundaries between soil bodies that require different land use and management are elevated to the status of map unit boundaries, and the continua are granted standing as map units. Closely spaced boundaries and those separating bodies with similar land use and management are ignored. The soil bodies on either side are assigned to the same map unit and are mapped together. For this reason, most map units in Big Bend National Park are multi-taxa complexes, associations, and undifferentiated units.

The initial stratification of Big Bend National Park was by the climate factor. Areas of Mixed Prairie were to be identified by the presence of certain plant indicator species. The Mixed Prairie was separated from Mountain Savannah at higher elevations and from Desert Grassland at lower elevations.

The second level of stratification within the Mixed Prairie was by the parent material factor. Areas of alluvium derived from igneous bedrock were separated from the areas of igneous bedrock and areas of limestone bedrock. Pine Canyon is one area underlain by igneous gravel.

Within the Mixed Prairie (climate) igneous alluvium (parent material) combination, the third level of stratification was by landform. Three map unit components were recognized within Pine Canyon, which is a mountain valley fan. (Peterson, 1981) Individual landforms and individual soils there varied with respect to height above the arroyo channel. At a scale of 1:24,000, the individual components were not mappable, so the map unit was established as a complex with three components.

Mapping the Soils

Soil map unit boundaries were drawn through aerial photo interpretation. The quality of the 1996 vintage orthoimagery was rather low. Because the imagery was collected during a drought, differences in vegetation cover on various landforms were not well expressed. Ancillary tools such as digital raster graphics, electronic topographic maps, and slope grids derived from digital elevation models were also used.

During the process of soil survey mapping, soil scientists applied the map unit concept developed during legend building to the entire soil-landscape. They searched for the significant discontinuities on the landscape, and drafted soil map unit boundaries on the map. The two most important tasks during soil survey mapping are line placement and map unit identification of delineated areas.

The objective of line placement is to document the locations of soil-landscape boundaries. To accomplish this, soil scientists detected map unit boundaries by remote sensing as they crossed the landscape and drafted the corresponding lines on the aerial photograph. Map unit identification focuses on labeling soil-landscape continua. In this task the soil scientists deduced map unit identity from the soil-landscape model and surface features evident to them through remote sensing. Then they allocated the delineation to the correct map unit and labeled the delineation with the right symbol. Periodic verification with contact sensing tested the model predictions.

Soil boundaries plotted by observation and interpretation of remotely sensed data. Map unit boundaries were “heads-up” digitized with ArcView 3.3, using 1996 vintage 1-meter resolution DOQ mosaic as the basemap. The imagery was displayed onscreen at a scale of 1:5,000, in combination with the transparent topographic map mosaic (DRG). A slope gradient grid computed from the 30-meter DEM, using the SinMap extension was used to identify map unit boundaries. The Minnesota DNR Stream Mode digitizing extension was used to draft map unit boundaries. The interval between vertices was established at 10 meters.

The channel of the Rio Grande was digitized to match the 2005 NAIP. Because the channel of the Rio Grande migrates through time, the delineated boundary differs from that shown on USGS 7.5 minute quadrangle maps.

Documentation

The accuracy of soil surveys depends not only on line placement and map unit identification, but also the accuracy and detail of map unit definitions. The objective of transecting is to document the soil properties and taxonomic composition, that is, the kinds and proportions of various soils present in map units. Transecting provides documentation of the continuous portion of the landscape.

Transect investigations were conducted after the extent of a map unit is known. Soil scientists selected a delineation (polygon) judged to be representative of the map unit, and established within the delineation a line that crossed the major variation. Then they described soil morphology at 10 points equally spaced along the line. They recorded and archived the descriptions in the National Soil Information System database (NASIS) that can produce reports on the kind and proportion of soil taxa, as well as the ranges of various soil properties.

On-site investigations were performed in areas with high value, but too small to justify recognition and mapping of unique map units. An example is the twenty acres of Vertisols in the Rosillos Mountains on the north side of the park.

Soil scientists described site characteristics and soil morphology at numerous locations within Big Bend National Park. Site characteristics include slope gradient, slope shape, surface fragments, vegetation cover, species composition, and elevation. Soil morphological properties described for each horizon are color, texture, structure, consistence, rock fragment content, and effervescence. Site and pedon descriptions written during the 2001 to 2006 time period are archived in the NASIS database.

Database Population

The NASIS database houses the attribute data attached to each soil map unit. Tables for components and horizons are populated with data on site and soil properties. Component tables include data such as slope gradient, elevation, mean annual precipitation, mean annual temperature, and soil classification. Horizon tables house data on important physical properties such as rock fragment content, particle-size separates, water retention, bulk density, and permeability. Chemical properties for each horizon include organic matter, calcium carbonate equivalent, gypsum, pH, cation exchange capacity, and salinity. Values of these variables derived from laboratory analysis of soils from within and near Big Bend National Park were placed in the appropriate tables.

The purpose of this database is to generate ratings of the potentials and limitations of soils for various uses. Soil interpretation tables found in the back of this report are calculated based on soil properties populated within the component and horizon tables, rules and evaluations.

Developing Ecological Site Descriptions

Rangeland landscapes are divided into ecological sites for the purposes of inventory, evaluation, and management. Ecological sites are assigned to soil map unit components on the basis of species composition, proportion of species, and total annual production.

Ecological site descriptions are comprehensive reports that describe the biophysical properties and the vegetation potential and dynamics of individual ecological sites. A total of nineteen ecological site descriptions were developed for Big Bend National Park. Of these, seventeen were existing range site descriptions converted into ecological sites descriptions. Two additional ecological site descriptions were newly created: Clay Hill and Salty Clay Hill, in the Hot Desert Shrub vegetative zone.

Vegetation measurements used to develop ecological site descriptions during the survey included line point intercept, weight unit method for aboveground biomass, and ocular cover estimates. The historic climax plant community, or the plant community that existed at the time of European settlement, was estimated and determined by historical records and reference sites (when available), current vegetation composition, and knowledge of the adaptability of plants within certain soil and climate limitations.

Big Bend National Park was subject to livestock grazing for about 60 years, from the establishment of ranches in the 1880’s until 1944. Since the establishment of the park, more than 60 years have transpired in the absence of livestock. Secondary succession has returned species composition to near climax in some areas within the Desert Grassland and Hot Desert Shrub ecological zones. Big Bend National Park serves as a useful reference area to establish historical climax plant communities for Trans-Pecos ecological sites.

An important and unique component of the ecological site description is the state and transition model. The model provides a method to organize and communicate complex information about vegetation response to disturbances (fire, lack of fire, drought, insects, grazing, etc.) and management.

A state is a recognizable, relatively resistant and resilient complex with attributes that include a characteristic climate, the soil resource including soil biota, and the associated aboveground plant communities. States are relatively stable and resistant to change caused by disturbances up to a threshold point.

A threshold is the boundary between two states such that one or more of the ecological processes has been irreversibly changed. Irreversible implies that restoration cannot be accomplished through natural events or a simple change in management. Active restoration (brush management, range planting, prescribed burning, etc.) must be accomplished before a return to a previous state is possible. States are not static, as they encompass a certain amount of variation because of climatic events, management actions, or both. Vegetation dynamics within a state do not represent a state change since a threshold is not crossed.

Analysis and interpretation of new information about the soil, vegetation, and other onsite environmental factors will reveal a need to revise or update ecological site descriptions. Since the collection of such information through resource inventories and monitoring is a continuous process, site descriptions will be periodically reviewed and updated. The most up-to-date information can be obtained via Web Soil Survey at http://websoilsurvey.nrcs.usda.gov.

General Soil Map Units

The general soil map in 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, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils 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 the land or 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.

Soils of the Hot Desert Shrub Vegetative Zone

This group of general soil map units makes up about 49 percent of the survey area. The major soils are the Corazones, Geefour, Ninepoint, Solis, Studybutte, Terlingua, and Tornillo series. Also in this group are areas of Rock outcrop. Most of the soils in this group have loamy and gravelly surfaces. Corazones soils are very deep and very gravelly soils. Geefour soils are very shallow or shallow to densic bedrock. Ninepoint and Tornillo soils are very deep loamy soils. Soils are very shallow or shallow soil to sandstone bedrock. Studybutte and Terlingua soils are very shallow or shallow soils over igneous bedrock.

The arid soils in this group are used as rangeland. The native vegetation consists of drought tolerant short and mid grasses with an abundance of shrubs. The dominant grasses in areas of this group include black grama, bush muhly, Chino grama, fluffgrass, and perennial threeawns. Woody species include catclaw acacia, creosotebush, fourwing saltbush, and lechuguilla.

Most of the soils in this group are best suited to wildlife habitat because of the very limited rainfall and hazard of erosion. Erosion on areas of Ninepoint and Tornillo soils is a major management concern. Management practices that maintain an adequate vegetative cover reduce this hazard. Invasive plant species such as, buffelgrass and salt cedar, are also major management concerns.

The ranger stations at Persimmon Gap, Rio Grande Village, and Castolon are located within this zone, as well as Fossil Bone Exhibit, Glenn Spring, and Santa Elena Canyon Overlook.

1—Corazones

Very deep, loamy, very gravelly soils

This map unit makes up 21 percent of the survey area.

Corazones soils are on fan remnants and fan piedmonts on 1 to 30 percent slopes. They are very deep and moderately rapidly permeable soils. Typically, the surface layer is pink very gravelly loam about 4 inches thick. The subsoil from 4 to 55 inches is pink very gravelly loam and extremely gravelly loam. The underlying material from 55 to 80 inches is light brown extremely gravelly sandy loam.

Of minor extent are areas of Riverwash, which are on the nearly level floor of wide, active arroyos. These areas will flood during rainfall events. Rushing water and debris will destroy any existing vegetation. Texture and gravel content is variable depending on the watershed area contributing the sediments.

2—Solis–Geefour–Rock outcrop

Very shallow or shallow and deep, loamy or clayey, gravelly or very gravelly soils

This map unit makes up 17 percent of the survey area.

Solis soils are on sandstone hills on 1 to 60 percent slopes. They are very shallow or shallow and are moderately rapidly permeable. Typically the surface layer is light yellowish brown fine sandy loam about 2 inches thick. The subsurface layer from 2 to 6 inches is light brown fine sandy loam. The upper underlying material from 6 to 28 inches is very pale brown platy sandstone and light yellowish brown platy sandstone. The lower underlying material from 28 to 38 inches is light brownish gray fractured shale.

Geefour soils are on erosional uplands associated with badlands, and above desert floors on 3 to 45 percent slopes. They are very shallow or shallow soils that are slowly permeable over shale bedrock. Typically, the surface layer is brown silty clay about 6 inches thick. The subsurface layer from 6 to 15 inches is grayish brown very paragravelly silty clay. The underlying material from 15 to 25 inches is gray shale that has a silty clay texture.

3—Studybutte–Rock outcrop

Very shallow or shallow, loamy, very gravelly soils, and areas of exposed igneous bedrock

This map unit makes up 6 percent of the survey area.

Studybutte soils are on hills and mountains on 10 to 60 percent slopes. They are very shallow or shallow soils and are moderately rapidly permeable over very slowly permeable bedrock. Typically the surface layer is reddish brown very gravelly loam about 3 inches thick. The subsurface layer from 3 to 6 inches is reddish brown extremely gravelly loam. The underlying material from 6 to 16 inches is indurated, igneous bedrock.

Rock outcrop consists of areas of exposed igneous bedrock on escarpments and ledges or exposed areas on the summits, shoulders, and backslopes of hills and mountains.

4—Ninepoint–Tornillo

Very deep, loamy soils

This map unit makes up 5 percent of the survey area.

Ninepoint soils are on nearly level alluvial flats in a semi-bolson landscape on 0 to 3 percent slopes. They are very deep and moderately permeable soils. Typically, the surface is pale brown clay loam that is 4 inches thick. The upper subsoil from 4 to 61 inches is yellowish brown and light yellowish brown clay loam; the lower subsoil from 31 to 80 inches is light yellowish brown clay loam.

Tornillo soils are on broad valley floors that occasionally flood, on 0 to 2 percent slopes. They are very deep and are moderately permeable. Typically the surface layer is grayish brown loam about 5 inches thick. The subsurface layer from 5 to 19 inches is pale brown loam. The subsoil from 19 to 26 inches is pale brown stratified gravelly sandy loam; the middle subsoil from 26 to 48 inches is light yellowish brown loam; the lower subsoil from 48 to 80 inches is pale brown stratified silty clay loam.

Soils of the Desert Grassland Vegetative Zone

This group of general soil map units makes up about 26 percent of the survey area. The major soils are the Bissett, Chilicotal, Leyva, Lingua, and Paisano series. Also in this group are areas of Rock outcrop. Most of the soils in this group have loamy and gravelly surfaces. Bissett soils are very shallow or shallow to limestone. Chilicotal soils are very deep. Leyva soils are very shallow or shallow to igneous bedrock. Lingua soils are very shallow or shallow to basalt bedrock. Paisano soils are very shallow or shallow to petrocalcic.

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. The native vegetation consists of short and mid grasses associated with shrubs. The dominant grasses in areas of this group include black grama, blue grama, burrograss, cane bluestem, plains bristlegrass, sideoats grama, and tobosagrass. Woody species such as catclaw acacia, creosotebush, mariola, mesquite, skeletonleaf goldeneye, and tarbush have encroached on most areas.

The park headquarters at Panther Junction is located within this zone, as well as K-Bar, Dugout Wells, and Sotol Vista Overlook.

5—Lingua–Leyva–Rock outcrop

Very shallow or shallow, loamy, very gravelly soils and areas of exposed igneous bedrock

This map unit makes up 14 percent of the survey area.

Lingua soils are on erosional uplands on 20 to 60 percent slopes. They are very shallow or shallow and moderately permeable. Typically the surface layer is brown very gravelly sandy clay loam about 5 inches thick. The subsurface layer from 5 to 13 inches is brown extremely gravelly sandy clay loam. The underlying material from 13 to 23 inches is very strongly cemented rhyolite bedrock.

Leyva soils are on pediments, hills, and mountains on 10 to 30 percent slopes. They are very shallow or shallow soils and are slowly permeable. Typically the surface layer is brown very gravelly loam about 4 inches thick. The subsoil from 4 to 15 inches is brown very gravelly clay loam. The underlying material from 15 to 25 inches is very strongly cemented rhyolite bedrock.

Also included are areas of Rock outcrop, which is exposed bedrock on the summit, shoulder, and backslopes of hills and mountains, or as escarpments and ledges.

6—Chilicotal–Paisano

Very shallow to very deep, loamy, gravelly or very gravelly soils

This map unit makes up 7 percent of the survey area.

Chilicotal soils are on alluvial fans and piedmonts of igneous mountains on 1 to 30 percent slopes. They are very deep soils and are moderately permeable. Typically the surface layer is very gravelly fine sandy loam about 2 inches thick. The subsurface layer from 2 to 7 inches is brown gravelly loam. The upper part of the subsoil from 7 to 23 inches is brown very gravelly loam and very gravelly clay loam; the middle part of the subsoil from 23 to 40 inches is brown and light brown extremely gravelly loam; the lower part of the subsoil from 40 to 61 inches is pink very gravelly sandy loam and extremely gravelly sandy loam.

Paisano soils are on piedmonts and fan remnants on 1 to 20 percent slopes. They are very shallow or shallow soils that are moderately permeable over very slowly permeable cemented caliche. Typically, the surface layer is light brown very gravelly fine sandy loam about 1 inch thick. The upper part of the subsoil from 1 to 12 inches is light brown very gravelly sandy loam, and extremely gravelly sandy clay loam; the middle part of the subsoil from 12 to 16 inches is pinkish white cemented material; the lower part of the subsoil from 16 to 62 inches is pink very gravelly loam.

7—Bissett–Rock outcrop

Very shallow or shallow, loamy, very gravelly soils and areas of exposed limestone bedrock

This map unit makes up 5 percent of the survey area.

Bissett soils are on limestone hills and mountains on 5 to 70 percent slopes. They are very shallow or shallow soils that are moderately permeable over very slowly permeable limestone bedrock. Typically, the surface layer is brown extremely gravelly loam about 3 inches thick; the subsoil from 3 to 17 inches is brown extremely cobbly loam. The underlying material from 17 to 27 inches is limestone bedrock.

Rock outcrop consists of areas of exposed limestone bedrock on escarpments and ledges or exposed areas on the summits, shoulders, and backslopes of hills and mountains.

Soils of the Southern Edwards Plateau Major Land Resource Area

This group of map units makes up about 22 percent of the survey area. The major soils are the Blackgap, Mariscal, Stillwell, Strawhouse, and Terlingua soils. Also in this group are areas of Rock outcrop. The soils in this group have a loamy and gravelly or very gravelly surface. Blackgap soils are very shallow or shallow to limestone bedrock. Mariscal soils are very shallow or shallow to limestone strata. Stillwell soils are very deep and very gravelly soils. Strawhouse soils are very shallow or shallow to a petrocalcic layer. Terlingua soils are very shallow or shallow soils over igneous bedrock.

The arid soils in this group are used as rangeland. The native vegetation dominantly consists of drought tolerant short grasses and frequent woody shrubs. The grasses consist of black grama, bush muhly, Chino grama, fluffgrass, and perennial threeawns. The woody species include creosotebush, lechuguilla, mariola, range ratany, and skeletonleaf goldeneye.

Most of the soils in this group are best suited to recreation and wildlife habitat because of the hazard of erosion. Management practices that maintain an adequate vegetative cover reduce this hazard. Overuse of these areas make recovery a very slow process because of the very limited rainfall, steep slopes, and very gravelly soils.

8—Blackgap–Rock outcrop

Very shallow or shallow, loamy, very cobbly soils

This map unit makes up 11 percent of the survey area.

Blackgap soils are on mesas or divides, hillslopes, and mountainsides on 1 to 30 percent slopes. They are very shallow or shallow, moderately permeable soils over very slowly permeable bedrock. Typically, the surface is light brown very cobbly loam that is 5 inches thick. The subsurface layer from 5 to 11 inches light brown extremely cobbly silt loam. The underlying material from 11 to 21 inches is indurated limestone bedrock.

Rock outcrop are areas of exposed limestone bedrock on the summits, shoulders, and backslopes of hills and mountains, and include almost vertical escarpments and ledges.

9—Mariscal–Terlingua–Rock outcrop

Very shallow or shallow, loamy, very channery soils

This map unit makes up 6 percent of the survey area.

Mariscal soils are on limestone hills on 1 to 30 percent slopes. They are very shallow or shallow, and moderately permeable soils. Typically, the surface is pale brown extremely channery loam that is 2 inches thick. The subsurface layer from 2 to 5 inches is pale brown extremely channery loam. The upper underlying material is platy fractured limestone. The lower underlying material from 10 to 40 inches is interbedded limestone bedrock.

Terlingua soils are on igneous hills and mountains on 10 to 30 percent slopes. They are very shallow or shallow, and are moderately rapidly permeable. Typically the surface layer is yellowish brown very gravelly sandy loam about 4 inches thick. The subsoil from 4 to 8 inches is yellowish brown very gravelly loam. The upper underlying material from 8 to 16 inches is partially weathered igneous bedrock. The lower underlying material from 16 to 26 inches is igneous bedrock.

Rock outcrop are areas of exposed limestone bedrock on the summits, shoulders, and backslopes of hills and mountains, and include almost vertical escarpments and ledges.

10—Strawhouse–Stillwell

Very shallow or very deep, loamy, very gravelly soils

This map unit makes up 5 percent of the survey area.

Strawhouse soils are on pediment remnants on 1 to 30 percent slopes. They are very shallow or shallow soils and are moderately rapidly permeable over a very slowly permeable petrocalcic horizon. Typically, the surface is pale brown very gravelly loam that is 5 inches thick. The upper subsoil from 5 to 15 inches is very pale brown very gravelly loam; the middle subsoil from 15 to 19 inches is white strongly cemented material. The underlying material from 19 to 80 inches is pinkish white very gravelly loam.

Stillwell soils are on erosional fan terraces on 1 to 30 percent slopes. They are very deep and moderately rapidly permeable soils. Typically, the surface layer is pale brown very gravelly sandy loam about 3 inches thick. The upper subsoil from 3 to 12 inches is pale brown very gravelly sandy loam; the lower subsoil from 12 to 30 inches is very pale brown very gravelly sandy loam. The underlying material from 30 to 80 inches is pink extremely gravelly coarse sandy loam.

Soils of the Mixed Prairie Vegetative Zone

This group of map units makes up about 2 percent of the survey area. The major soils are Altuda and Brewster. Also included in this group are areas of Rock outcrop. Most of the soils in this group have a loamy or extremely gravelly surface. Altuda and Brewster soils are very shallow or shallow to bedrock.

The native vegetation consists of short and mid grasses and scattered shrubs. The dominant grasses consist of black grama, blue grama, cane bluestem, green sprangletop, plains bristlegrass, and sideoats grama. Woody species include butterfly bush, clematis, gray oak, javelinabush, juniper, and whitethorn acacia.

Green Gulch and Pine Canyon are located within this zone.

11—Rock outcrop–Brewster

Very shallow or shallow; loamy, extremely gravelly soils and areas of exposed rhyolite bedrock

This map unit makes up 1 percent of the survey area.

Rock outcrop areas are exposed rhyolite bedrock on the summits, shoulders, and backslopes of hills and mountains. These areas include almost vertical escarpments and ledges.

Brewster soils are on hills and mountains on 20 to 70 percent slopes. They are very shallow or shallow soils that are moderately permeable over very slowly permeable igneous bedrock. Typically, the surface layer is reddish gray very gravelly loam about 4 inches thick. The underlying material from 4 to 14 inches is indurated igneous bedrock.

12—Altuda–Rock outcrop

Very shallow or shallow, loamy, very cobbly soils and areas of exposed limestone bedrock

This map unit makes up 1 percent of the survey area.

Altuda soils are on limestone hills and mountains on 10 to 60 percent slopes. They are very shallow or shallow soils that are moderately permeable over very slowly permeable limestone bedrock. Typically, the surface layer is brown very cobbly silt loam about 6 inches thick. The subsoil from 6 to 10 inches is dark grayish brown very cobbly silt loam. The underlying material from 10 to 20 inches is indurated limestone bedrock.

Rock outcrop consists of exposed limestone bedrock on summits, shoulders, and backslopes of hills and mountains, and includes almost vertical escarpments and ledges.

Soils of the Mountain Savannah Vegetative Zone

This general soil map unit makes up about 1 percent of the survey area. The major soils are the Madrone and Puerta series. These soils are shallow and moderately deep with cobbly or gravelly loamy surface horizons. Madrone soils are moderately deep to rhyolite bedrock. Puerta soils are shallow to rhyolite bedrock.

The sub-humid soils in this zone are used for recreation, wildlife habitat, and aquifer recharge. The ranger station and lodge at Chisos Basin are located within this zone.

Native vegetation consists of woodland dominated by evergreen and deciduous trees, with mid and tall grasses in the understory and in canopy openings. Dominant tree species include gray oak, graves oak, alligator juniper, Mexican pinyon, Ponderosa pine, and Texas madrone. Warm-season grasses are bull muhly, sideoats grama, cane bluestem, Texas bluestem, and blue grama. Cool-season grasses are pinyon ricegrass and finestem needlegrass.

Soils in this zone are well suited for recreation. Wildfire hazards resulting from woody fuel accumulation and potential black bear encounters are major management concerns. Management practices that maintain open canopy help reduce wildfire hazards.

13—Puerta–Madrone

Shallow to moderately deep, loamy and clayey, gravelly soils

This map unit makes up 1 percent of the survey area.

Puerta soils are on mountainsides and moutainflanks on 20 to 45 percent slopes. They are shallow soils that are moderately slowly permeable. Typically, the surface layer is brown very gravelly silt loam about 4 inches thick. The subsurface layer from 4 to 5 inches is brown very gravelly loam. The subsoil from 5 to 19 inches is reddish brown, very gravelly clay. The underlying material from 19 to 29 inches is rhyolite bedrock.

Madrone soils are on mountains on 20 to 45 percent slopes. They are moderately deep soils that are moderately slowly permeable. Typically the surface layer is brown very gravelly loam about 4 inches thick. The subsurface layer from 4 to 6 inches is pinkish gray very gravelly loam. The subsoil from 6 to 32 inches is olive very gravelly clay. The underlying material from 32 to 42 inches is rhyolite bedrock.

Of minor extent are areas of Rock outcrop, which consist of exposed igneous bedrock on summits, shoulders, and backslopes of hills and mountains, and includes almost vertical escarpments and ledges.

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit.

Soils that have profiles that are almost alike make up a soil series. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, 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, Corazones very gravelly sandy loam, 1 to 8 percent slopes is a phase of the Corazones series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Strawhouse-Stillwell complex, 1 to 8 percent slopes is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Chilicotal-Paisano association, 5 to 30 percent slopes is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, occasionally flooded, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Table 10 lists the map units in this survey area. Other 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.

AAC—Altar gravelly sandy loam, 1 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,680 to 4,895 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Map Unit Composition

Altar and similar soils: 83 percent
Dissimilar minor components 17 percent
Minor components:
Pantera soils—7 percent; not hydric
Unnamed, minor components soils—7 percent; not hydric
Lingua soils—3 percent; not hydric

Description of Altar soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, thermic Ustic Haplocambids
Ecological site name and identification: Gravelly, Desert Grassland (R042XC244TX) (fig. 4)

Setting

Landscape: Piedmont slopes
Landform: Fan terraces
Landform position (three-dimensional): Tread
Slope: 1 to 8 percent
Down-slope shape: Linear

Figure 4.—An area of Altar gravelly sandy loam, 1 to 8 percent slopes. Vegetation consists of sideoats grama, cane bluestem, Harvard agave, pricklypear, javelinabush, creosotebush, and whitethorn acacia. Altar soils are in the Gravelly ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very low
Parent material: Colluvium and residuum weathered from limestone bedrock
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 3.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 8
Available water capacity: Low (about 4.4 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Black grama, bush muhly, cane bluestem, sideoats grama, blue grama, Arizona cottontop, creosotebush, dropseed, other shrubs, slim tridens, fourwing saltbush, range ratany, plains bristlegrass, Harvard agave, pricklypear, javelinabush, whitethorn acacia, perennial forbs, other perennial grasses

Typical Profile

A—0 to 7 inches; gravelly sandy loam
Bw—7 to 19 inches; extremely gravelly sandy loam
C—19 to 80 inches; extremely gravelly coarse sandy loam

ADE—Altuda very cobbly silt loam, 10 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 4,025 to 6,940 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Altuda and similar soils: 75 percent
Dissimilar minor components: 25 percent
Minor components:
Rock outcrop—9 percent; not hydric
Cienega soils—8 percent; not hydric
Crossen soils—8 percent; not hydric

Description of Altuda soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Ecological site name and identification: Limestone Hill and Mountain, Mixed Prairie (fig. 5) (R042XE278TX)

Setting

Landscape: Mountains
Landform: Mountain slopes, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Slope: 10 to 30 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Ustic

Figure 5.—An area of Altuda very cobbly silt loam, 10 to 30 percent slopes. Vegetation includes little bluestem, cane bluestem, sideoats grama, black grama, hairy grama, redberry juniper, green sprangletop, Mexican pinyon, perennial forbs, other perennial grasses, other shrubs, New Mexico Feathergrass, curlyleaf muhly, blue grama, true mountain mahogany, and agarito. Altuda soils are in the Limestone Hill and Mountain ecological site, Mixed Prairie vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Properties and Qualities

Runoff class: High
Parent material: Colluvium and residuum weathered from limestone bedrock
Depth to restrictive feature: 6 to 19 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: 55
Available water capacity: Very low (about 0.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s

Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Little bluestem, cane bluestem, sideoats grama, black grama, hairy grama, redberry juniper, green sprangletop, Mexican pinyon, perennial forbs, other perennial grasses, other shrubs, New Mexico Feathergrass, curlyleaf muhly, blue grama, true mountain mahogany, agarito

Typical Profile

Ak—0 to 6 inches; very cobbly silt loam
Bk—6 to 10 inches; very cobbly silt loam
R—10 to 20 inches; limestone bedrock

ADG—Altuda-Rock outcrop complex, 20 to 70 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 4,645 to 5,835 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Altuda and similar soils: 60 percent
Rock outcrop: 30 percent
Dissimilar minor components: 10 percent
Minor components:
Cienega soils—5 percent; not hydric
Crossen soils—5 percent; not hydric

Description of Altuda soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Ecological site name and identification: Limestone Hill and Mountain, Mixed Prairie (R042XE278TX) (fig. 6)

Setting

Landscape: Mountains
Landform: Mountain slopes, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Slope: 20 to 70 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Ustic

Figure 6.—An area of Altuda-Rock outcrop complex, 20 to 70 percent slopes. Altuda soils are in the Limestone Hill and Mountain ecological site, Mixed Prairie vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Altuda soils are at elevations where trees such as redberry juniper, Mexican pinyon, and true mountain mahogany can grow.

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum weathered from limestone bedrock
Depth to restrictive feature: 6 to 19 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: 55
Available water capacity: Very low (about 0.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Sideoats grama, curlyleaf muhly, green sprangletop, little bluestem, cane bluestem, black grama, blue grama, hairy grama, New Mexico Feathergrass, redberry juniper, Mexican pinyon, agarito, true mountain mahogany, other shrubs, perennial forbs, other perennial grasses

Typical Profile

Ak—0 to 6 inches; very cobbly silt loam
Bk—6 to 10 inches; very cobbly silt loam
R—10 to 20 inches; limestone bedrock

Description of Rock outcrop

Setting

Landscape: Mountains
Slope: 20 to 70 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Limestone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; limestone bedrock

BIE—Bissett-Rock outcrop complex, 5 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,695 to 5,460 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Map Unit Composition

Bissett and similar soils: 50 percent
Rock outcrop: 30 percent
Dissimilar minor components: 20 percent
Minor components:
Unnamed, minor components soils—20 percent; not hydric

Description of Bissett soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, thermic Lithic Ustic Haplocalcids
Ecological site name and identification: Limestone Hill and Mountain, Desert Grassland (R042XC249TX)

Setting

Landscape: Hills
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Slope: 5 to 30 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum weathered from limestone
Depth to restrictive feature: 6 to 19 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 80
Available water capacity: Very low (about 0.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Cane bluestem, Chino grama, sideoats grama, black grama, hairy grama, Arizona cottontop, tanglehead, range ratany, green sprangletop, perennial forbs, perennial grasses, plains bristlegrass, other shrubs, skeletonleaf goldeneye

Typical Profile

A—0 to 3 inches; very gravelly loam
Bk—3 to 9 inches; very gravelly clay loam
R—9 to 19 inches; limestone bedrock

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 10 to 30 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Limestone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; limestone bedrock

BIG—Bissett-Rock outcrop complex, 20 to 70 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,815 to 5,815 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Map Unit Composition

Bissett and similar soils: 55 percent
Rock outcrop: 30 percent
Dissimilar minor components: 15 percent
Minor components:
  Mabray soils—9 percent; not hydric
  Unnamed, minor components soils—6 percent; not hydric

Description of Bissett soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, thermic Lithic Ustic Haplocalcids
Ecological site name and identification: Limestone Hill and Mountain, Desert Grassland (R042XC249TX) (fig. 7)

Setting

Landscape: Hills and mountains
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope

Figure 7.—An area of Bissett-Rock outcrop complex, 20 to 70 percent slopes. Vegetation includes sideoats grama, slim tridens, lechuguilla, pricklypear, Gregg's coldenia, and whitethorn acacia. Bissett soils are in the Limestone Hill and Mountain ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Slope: 20 to 60 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum weathered from limestone
Depth to restrictive feature: 7 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 80
Available water capacity: Very low (about 1.7 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Cane bluestem, Chino grama, sideoats grama, black grama, hairy grama, Arizona cottontop, tanglehead, range ratany, green sprangletop, slim tridens, lechuguilla, pricklypear, Gregg's coldenia, whitethorn acacia, perennial forbs, perennial grasses, plains bristlegrass, other shrubs, skeletonleaf goldeneye

Typical Profile

A—0 to 3 inches; very gravelly loam
Bk—3 to 17 inches; very gravelly clay loam
R—17 to 27 inches; limestone bedrock

Description of Rock outcrop

Setting

Landscape: Hills and mountains
Slope: 20 to 70 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Limestone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; limestone bedrock

BLD—Blackgap-Rock outcrop complex, 1 to 16 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,925 to 3,910 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Blackgap and similar soils: 85 percent
Rock outcrop: 10 percent
Dissimilar minor components: 5 percent
Minor components:
Unnamed, minor components soils—5 percent; not hydric

Description of Blackgap soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Haplocalcids
Ecological site name and identification: Limestone Hill and Mountain 8-14" PZ (R081DY592TX)

Setting

Landscape: Dissected plateaus
Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope (fig. 8)
Slope: 1 to 16 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium derived from thick-bedded limestone bedrock
Depth to restrictive feature: 7 to 20 inches to lithic bedrock

Figure 8.—An area of Blackgap-Rock outcrop complex, 1 to 16 percent slopes. This area shows vegetation such as Texas false agave, creosotebush, and Chino grama growing on a backslope. This map unit is in the Limestone Hill and Mountain 8-14" PZ ecological site of MLRA 81D—Southern Edwards Plateau.

Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 47
Available water capacity: Very low (about 1.1 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, lechuguilla, creosotebush, guayacan, Big Bend silverleaf, sideoats grama, black grama, candelilla, slim tridens, Texas false agave, perennial forbs, other perennial grasses, other shrubs

Typical Profile

Ak—0 to 5 inches; very gravelly loam
Bk—5 to 11 inches; extremely cobbly silt loam
R—11 to 21 inches; limestone bedrock

Description of Rock outcrop

Setting

Landscape: Dissected plateaus
Slope: 1 to 16 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Limestone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; limestone bedrock

BLE—Blackgap-Rock outcrop complex, 10 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,805 to 4,170 feet
Mean annual precipitation: 10 to 13 inches

Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Blackgap and similar soils: 50 percent
Rock outcrop: 40 percent
Dissimilar minor components: 10 percent
Minor components:
Unnamed, minor components soils—10 percent; not hydric

Description of Blackgap soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Haplocalcids
Ecological site name and identification: Limestone Hill and Mountain 8-14" PZ (R081DY592TX) (fig. 9)

Setting

Landscape: Dissected plateaus
Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Slope: 10 to 30 percent

Figure 9.—An area of Blackgap-Rock outcrop complex, 10 to 30 percent slopes. Vegetation on this site includes sideoats grama, slim tridens, lechuguilla, pricklypear, and whitethorn acacia. This map unit is in the Limestone Hill and Mountain 8-14" PZ ecological site of MLRA 81D—Southern Edwards Plateau.

Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium derived from thick-bedded limestone bedrock
Depth to restrictive feature: 7 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 47
Available water capacity: Very low (about 1.1 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, black grama, sideoats grama, slim tridens, creosotebush, guayacan, lechuguilla, candelilla, Big Bend silverleaf, pricklypear, whitethorn acacia, other shrubs, perennial forbs, other perennial grasses

Typical Profile

Ak—0 to 5 inches; very gravelly loam
Bk—5 to 11 inches; extremely cobbly silt loam
R—11 to 21 inches; limestone bedrock

Description of Rock outcrop

Setting

Landscape: Dissected plateaus
Slope: 10 to 30 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Limestone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; limestone bedrock

BLG—Blackgap-Rock outcrop complex, 20 to 70 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,725 to 4,635 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Blackgap and similar soils: 50 percent
Rock outcrop: 40 percent
Dissimilar minor components: 10 percent
Minor components:
Unnamed, minor components soils—10 percent; not hydric

Description of Blackgap soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Haplocalcids
Ecological site name and identification: Limestone Hill and Mountain 8-14" PZ (R081DY592TX) (fig. 10)

Setting

Landscape: Dissected plateaus
Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Slope: 20 to 60 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium derived from thick-bedded limestone bedrock
Depth to restrictive feature: 7 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)

Figure 10.—Bedrock exposures enhance the available water of Blackgap soils within the Blackgap-Rock outcrop, 20 to 70 percent slopes map unit. Runoff from exposed bedrock infiltrates allowing western honey mesquite, creosotebush, desert shrub pitaya, croton, and fluffgrass to grow on this hot, dry Limestone Hill and Mountain 8-14" PZ ecological site of MLRA 81D—Southern Edwards Plateau.

Sodicity maximum: Not sodic
Calcium carbonate maximum: 47
Available water capacity: Very low (about 1.1 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, black grama, sideoats grama, slim tridens, creosotebush, guayacan, lechuguilla, candelilla, Big Bend silverleaf, western honey mesquite, desert shrub pitaya, croton, fluffgrass, other shrubs, perennial forbs, other perennial grasses

Typical Profile

Ak—0 to 5 inches; very gravelly loam
Bk—5 to 11 inches; extremely cobbly silt loam
R—11 to 21 inches; limestone bedrock

Description of Rock outcrop

Setting

Landscape: Dissected plateaus
Slope: 20 to 70 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Limestone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; limestone bedrock

CIC—Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,510 to 4,865 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Map Unit Composition

Chilicotal and similar soils: 70 percent
Dissimilar minor components: 30 percent
Minor components:
Paisano soils—9 percent; not hydric
Straddlebug soils—9 percent; not hydric
Butcherknife soils—7 percent; not hydric
Lingua soils—5 percent; not hydric

Description of Chilicotal soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids
Ecological site name and identification: Gravelly, Desert Grassland (R042XC244TX) (fig. 11)

Setting

Landscape: Piedmont slopes
Landform: Fan remnants
Slope: 1 to 8 percent
Down-slope shape: Linear
Across-slope shape: Convex

Figure 11.—Sotol, skeletonleaf goldeneye, sideoats grama, and black grama dominate the vegetation on this area of Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes. This map unit is in the Gravelly ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Low
Parent material: Loamy and gravelly piedmont sediments
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 10.0
Calcium carbonate maximum: 40
Available water capacity: Moderate (about 7.2 inches)
Gypsum maximum: About 5 percent

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Sideoats grama, black grama, bush muhly, Arizona cottontop, slim tridens, threeawn, creosotebush, mariola, range ratany, sotol, skeletonleaf goldeneye, other shrubs, perennial forbs, other annual forbs, other perennial grasses

Typical Profile

A—0 to 2 inches; very gravelly fine sandy loam
Bw—2 to 7 inches; very gravelly loam
Bk1—7 to 14 inches; very gravelly loam
Bk2—14 to 23 inches; very gravelly clay loam
Bk3—23 to 40 inches; extremely gravelly loam
Bk4—40 to 51 inches; very gravelly sandy loam
Bk5—51 to 80 inches; extremely gravelly sandy loam

CLE—Chilicotal-Paisano association, 5 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,595 to 4,855 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Map Unit Composition

Chilicotal and similar soils: 60 percent
Paisano and similar soils: 25 percent
Dissimilar minor components: 15 percent
Minor components:
Unnamed, minor components soils—15 percent; not hydric

Description of Chilicotal soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids
Ecological site name and identification: Gravelly, Desert Grassland (R042XC244TX)

Setting

Landscape: Piedmont slopes
Landform: Fan remnants
Slope: 5 to 30 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Medium
Parent material: Loamy and gravelly piedmont sediments
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 17.0
Calcium carbonate maximum: 40
Available water capacity: Moderate (about 7.2 inches)
Gypsum maximum: About 5 percent

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Other annual forbs, threeawn, sideoats grama, black grama, mariola, creosotebush, bush muhly, perennial forbs, other perennial grasses, other shrubs, slim tridens, Arizona cottontop, range ratany

Typical Profile

A—0 to 2 inches; very gravelly fine sandy loam
Bw—2 to 7 inches; very gravelly loam
Bk1—7 to 14 inches; very gravelly loam
Bk2—14 to 23 inches; very gravelly clay loam
Bk3—23 to 40 inches; extremely gravelly loam
Bk4—40 to 51 inches; very gravelly sandy loam
Bk5—51 to 80 inches; extremely gravelly sandy loam

Description of Paisano soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, thermic, shallow Calcic Petrocalcids (fig. 12)
Ecological site name and identification: Gravelly, Desert Grassland (R042XC244TX)

Setting

Landscape: Piedmont slopes
Landform: Fan remnants
Slope: 5 to 8 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Figure 12.—A roadcut exposure of Paisano very gravelly fine sandy loam in an area of Chilicotal-Paisano association, 5 to 30 percent slopes. The Paisano soils are in the Gravelly ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Paisano soils are shallow (less than 20 inches) to cemented material. Subrounded igneous gravel is cemented by calcium carbonate.

Properties and Qualities

Runoff class: Very high
Parent material: Gravelly alluvium derived from mixed sources
Depth to restrictive feature: 5 to 20 inches to petrocalcic
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 2.0
Calcium carbonate maximum: 32
Available water capacity: Very low (about 0.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Sideoats grama, black grama, bush muhly, Arizona cottontop, slim tridens, threeawn, creosotebush, mariola, range ratany, other shrubs, perennial forbs, other annual forbs, other perennial grasses

Typical Profile

Ak—0 to 1 inches; very gravelly fine sandy loam
Bk1—1 to 4 inches; very gravelly sandy loam
Bk2—4 to 12 inches; very gravelly sandy clay loam
Bkkm—12 to 16 inches; cemented material
BCk—16 to 62 inches; very gravelly loam

CNB—Chillon very gravelly fine sandy loam, 1 to 3 percent slopes, rarely flooded

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,850 to 4,295 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Chillon and similar soils: 81 percent
Dissimilar minor components: 19 percent
Minor components:
Unnamed, minor components soils—12 percent; not hydric
Rock outcrop—7 percent; not hydric

Description of Chillon soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, hyperthermic Ustic Haplocambids
Ecological site name and identification: Arroyo, Hot Desert Shrub (R042XG736TX)

Setting

Landscape: Semi-bolsons
Landform: Low terraces, flood-plain steps (fig. 13)
Landform position (three-dimensional): Tread
Slope: 1 to 3 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Figure 13.—Dense woody vegetation on an area of Chillon very gravelly fine sandy loam, 1 to 3 percent slopes, rarely flooded. Chillon soils receive extra water from adjoining soils, so they support greater biomass and diversity than water-shedding soils. Chillon soils are in the Arroyo ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Rock outcrop-Brewster complex, 20 to 70 percent slopes is in the background.

Properties and Qualities

Runoff class: Low
Parent material: Gravelly alluvium derived from igneous and sedimentary rock
Depth to restrictive feature: None within 60 inches
Frequency of flooding: Rare
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Slightly saline (about 5.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 21.0
Calcium carbonate maximum: 5
Available water capacity: Very low (about 2.3 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): Not populated
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Sideoats grama, tanglehead, black grama, sand dropseed, Chino grama, desert willow, creosotebush, catclaw acacia, Trans-Pecos poreleaf, western honey mesquite, spiny hackberry, leatherstem, elbowbush, other shrubs, other perennial grasses, perennial forbs, baccharis, cane bluestem

Typical Profile

A—0 to 5 inches; very gravelly fine sandy loam
Bw—5 to 42 inches; very gravelly fine sandy loam
C—42 to 61 inches; very gravelly coarse sandy loam

COC—Corazones very gravelly sandy loam, 1 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,860 to 4,295 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Corazones and similar soils: 85 percent
Dissimilar minor components: 15 percent
Minor components:
Tornillo soils—9 percent; not hydric
Ojinaga soils—6 percent; not hydric

Description of Corazones soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, hyperthermic Ustic Haplocalcids
Ecological site name and identification: Gravelly, Hot Desert Shrub (R042XG735TX)

Setting

Landscape: Piedmont slopes
Landform: Pediments (fig. 14)
Slope: 1 to 8 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Low
Parent material: Gravelly alluvium derived from igneous and sedimentary rock
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None

Figure 14.—Low-growing creosotebush with ocotillo, leatherstem, and dog cactus on an area of Corazones very gravelly sandy loam, 1 to 8 percent slopes. Broad pediment landforms grade southward toward the Rio Grande from the Chisos Mountains (background). A well-developed desert pavement consisting of varnished igneous fragments covers the soil.

Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 2.6 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 7.0
Calcium carbonate maximum: 30
Available water capacity: Low (about 5.7 inches)
Gypsum maximum: About 2 percent

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: A

Vegetation

Existing plants: Chino grama, black grama, bush muhly, false grama, fluffgrass, dog cactus, threeawn, creosotebush, ocotillo, leatherstem, range ratany, Gregg's coldenia, other shrubs, perennial forbs, other perennial grasses, feather pappusgrass, slim tridens

Typical Profile

A—0 to 4 inches; very gravelly sandy loam
Bk1—4 to 13 inches; very gravelly loam
Bk2—13 to 55 inches; extremely gravelly loam
BCk—55 to 80 inches; extremely gravelly sandy loam

COE—Corazones very gravelly sandy loam, 1 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,935 to 3,550 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Corazones and similar soils: 70 percent
Dissimilar minor components: 30 percent
Minor components:
Unnamed, minor components soils—20 percent; not hydric
Pantera soils—5 percent; not hydric
Tornillo soils—5 percent; not hydric

Description of Corazones soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, hyperthermic Ustic Haplocalcids
Ecological site name and identification: Gravelly, Hot Desert Shrub (R042XG735TX)

Setting

Landscape: Piedmont slopes
Landform: Pediments (fig. 15)
Slope: 1 to 30 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Medium
Parent material: Gravelly alluvium derived from igneous and sedimentary rock
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 2.6 dS/m)

Figure 15.—North-facing slope in an area of Corazones very gravelly sandy loam, 1 to 30 percent slopes with cover of Chino grama, lechuguilla, and other shrubs. Often, sloping areas of Corazones will support more plant cover than areas with less slope. Desert pavement on less sloping areas can form a "shingle roof" that hinders intake of rainfall.

Sodicity maximum: Sodium adsorption ratio is about 7.0
Calcium carbonate maximum: 30
Available water capacity: Low (about 5.7 inches)
Gypsum maximum: About 2 percent

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: A

Vegetation

Existing plants: Chino grama, black grama, bush muhly, false grama, fluffgrass, threeawn, slim tridens, feather pappusgrass, creosotebush, ocotillo, leatherstem, range ratany, Gregg's coldenia, lechuguilla other shrubs, perennial forbs, other perennial grasses

Typical Profile

A—0 to 4 inches; very gravelly sandy loam
Bk1—4 to 13 inches; very gravelly loam
Bk2—13 to 55 inches; extremely gravelly loam
BCk—55 to 80 inches; extremely gravelly sandy loam

EUB—Equipaje-Agust complex, 1 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,630 to 3,330 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Equipaje and similar soils: 45 percent
Agust and similar soils: 40 percent
Dissimilar minor components: 15 percent
Minor components:
Unnamed, minor components soils—15 percent; not hydric

Description of Equipaje soils

Classification

Soil taxonomic classification: Coarse-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Ecological site name and identification: Gravelly, Hot Desert Shrub (R042XG735TX)

Setting

Landscape: Piedmont slopes
Landform: Piedmont slopes, alluvial fans, and stream terraces
Slope: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very low
Parent material: Loamy alluvium derived from igneous and sedimentary rock
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 2.0
Calcium carbonate maximum: 5
Available water capacity: High (about 11.2 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7c
Land capability subclass (irrigated): 3e
Hydric soil rating: No
Hydrologic soil group: A

Vegetation

Existing plants: Chino grama, black grama, bush muhly, false grama, fluffgrass, threeawn, slim tridens, feather pappusgrass, creosotebush, ocotillo, leatherstem, range ratany, Gregg's coldenia, other shrubs, perennial forbs, other perennial grasses

Typical Profile

A—0 to 2 inches; fine sandy loam
Bw1—2 to 26 inches; fine sandy loam
Bw2—26 to 53 inches; sandy loam
Bw3—53 to 80 inches; fine sandy loam

Description of Agust soils

Classification

Soil taxonomic classification: Coarse-loamy, mixed, superactive, hyperthermic Ustic Haplocalcids
Ecological site name and identification: Gravelly, Hot Desert Shrub (R042XG735TX)

Setting

Landscape: Piedmont slopes
Landform: Alluvial fans and terraces
Slope: 1 to 3 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Negligible
Parent material: Loamy gravelly alluvium and colluvium
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 15
Available water capacity: Moderate (about 6.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7e

Hydric soil rating: No
Hydrologic soil group: A

Vegetation

Existing plants: Chino grama, black grama, bush muhly, false grama, fluffgrass, threeawn, slim tridens, feather pappusgrass, creosotebush, ocotillo, leatherstem, range ratany, Gregg's coldenia, other shrubs, perennial forbs, other perennial grasses

Typical Profile

A—0 to 2 inches; gravelly fine sandy loam
Bk1—2 to 11 inches; gravelly fine sandy loam
Bk2—11 to 28 inches; gravelly loam sand
C—28 to 80 inches; very gravelly fine sandy loam

GEE—Geefour silty clay, 3 to 20 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,810 to 3,855 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Geefour and similar soils: 60 percent
Dissimilar minor components: 40 percent
Minor components:
Unnamed, minor components soils—30 percent; not hydric
Corazones soils—5 percent; not hydric
Tornillo soils—5 percent; not hydric

Description of Geefour soils

Classification

Soil taxonomic classification: Clayey, smectitic, calcareous, hyperthermic, shallow Ustic Torriorthents
Ecological site name and identification: Salty Clay Hill, Hot Desert Shrub (R042XG734TX)

Setting

Landscape: Intermontane basins
Landform: Erosional hillslopes associated with badlands, above desert basin floors (fig. 16)
Landform position (two-dimensional): Backslope
Slope: 3 to 20 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Figure 16.—Clay of the Cretaceous age Pen Formation forms the Geefour soils. Vegetated areas occur on slopes with a gravel mulch, whereas areas stripped of gravel cover do not support vegetation. On the Maverick Mountain behind, Studybutte-Rock outcrop complex, 20 to 60 percent slopes is on intrusive igneous bedrock.

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and clayey residuum weathered from mudstone
Depth to restrictive feature: 3 to 20 inches to densic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: High (about 7.5 LEP)
Salinity maximum: Slightly saline (about 6.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 8.0
Calcium carbonate maximum: 6
Available water capacity: Very low (about 1.1 inches)
Gypsum maximum: About 2 percent

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Alkali sacaton, Hall’s panicum, tubercled saltbush, wolfberry, fluffgrass, whorled dropseed, false grama, mound saltbush, creosotebush, western honey mesquite, tobosa, perennial forbs, other perennial grasses, other shrubs

Typical Profile

A1—0 to 6 inches; silty clay
A2—6 to 15 inches; silty clay
Cd—15 to 25 inches; extremely hard silty clay

GEF—Geefour silty clay, 10 to 45 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,840 to 4,560 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Geefour and similar soils: 70 percent
Dissimilar minor components: 30 percent
Minor components:
Unnamed, minor components soils—22 percent; not hydric
Rock outcrop—8 percent; not hydric

Description of Geefour soils

Classification

Soil taxonomic classification: Clayey, smectitic, calcareous, hyperthermic, shallow Ustic Torriorthents
Ecological site name and identification: Salty Clay Hill, Hot Desert Shrub (R042XG734TX)

Setting

Landscape: Intermontane basins
Landform: Erosional hillslopes associated with badlands, above desert basin floors
Landform position (two-dimensional): Backslope
Slope: 10 to 45 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and clayey residuum weathered from mudstone (fig. 17)
Depth to restrictive feature: 3 to 19 inches to densic bedrock
Frequency of flooding: None
Frequency of ponding: None

Figure 17.—Geefour silty clay, 10 to 45 percent slopes drape over this exposure of Cretaceous age mudstone. The veneer of very gravelly silty clay on the opposite slope allows it to maintain a sparse cover of shrubs and grasses. In contrast, the eroded Geefour soil with a silty clay surface texture in the foreground does not support vegetation.

Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: High (about 7.5 LEP)
Salinity maximum: Moderately saline (about 13.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 8.0
Calcium carbonate maximum: 6
Available water capacity: Very low (about 1.7 inches)
Gypsum maximum: About 2 percent

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Alkali sacaton, Hall's panicum, tubercled saltbush, wolfberry, fluffgrass, whorled dropseed, false grama, mound saltbush, creosotebush, western honey mesquite, tobosa, perennial forbs, other perennial grasses, other shrubs

Typical Profile

A1—0 to 5 inches; silty clay
A2—5 to 12 inches; silty clay
Cdy—12 to 39 inches; extremely hard silty clay

HRE—Hurds very cobbly loam, 10 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 4,020 to 6,525 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Hurds and similar soils: 70 percent
Dissimilar minor components: 30 percent
Minor components:
Brewster soils—9 percent; not hydric
Unnamed, minor components soils—16 percent; not hydric
Rubble land—5 percent; not hydric

Description of Hurds soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, thermic Aridic Argiustolls
Ecological site name and identification: Foothill Slope, Mixed Prairie (R042XE274TX)

Setting

Landscape: Mountain valleys or canyons
Landform: Alluvial fans and terraces
Landform position (three-dimensional): Side slope
Slope: 10 to 30 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Ustic

Properties and Qualities

Runoff class: High
Parent material: Colluvium and alluvium derived from igneous rock
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline

Sodicity maximum: Not sodic
Calcium carbonate maximum: No carbonates
Available water capacity: Low (about 5.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Cane bluestem, sideoats grama, black grama, blue grama, skeletonleaf goldeneye, tanglehead, juniper, perennial forbs, other perennial grasses, other shrubs, catclaw acacia, elbowbush, green sprangletop, bristlegrass, other trees

Typical Profile

A—0 to 10 inches; very cobbly loam
Bt—10 to 80 inches; very cobbly sandy clay loam

LEE—Leyva-Rock outcrop complex, 10 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,460 to 5,435 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Map Unit Composition

Leyva and similar soils: 75 percent
Rock outcrop: 15 percent
Dissimilar minor components: 10 percent
Minor components:
Unnamed, minor components soils—10 percent; not hydric

Description of Leyva soils

Classification

Soil taxonomic classification: Clayey-skeletal, mixed, superactive, thermic Lithic Ustic Haplargids
Ecological site name and identification: Igneous Hill and Mountain, Desert Grassland (R042XC247TX) (fig. 18)

Setting

Landscape: Hills and mountains
Landform: Pediments, hills and mountains
Landform position (two-dimensional): Summit, backslope
Slope: 10 to 30 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Figure 18.—An area of Leyva-Rock outcrop complex, 10 to 30 percent slopes. Vegetation includes black grama, Ephedra, filly panicum, mariola, range ratany, broom snakeweed, Chino grama, common sotol, lechuguilla, pricklypear, sideoats grama, and skeletonleaf goldeneye. Leyva soils are in the Igneous Hill and Mountain ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desert Basins, Plains, and Mountains.

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum from weathered from rhyolite
Depth to restrictive feature: 7 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 5.5 LEP)
Salinity maximum: Not saline (about 0.5 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: No carbonates
Available water capacity: Very low (about 1.5 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Bush muhly, sideoats grama, tanglehead, black grama, Arizona cottontop, mariola, skeletonleaf goldeneye, range ratany, catclaw acacia, cane bluestem, Ephedra, filly panicum, broom snakeweed, Chino grama, common sotol, lechuguilla, pricklypear, other perennial grasses, other shrubs, other perennial forbs

Typical Profile

A—0 to 4 inches; very gravelly loam
Bt—4 to 15 inches; very gravelly clay loam
R—15 to 25 inches; rhyolite bedrock

Description of Rock outcrop

Setting

Landscape: Hills and mountains
Slope: 10 to 30 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Rhyolite and/or igneous rock
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; rhyolite bedrock

LGG—Lingua-Rock outcrop complex, 20 to 60 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,385 to 7,365 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Map Unit Composition

Lingua and similar soils: 41 percent
Rock outcrop: 36 percent
Dissimilar minor components: 23 percent
Minor components:
  Leyva soils—9 percent; not hydric
  Unnamed, minor components soils—8 percent; not hydric
  Pantak soils—6 percent; not hydric

Description of Lingua soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, nonacid, thermic Lithic Ustic Torriorthents
Ecological site name and identification: Igneous Hill and Mountain, Desert Grassland (R042XC247TX) (fig. 19)

Setting

Landscape: Hills
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope: 20 to 60 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Aridic (torric)

Figure 19.—Black grama, sideoats grama, pricklypear, ocotillo, lechuguilla, and whitethorn acacia growing on an area of Lingua-Rock outcrop complex, 20 to 60 percent slopes. Lingua soils are in the Igneous Hill and Mountain ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Properties and Qualities

Runoff class: Very high
Parent material: Residuum weathered mainly from igneous bedrock
Depth to restrictive feature: 4 to 15 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 0.5 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: No carbonates
Available water capacity: Very low (about 1.0 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Sideoats grama, tanglehead, Arizona cottontop, black grama, cane bluestem, bush muhly, skeletonleaf goldeneye, range ratany, catclaw acacia, mariola, ocotillo, lechuguilla, whitethorn acacia, other shrubs, other perennial forbs, other perennial grasses

Typical Profile

A1—0 to 5 inches; very gravelly sandy clay loam
A2—5 to 13 inches; extremely gravelly sandy clay loam
R—13 to 23 inches; rhyolite bedrock

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 20 to 60 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Rhyolite
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; rhyolite bedrock

LMF—Liv-Mainstay-Rock outcrop complex, 20 to 45 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 4,615 to 7,180 feet
Mean annual precipitation: 18 to 26 inches
Mean annual air temperature: 56 to 59 degrees F
Frost-free period: 160 to 200 days

Map Unit Composition

Liv and similar soils: 30 percent
Mainstay: 30 percent
Rock outcrop: 15 percent
Dissimilar minor components: 25 percent
Minor components:
Unnamed, minor components soils—25 percent; not hydric

Description of Liv soils

Classification

Soil taxonomic classification: Clayey-skeletal, smectitic, thermic Pachic Paleustolls
Ecological site name and identification: Igneous Hill and Mountain, Mountain Savannah (R042XF286TX)

Setting

Landscape: Mountains
Landform: Hills and mountains
Landform position (two-dimensional): Backslope
Slope: 20 to 45 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Ustic

Properties and Qualities

Runoff class: High
Parent material: Colluvium and residuum weathered from trachyte
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 13
Available water capacity: Very low (about 2.7 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: C

Vegetation

Existing plants: Bullgrass, Texas bluestem, little bluestem, sideoats grama, cane bluestem, blue grama, Mexican pinyon, alligator juniper, gray oak, true mountain mahogany, evergreen sumac, mimosa, other shrubs, perennial forbs, other trees, other perennial grasses

Typical Profile

A—0 to 9 inches; very gravelly clay loam
Bt1—9 to 23 inches; very gravelly clay
Bt2—23 to 38 inches; extremely cobbly clay
R—38 to 48 inches; trachyte bedrock

Description of Mainstay soils

Classification

Soil taxonomic classification: Clayey-skeletal, smectitic, thermic Aridic Lithic Argiustolls
Ecological site name and identification: Igneous Hill and Mountain, Mountain Savannah (R042XF286TX)

Setting

Landscape: Mountains
Landform: Hills and mountains
Landform position (two-dimensional): Backslope
Slope: 20 to 45 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Ustic

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum weathered from igneous bedrock
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 5
Available water capacity: Very low (about 1.7 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s

Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: True mountain mahogany, evergreen sumac, mimosa, other shrubs, perennial forbs, other trees, other perennial grasses, bullgrass, Texas bluestem, little bluestem, sideoats grama, cane bluestem, blue grama, Mexican pinyon, alligator juniper, gray oak

Typical Profile

A—0 to 5 inches; very gravelly loam
Bt—5 to 18 inches; very gravelly clay
R—18 to 28 inches; rhyolite bedrock

Description of Rock outcrop

Setting

Landscape: Mountains
Slope: 20 to 45 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Trachyte
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; trachyte bedrock

MCC—Mariscal very channery loam, 1 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,890 to 3,600 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Mariscal and similar soils: 70 percent
Dissimilar minor components: 30 percent
Minor components:
Unnamed, minor components soils—21 percent; not hydric
Blackgap soils—9 percent; not hydric

Description of Mariscal soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Flagstone Hill 8-14" PZ (R081DY295TX) (fig. 20)

Setting

Landscape: Dissected plateaus
Landform: Limestone hills and plateaus
Landform position (two-dimensional): Summit, shoulder, backslope
Slope: 1 to 8 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Low
Parent material: Residuum and colluvium weathered from limestone and shale

Figure 20.—Chino grama, candelilla, lechuguilla, sotol, and Gregg's coldenia on an area of Mariscal very channery loam, 1 to 8 percent slopes. This map unit is in the Flagstone Hill 8-14" PZ ecological site of MLRA 81D—Southern Edwards Plateau.

Depth to restrictive feature: 4 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate maximum: 70
Available water capacity: Very low (about 0.4 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Threeawn, gypsum grama, sideoats grama, Arizona cottontop, bush muhly, Chino grama, candelilla, lechuguilla, sotol, Gregg's coldenia, perennial forbs, perennial grasses, other shrubs, slim tridens, skeletonleaf goldeneye

Typical Profile

A and Ak—0 to 5 inches; extremely channery loam
Rk and R—5 to 15 inches; limestone bedrock interbedded with marl

MDE—Mariscal-Rock outcrop complex, 5 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,820 to 3,585 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Mariscal and similar soils: 45 percent
Rock outcrop: 40 percent
Dissimilar minor components: 15 percent
Minor components:
Blackgap soils—9 percent; not hydric
Unnamed, minor components soils—6 percent; not hydric

Description of Mariscal soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Flagstone Hill 8-14" PZ (R081DY295TX)

Setting

Landscape: Dissected plateaus
Landform: Hills
Landform position (two-dimensional): Backslope

Slope: 5 to 30 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium weathered from limestone and shale
Depth to restrictive feature: 4 to 19 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate maximum: 70
Available water capacity: Very low (about 0.4 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, slim tridens, threeawn, black grama, desert myrtlecroton, skeletonleaf goldeneye, guayacan, ceniza, feathery dalea, creosotebush, candelilla, other shrubs, perennial forbs, other perennial grasses

Typical Profile

A and Ak—0 to 5 inches; extremely channery loam
Rk and R—5 to 15 inches; limestone bedrock interbedded with marl

Description of Rock outcrop

Setting

Landscape: Dissected plateaus
Slope: 10 to 30 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Limestone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; limestone bedrock

MNE—Mariscal-Terlingua complex, 10 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,885 to 3,930 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Mariscal and similar soils: 45 percent
Terlingua and similar soils: 40 percent
Dissimilar minor components: 15 percent
Minor components:
  Blackgap soils—9 percent not hydric
  Studybutte soils—6 percent; not hydric

Description of Mariscal soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Flagstone Hill 8-14" PZ (R081DY295TX) (fig. 21)

Setting

Landscape: Dissected plateaus
Landform: Hills
Landform position (two-dimensional): Backslope
Slope: 10 to 30 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium weathered from limestone and shale
Depth to restrictive feature: 4 to 19 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline

Figure 21.—An area of Mariscal-Terlingua complex, 10 to 30 percent slopes. Chino grama, creosotebush, skeletonleaf goldeneye, pricklypear, and yucca are on this site. The Mariscal part of this map unit is in the Flagstone Hill 8-14" PZ ecological site of MLRA 81D—Southern Edwards Plateau. The Terlingua part is in the Basalt Hills ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate maximum: 70
Available water capacity: Very low (about 0.4 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, slim tridens, threeawn, black grama, desert myrtlecroton, skeletonleaf goldeneye, guayacan, ceniza, feathery dalea, creosotebush, candelilla, pricklypear, yucca, other shrubs, perennial forbs, other perennial grasses

Typical Profile

A and Ak—0 to 5 inches; extremely channery loam
Rk and R—5 to 15 inches; limestone bedrock interbedded with marl

Description of Terlingua soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Basalt Hill, Hot Desert Shrub (R042XG263TX)

Setting

Landscape: Dissected plateaus
Landform: Hills
Landform position (two-dimensional): Backslope
Slope: 10 to 30 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum weathered from basalt
Depth to restrictive feature: 4 to 12 inches to paralithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 20
Available water capacity: Very low (about 0.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Threeawn, gypsum grama, sideoats grama, Arizona cottontop, bush muhly, Chino grama, creosotebush, pricklypear, yucca, perennial forbs, perennial grasses, other shrubs, slim tridens, skeletonleaf goldeneye

Typical Profile

A—0 to 4 inches; very gravelly sandy loam
Bk—4 to 8 inches; very gravelly loam
Crk—8 to 16 inches; partially weathered igneous bedrock
R—16 to 26 inches; igneous bedrock

MSE—Musgrave silty clay, 1 to 20 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,020 to 3,575 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Musgrave and similar soils: 92 percent
Dissimilar minor components: 8 percent
Minor components:
Densic outcrop—4 percent; not hydric
Unnamed, minor components soils—4 percent; not hydric

Description of Musgrave soils

Classification

Soil taxonomic classification: Clayey, mixed, superactive, calcareous, hyperthermic, shallow Ustic Torriorthents
Ecological site name and identification: Clay Hill, Hot Desert Shrub (R042XG739TX) (fig. 22)

Setting

Landscape: Basins
Landform: Scarps and erosional uplands
Landform position (two-dimensional): Backslope
Slope: 1 to 20 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum weathered from tuff
Depth to restrictive feature: 4 to 20 inches to densic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Slightly saline (about 7.5 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 19.0
Calcium carbonate maximum: 18
Available water capacity: Low (about 3.0 inches)
Gypsum maximum: About 2 percent

Figure 22.—An area of Musgrave silty clay, 1 to 20 percent slopes. The Musgrave soils are on low hills and are sparsely vegetated. Musgrave soils are in the Clay Hill ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Tobosa, false grama, sideoats grama, creosotebush, western honey mesquite, leatherstem, guayacan, Menodora, lechuguilla, other shrubs, perennial forbs, other perennial grasses, Arizona cottontop, Chino grama

Typical Profile

A—0 to 6 inches; silty clay
Cy—6 to 19 inches; silty clay
Cdy—19 to 41 inches; weathered tuff that has silty clay texture

NNB—Ninepoint clay loam, 0 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,835 to 3,430 feet
Mean annual precipitation: 10 to 13 inches

Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Ninepoint and similar soils: 85 percent
Dissimilar minor components: 15 percent
Minor components:
Unnamed, minor components soils—11 percent; not hydric
Chillon soils—4 percent; not hydric

Description of Ninepoint soils

Classification

Soil taxonomic classification: Fine-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Ecological site name and identification: Loamy, Hot Desert Shrub (R042XG738TX)

Setting

Landscape: Basins
Landform: Alluvial flats (fig. 23)
Slope: 0 to 3 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very low
Parent material: Calcareous alluvium derived from limestone and mudstone
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline (about 0.7 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate maximum: 32
Available water capacity: Very high (about 15.1 inches)
Gypsum maximum: About 2 percent

Interpretive Groups

Land capability subclass (nonirrigated): 7c
Land capability subclass (irrigated): 3e
Hydric soil rating: No
Hydrologic soil group: C

Vegetation

Existing plants: Tobosa, alkali sacaton, pappusgrass, burrograss, plains bristlegrass, cane bluestem, fourwing saltbush, tarbush, western honey mesquite, catclaw acacia, creosotebush, other shrubs, perennial forbs, other annual forbs, other perennial grasses, vine mesquite

Figure 23.—Creostebush is the dominant vegetation on this area of Ninepoint clay loam, 0 to 3 percent slopes. Only a few mesquite and creosotebush plants can grow on this site. The Ninepoint soils are on alluvial flats, and are in the Loamy ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Typical Profile

A—0 to 4 inches; clay loam
Bw—4 to 80 inches; clay loam

NPB—Ninepoint complex, 1 to 3 percent slopes, pitted

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,795 to 2,945 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Ninepoint, flat and similar soils: 35 percent (fig. 24)
Ninepoint, pit and similar soils: 30 percent
Ninepoint, mound and similar soils: 20 percent
Dissimilar minor components: 15 percent
Minor components:
Unnamed, minor components soils—15 percent; not hydric

Figure 24.—An area of Ninepoint complex, 1 to 3 percent slopes, pitted. Pitting is a soil modification practice that was used in the past to catch and conserve precipitation onsite. The pitted areas are the slightly concave areas overflowing with vegetation. The mounded areas are the slightly elevated and sparsely vegetated areas behind the pitted areas in the middle of the photograph. The flat areas are the sparsely vegetated areas seen in the lower foreground and behind the pitted areas in the foreground.

Description of Ninepoint, flat soils

Classification

Soil taxonomic classification: Fine-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Ecological site name and identification: Loamy, Hot Desert Shrub (R042XG738TX)

Setting

Landscape: Basins
Landform: Alluvial flats
Slope: 0 to 2 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very low
Parent material: Calcareous alluvium derived from limestone and mudstone

Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 15.0
Calcium carbonate maximum: 10
Available water capacity: Very high (about 13.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 6e
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Other annual forbs, tarbush, western honey mesquite, tobosa, catclaw acacia, burrograss, plains bristlegrass, alkali sacaton, other shrubs, fourwing saltbush, pappusgrass, other perennial grasses, perennial forbs, cane bluestem

Typical Profile

A—0 to 2 inches; clay loam
Bk—2 to 20 inches; clay loam
Bw—20 to 80 inches; sandy clay loam

Description of Ninepoint, pit soils

Classification

Soil taxonomic classification: Fine-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Ecological site name and identification: Loamy, Hot Desert Shrub (R042XG738TX)

Setting

Landscape: Basins
Landform: Alluvial flats
Slope: 0 to 1 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very low
Parent material: Calcareous alluvium derived from limestone and mudstone
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)

Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 15.0
Calcium carbonate maximum: 10
Available water capacity: Very high (about 13.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 6e
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Tobosa, alkali sacaton, pappusgrass, burrograss, plains bristlegrass, cane bluestem, fourwing saltbush, tarbush, western honey mesquite, catclaw acacia, other shrubs, perennial forbs, other annual forbs, other perennial grasses

Typical Profile

A—0 to 2 inches; clay loam
Bw1—2 to 10 inches; clay loam
Bw2—10 to 80 inches; clay loam

Description of Ninepoint, mound soils

Classification

Soil taxonomic classification: Fine-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Ecological site name and identification: Loamy, Hot Desert Shrub (R042XG738TX)

Setting

Landscape: Basins
Landform: Alluvial flats
Slope: 1 to 3 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very low
Parent material: Calcareous alluvium derived from limestone and mudstone
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 15.0
Calcium carbonate maximum: 10
Available water capacity: Very high (about 13.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 6e
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Tobosa, alkali sacaton, pappusgrass, burrograss, plains bristlegrass, cane bluestem, fourwing saltbush, tarbush, western honey mesquite, catclaw acacia, other shrubs, perennial forbs, other annual forbs, other perennial grasses

Typical Profile

A—0 to 5 inches; clay loam
Bw1—5 to 39 inches; sandy clay loam
Bw2—39 to 80 inches; clay loam

PUF—Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains (fig. 25)
Elevation: 5,575 to 7,780 feet
Mean annual precipitation: 18 to 26 inches
Mean annual air temperature: 56 to 59 degrees F
Frost-free period: 160 to 200 days

Map Unit Composition

Puerta and similar soils: 50 percent
Madrone and similar soils: 35 percent
Lazarus and similar soils: 3 percent
Dissimilar minor components: 12 percent
Minor components:
Unnamed, minor components soils—12 percent; not hydric

Description of Puerta soils

Classification

Soil taxonomic classification: Clayey-skeletal, smectitic, mesic Alfic Lithic Argiustolls
Ecological site name and identification: Igneous Hill and Mountain, Mountain Savannah (R042XF286TX)

Setting

Landscape: Mountains
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Slope: 20 to 45 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Figure 25.—This area is Lazarus component, in an area of Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes map unit. The mountains in the far background are mapped Rock outcrop-Brewster complex, 20 to 70 percent slopes. Finestem needlegrass is the dominant grass in this Juniper Meadow. These meadows are composed of cool-season grasses. These meadows in the Chisos Mountains are unique within the Chihuahuan Desert. Pinyon and juniper are encroaching on the area.

Properties and Qualities

Runoff class: Very high
Parent material: Gravelly residuum weathered from igneous bedrock
Depth to restrictive feature: 11 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: High (about 7.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: No carbonates
Available water capacity: Very low (about 1.7 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Texas bluestem, little bluestem, sideoats grama, alligator juniper, bullgrass, true mountain mahogany, Mexican pinyon, perennial forbs, other perennial grasses, gray oak, other shrubs, other trees, cane bluestem, blue grama, evergreen sumac, mimosa

Typical Profile

A—0 to 4 inches; very gravelly silt loam
E—4 to 5 inches; very gravelly loam
Bt—5 to 19 inches; very gravelly clay
R—19 to 29 inches; rhyolite bedrock

Description of Madrone soils

Classification

Soil taxonomic classification: Clayey-skeletal, smectitic, mesic Typic Paleustalfs
Ecological site name and identification: Igneous Hill and Mountain, Mountain Savannah (R042XF286TX)

Setting

Landscape: Mountains
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Slope: 20 to 45 percent
Down-slope shape: Linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium weathered from igneous bedrock
Depth to restrictive feature: 21 to 40 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: No carbonates
Available water capacity: Very low (about 2.4 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Hydric soil rating: No
Hydrologic soil group: C

Vegetation

Existing plants: Bullgrass, Texas bluestem, little bluestem, sideoats grama, cane bluestem, blue grama, Mexican pinyon, alligator juniper, gray oak, true mountain mahogany, evergreen sumac, mimosa, other shrubs, perennial forbs, other trees, other perennial grasses

Typical Profile

A—0 to 4 inches; very gravelly loam
E—4 to 6 inches; very gravelly loam
Bt—6 to 32 inches; very gravelly clay
R—32 to 42 inches; rhyolite bedrock

Description of Lazarus soils

Classification

Soil taxonomic classification: Fine-loamy, mixed, superactive, mesic Pachic Argiustolls
Ecological site name and identification: Loamy (R70CY109NM)

Setting

Landscape: Mountains
Landform: Valley floors
Landform position (two-dimensional): Toeslope
Slope: 0 to 10 percent
Down-slope shape: Linear
Across-slope shape: Concave
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities

Runoff class: Medium
Parent material: Alluvium derived from limestone and dolomite
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Available water capacity: Very high (about 16.0 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 3c
Hydric soil rating: No
Hydrologic soil group: C

Vegetation

Existing plants: Western wheatgrass, blue grama, sideoats grama, finestem needlegrass, Texas needlegrass, little bluestem, other forbs, other perennial grasses

Typical Profile

A—0 to 13 inches; loam
Bt—13 to 80 inches; clay loam

RIA—Riverwash and Pantera soils, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,735 to 4,140 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Riverwash: 60 percent
Pantera and similar soils: 30 percent
Dissimilar minor components: 10 percent
Minor components:
Corazones soils—5 percent; not hydric
Tornillo soils—5 percent; not hydric

Description of Riverwash

Setting

Landscape: Intermontane basins
Landform: Flood plains (fig. 26)
Slope: 0 to 2 percent

Properties and Qualities

Runoff class: Negligible
Parent material: Sandy and gravelly alluvium derived from mixed sources
Depth to restrictive feature: None within 60 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Excessively drained
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: No carbonates

Interpretive Groups

Land capability subclass (nonirrigated): 8w
Hydric soil rating: No

Description of Pantera soils

Classification

Soil taxonomic classification: Sandy-skeletal, mixed, hyperthermic Ustic Torrifluvents
Ecological site name and identification: Arroyo, Hot Desert Shrub (R042XG736TX)

Setting

Landscape: Intermontane basins
Landform: Flood plains (fig. 27)
Slope: 0 to 2 percent
Down-slope shape: Linear
Across-slope shape: Concave

Figure 26.—In an area of Riverwash and Pantera soils, 0 to 2 percent slopes, frequently flooded. Riverwash in the foreground, is devoid of permanent vegetation because of frequent scour by floodwaters. In the background, saltcedar has established on an area of Pantera soil. Pantera soils are in the Arroyo ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Saltcedar leaves turn a brilliant yellow color after the first fall freeze, and is quite visible on aerial photography flown at that time.

Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Negligible
Parent material: Sandy and gravelly alluvium derived from mixed sources
Depth to restrictive feature: None within 60 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 5
Available water capacity: Low (about 4.8 inches)
Gypsum maximum: None

Figure 27.—Desert willow in an area of Riverwash and Pantera soils, 0 to 2 percent slopes, frequently flooded. The dark-colored mineral on the arroyo channel is magnetite, derived from igneous rocks and transported by flowing water. Because magnetite has a particle density greater than 5.0 g/cm3, it quickly falls from suspension as flow velocity decreases.

Interpretive Groups

Land capability subclass (nonirrigated): 7w
Hydric soil rating: No
Hydrologic soil group: A

Vegetation

Existing plants: Western honey mesquite, desert willow, creosotebush, catclaw acacia, elbowbush, spiny hackberry, Trans-Pecos poreleaf, leatherstem, baccharis, sideoats grama, tanglehead, cane bluestem, black grama, sand dropseed, Chino grama, saltcedar, other perennial grasses, perennial forbs, other shrubs

Typical Profile

A—0 to 10 inches; gravelly sand
C—10 to 80 inches; very gravelly loamy sand

RKG—Rock outcrop-Brewster complex, 20 to 70 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 4,120 to 7,480 feet
Mean annual precipitation: 14 to 20 inches

Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Rock outcrop: 60 percent
Brewster and similar soils: 30 percent
Dissimilar minor components: 10 percent
Minor components:
Unnamed, minor components soils—7 percent; not hydric
Rubble land—3 percent; not hydric

Description of Rock outcrop

Setting

Landscape: Mountains
Slope: 30 to 70 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Trachyte
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; trachyte bedrock

Description of Brewster soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, thermic Aridic Lithic Haplustolls
Ecological site name and identification: Igneous Hill and Mountain, Mixed Prairie (R042XE277TX)

Setting

Landscape: Mountains
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Mountainflank
Slope: 20 to 45 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Ustic

Properties and Qualities

Runoff class: High
Parent material: Colluvium and residuum weathered from igneous bedrock
Depth to restrictive feature: 4 to 20 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: 5
Available water capacity: Very low (about 0.4 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Gray oak, redberry juniper, other trees, Texas bluestem, New Mexico bluestem, cane bluestem, sideoats grama, black grama, blue grama, feathery dalea, plains lovegrass, tanglehead, range ratany, green sprangletop, perennial forbs, other perennial grasses, other shrubs

Typical Profile

A—0 to 4 inches; very gravelly loam
R—4 to 14 inches; rhyolite bedrock

RTE—Rock outcrop-Terlingua complex, 10 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,965 to 3,485 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Rock outcrop: 50 percent
Terlingua and similar soils: 40 percent
Dissimilar minor components: 10 percent
Minor components:
Unnamed, minor components soils—10 percent; not hydric

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 10 to 30 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Basalt
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; basalt bedrock

Description of Terlingua soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Basalt Hill, Hot Desert Shrub (R042XG263TX)

Setting

Landscape: Hills
Landform: Igneous hills and mountains
Landform position (two-dimensional): Backslope
Slope: 10 to 30 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum weathered from basalt
Depth to restrictive feature: 4 to 16 inches to paralithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 0.4 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 20
Available water capacity: Very low (about 0.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Lechuguilla, Chino grama, fluffgrass, range ratany, plains blackfoot, tanglehead, other perennial forbs, other shrubs, slim tridens, leatherstem, spiderling, sideoats grama, other perennial grasses, creosotebush, whitethorn acacia

Typical Profile

A—0 to 4 inches; very gravelly sandy loam
Bk—4 to 8 inches; very gravelly loam
Crk—8 to 16 inches; partially weathered igneous bedrock
R—16 to 26 inches; igneous bedrock

RTG—Rock outcrop-Terlingua complex, 20 to 70 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,085 to 3,345 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Rock outcrop: 65 percent
Terlingua and similar soils: 25 percent
Dissimilar minor components: 10 percent
Minor components:
Unnamed, minor components soils—10 percent; not hydric

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 20 to 70 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Basalt
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; basalt bedrock

Description of Terlingua soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Igneous Hill and Mountain, Hot Desert Shrub (R042XG264TX) (fig. 28)

Setting

Landscape: Hills
Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope
Slope: 20 to 60 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Figure 28.—Very sparse vegetation cover on the Terlingua soils In an area of Rock outcrop-Terlingua complex, 20 to 70 percent slopes. The dark color of surface fragments and exposed basalt bedrock absorb solar radiation, which results in very hot soil temperatures during the summer. Terlingua soils are in the Igneous Hill and Mountain ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Properties and Qualities

Runoff class: Very high
Parent material: Colluvium and residuum weathered from basalt
Depth to restrictive feature: 4 to 16 inches to paralithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 0.4 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 20
Available water capacity: Very low (about 0.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, tanglehead, sideoats grama, slim tridens, fluffgrass, lechuguilla, leatherstem, creosotebush, range ratany, whitethorn acacia, spiderling, plains blackfoot, other shrubs, other perennial forbs, other perennial grasses

Typical Profile

A—0 to 4 inches; very gravelly sandy loam
Bk—4 to 8 inches; very gravelly loam
Crk—8 to 16 inches; partially weathered igneous bedrock
R—16 to 26 inches; igneous bedrock

SKE—Solis-Rock outcrop complex, 1 to 20 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,850 to 3,755 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Solis and similar soils: 45 percent
Rock outcrop: 35 percent
Dissimilar minor components: 20 percent
Minor components:
Geefour soils—9 percent; not hydric
Unnamed, minor components soils—6 percent; not hydric
Corazones soils—5 percent; not hydric

Description of Solis soils

Classification

Soil taxonomic classification: Loamy, mixed, superactive, calcareous, hyperthermic, shallow Ustic Torriorthents
Ecological site name and identification: Sandstone Hill and Mountain, Hot Desert Shrub (R042XG586TX)

Setting

Landscape: Hills
Landform: Erosion remnants (fig. 29)
Slope: 1 to 16 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Medium
Parent material: Residuum weathered from soft sandstone
Depth to restrictive feature: 4 to 20 inches to paralithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 15
Available water capacity: Very low (about 0.5 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Lechuguilla, ephedra, range ratany, other annual forbs, whitethorn acacia, threeawn, sideoats grama, black grama, feathery dalea, fluffgrass, ocotillo, creosotebush, perennial forbs, perennial grasses, western honey mesquite, dropseed, other shrubs, Chino grama

Typical Profile

A—0 to 6 inches; fine sandy loam
Cr—6 to 28 inches; platy sandstone bedrock
2Cd—28 to 38 inches; mudstone

Figure 29.—Sandstone of the Tertiary age Hannold Hill Formation crops out in an area of Solis-Rock outcrop complex, 1 to 20 percent slopes. Chino grama and scattered lechuguilla, ephedra, and range ratany grow in areas of shallow Solis soils between areas of rock outcrop. These areas are on hills. The Solis soils are in the Sandstone Hill and Mountain ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 3 to 20 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Sandstone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; sandstone bedrock

SKG—Solis-Rock outcrop complex, 20 to 60 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,860 to 4,055 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Solis and similar soils: 50 percent
Rock outcrop: 40 percent
Dissimilar minor components: 10 percent
Minor components:
Unnamed, minor components soils—10 percent; not hydric

Description of Solis soils

Classification

Soil taxonomic classification: Loamy, mixed, superactive, calcareous, hyperthermic, shallow Ustic Torriorthents
Ecological site name and identification: Sandstone Hill and Mountain, Hot Desert Shrub (R042XG586TX)

Setting

Landscape: Hills
Landform: Scarps (fig. 30)
Slope: 20 to 45 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Medium
Parent material: Residuum weathered from soft sandstone
Depth to restrictive feature: 4 to 20 inches to paralithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline (about 1.0 dS/m)
Sodicity maximum: Not sodic
Calcium carbonate maximum: 15
Available water capacity: Very low (about 0.6 inches)
Gypsum maximum: None

Figure 30.—Fluffgrass, tubercled saltbush, whitethorn acacia, ocotillo growing on a scarp of Solis-Rock outcrop complex, 20 to 60 percent slopes. This map unit is in the Sandstone Hill and Mountain ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, dropseed, black grama, sideoats grama, threeawn, fluffgrass, feathery dalea, ocotillo, creosotebush, whitethorn acacia, western honey mesquite, tubercled, saltbush, perennial grasses, perennial forbs, other shrubs, other annual forbs

Typical Profile

A—0 to 6 inches; fine sandy loam
Cr—6 to 28 inches; platy sandstone bedrock
2Cd—28 to 38 inches; mudstone

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 20 to 60 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Sandstone
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; sandstone bedrock

STC—Strawhouse-Stillwell complex, 1 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,725 to 3,730 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Strawhouse and similar soils: 60 percent
Stillwell and similar soils: 25 percent
Dissimilar minor components: 15 percent
Minor components:
- Unnamed, minor components soils—10 percent; not hydric
- Geefour soils—5 percent; not hydric

Description of Strawhouse soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic, shallow Calcic Petrocalcids
Ecological site name and identification: Gravelly 8-14" PZ (R081DY297TX)

Setting

Landscape: Piedmont slopes
Landform: Fan remnants
Slope: 1 to 3 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Gravelly alluvium and pedisediment derived from limestone
Depth to restrictive feature: 4 to 20 inches to petrocalcic
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Slightly saline (about 5.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 8
Calcium carbonate maximum: 58
Available water capacity: Very low (about 1.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, black grama, bush muhly, feather pappusgrass, fluffgrass, threeawn, creosotebush, ocotillo, leatherstem, range ratany, Gregg's coldenia, skeletonleaf goldeneye, perennial forbs, other perennial grasses, candelilla, slim tridens, fall witchgrass, mariola, ceniza, other shrubs

Typical Profile

Ak—0 to 5 inches; very gravelly loam
Bk—5 to 15 inches; very gravelly loam
Bkkm—15 to 19 inches; cemented material
CBk—19 to 80 inches; very gravelly loam

Description of Stillwell soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Sodic Ustic Haplocalcids
Ecological site name and identification: Gravelly 8-14" PZ (R081DY297TX)

Setting

Landscape: Piedmont slopes
Landform: Fan remnants
Slope: 1 to 8 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Medium
Parent material: Gravelly alluvium derived from limestone
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Slightly saline (about 5.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 28.0
Calcium carbonate maximum: 70
Available water capacity: Low (about 3.2 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: A

Vegetation

Existing plants: Chino grama, black grama, bush muhly, feather pappusgrass, slim tridens, threeawn, fall witchgrass, fluffgrass, creosotebush, mariola, ceniza, skeletonleaf goldeneye, candelilla, ocotillo, leatherstem, Gregg's coldenia, range ratany, other shrubs, other perennial grasses, perennial forbs

Typical Profile

A—0 to 3 inches; very gravelly sandy loam
Bk—3 to 30 inches; very gravelly sandy loam
2BCk—30 to 80 inches; extremely gravelly coarse sandy loam

STE—Strawhouse-Stillwell complex, 1 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 81D—Southern Edwards Plateau
Elevation: 1,705 to 3,335 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Strawhouse and similar soils: 45 percent
Stillwell and similar soils: 40 percent
Dissimilar minor components: 15 percent
Minor components:
Unnamed, minor components soils—10 percent; not hydric
Geefour soils—5 percent; not hydric

Description of Strawhouse soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic, shallow Calcic Petrocalcids
Ecological site name and identification: Gravelly 8-14" PZ (R081DY297TX)

Setting

Landscape: Piedmont slopes
Landform: Fan remnants
Slope: 1 to 8 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Gravelly alluvium and pedisediment derived from limestone
Depth to restrictive feature: 4 to 20 inches to petrocalcic
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Slightly saline (about 5.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 8
Calcium carbonate maximum: 58
Available water capacity: Very low (about 1.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7e
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, black grama, bush muhly, feather pappusgrass, slim tridens, threeawn, fall witchgrass, fluffgrass, creosotebush, mariola, ceniza, skeletonleaf goldeneye, candelilla, ocotillo, leatherstem, Gregg's coldenia, range ratany, other shrubs, other perennial grasses, perennial forbs

Typical Profile

Ak—0 to 5 inches; very gravelly loam
Bk—5 to 15 inches; very gravelly loam
Bkkm—15 to 19 inches; cemented material
CBk—19 to 80 inches; very gravelly loam

Description of Stillwell soils

Classification

Soil taxonomic classification: Loamy-skeletal, carbonatic, hyperthermic Sodic Ustic Haplocalcids
Ecological site name and identification: Gravelly 8-14" PZ (R081DY297TX)

Setting

Landscape: Piedmont slopes
Landform: Fan remnants
Landform position (two-dimensional): Backslope
Slope: 1 to 30 percent
Down-slope shape: Convex, linear
Across-slope shape: Convex
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Medium
Parent material: Gravelly alluvium derived from limestone
Depth to restrictive feature: None within 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Slightly saline (about 5.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 28.0
Calcium carbonate maximum: 70
Available water capacity: Low (about 3.2 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: A

Vegetation

Existing plants: Chino grama, black grama, bush muhly, feather pappusgrass, slim tridens, threeawn, fall witchgrass, fluffgrass, creosotebush, mariola, ceniza, skeletonleaf goldeneye, candelilla, ocotillo, leatherstem, Gregg's coldenia, range ratany, other shrubs, other perennial grasses, perennial forbs

Typical Profile

A—0 to 3 inches; very gravelly sandy loam
Bk—3 to 30 inches; very gravelly sandy loam
2BCk—30 to 80 inches; extremely gravelly coarse sandy loam

SUE—Studybutte-Rock outcrop complex, 10 to 30 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,260 to 3,910 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Studybutte and similar soils: 60 percent
Rock outcrop: 20 percent
Dissimilar minor components: 20 percent
Minor components:
Unnamed, minor components soils—18 percent; not hydric
Geefour soils—2 percent; not hydric

Description of Studybutte soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, nonacid, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Igneous Hill and Mountain, Hot Desert Shrub (R042XG264TX)

Setting

Landscape: Hills
Landform: Hillslopes (fig. 31)
Landform position (two-dimensional): Backslope
Slope: 10 to 30 percent
Down-slope shape: Linear
Across-slope shape: Linear

Figure 31.—Ocotillo, creosotebush, and Chino grama on an area of Studybutte-Rock outcrop complex, 10 to 30 percent slopes. The Studybutte soils are shallow to trachyte bedrock, which is exposed in the background. Ocotillo is drought deciduous, meaning it drops its leaves during drought. Some of the ocotillo plants in this photograph have new green leaves, which suggest a recent rainfall. The Studybutte soils are in the Igneous Hill and Mountain ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium weathered from siliceous igneous bedrock
Depth to restrictive feature: 4 to 19 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: 1
Available water capacity: Very low (about 0.5 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Other annual forbs, leatherstem, Chino grama, sideoats grama, black grama, slim tridens, feathery dalea, Arizona cottontop, tanglehead, range ratany, ceniza, perennial forbs, other shrubs, skeletonleaf goldeneye, ocotillo, creosotebush

Typical Profile

A—0 to 6 inches; very gravelly loam
R—6 to 16 inches; igneous bedrock

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 10 to 30 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Trachyte and/or rhyolite
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; igneous bedrock

SUG—Studybutte-Rock outcrop complex, 20 to 60 percent slopes

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 2,270 to 4,815 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Studybutte and similar soils: 55 percent
Rock outcrop: 30 percent
Dissimilar minor components: 15 percent
Minor components:
Unnamed, minor components soils—13 percent; not hydric
Geefour soils—2 percent; not hydric

Description of Studybutte soils

Classification

Soil taxonomic classification: Loamy-skeletal, mixed, superactive, nonacid, hyperthermic Lithic Ustic Torriorthents
Ecological site name and identification: Igneous Hill and Mountain, Hot Desert Shrub (R042XG264TX)

Setting

Landscape: Hills
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Slope: 20 to 45 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very high
Parent material: Residuum and colluvium weathered from siliceous igneous bedrock
Depth to restrictive feature: 4 to 19 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: 1
Available water capacity: Very low (about 0.5 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Hydric soil rating: No
Hydrologic soil group: D

Vegetation

Existing plants: Chino grama, black grama, sideoats grama, slim tridens, feathery dalea, Arizona cottontop, tanglehead, range ratany, ceniza, leatherstem, skeletonleaf goldeneye, perennial forbs, other shrubs, other annual forbs

Typical Profile

A—0 to 6 inches; very gravelly loam
R—6 to 16 inches; igneous bedrock

Description of Rock outcrop

Setting

Landscape: Hills
Slope: 20 to 60 percent
Representative aspect: North

Properties and Qualities

Runoff class: Very high
Parent material: Rhyolite and/or trachyte
Depth to restrictive feature: 0 inches to lithic bedrock
Frequency of flooding: None
Frequency of ponding: None
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate maximum: No carbonates

Interpretive Groups

Hydric soil rating: No

Typical Profile

R—0 to 10 inches; igneous bedrock

TOA—Tornillo loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,905 to 3,195 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Tornillo and similar soils: 80 percent (fig. 32)
Dissimilar minor components: 20 percent
Minor components:
Pantera soils—9 percent; not hydric
Unnamed, minor components soils—11 percent; not hydric

Description of Tornillo soils

Classification

Soil taxonomic classification: Fine-loamy, mixed, superactive, hyperthermic Ustifluventic Haplocambids
Ecological site name and identification: Loamy, Hot Desert Shrub (R042XG738TX)

Setting

Landscape: Basins
Landform: Alluvial flats
Slope: 0 to 2 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast

Figure 32.—An area of Tornillo loam, 0 to 2 percent slopes, occasionally flooded. Tornillo soils are on alluvial flats and very susceptible to water erosion. Tornillo soils are in the Loamy ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. The background is the Rosillos Mountains, located in the northern area of Big Bend National Park.

Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Very low
Parent material: Calcareous loamy alluvium
Depth to restrictive feature: None within 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 15.0
Calcium carbonate maximum: 10
Available water capacity: Very high (about 13.6 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 6e
Hydric soil rating: No
Hydrologic soil group: B

Vegetation

Existing plants: Tobosa, alkali sacaton, pappusgrass, burrograss, plains bristlegrass, cane bluestem, fourwing saltbush, tarbush, western honey mesquite, catclaw acacia, other shrubs, perennial forbs, other annual forbs, other perennial grasses

Typical Profile

A—0 to 19 inches; loam
Bw1—19 to 26 inches; stratified gravelly sandy loam
Bw2—26 to 80 inches; stratified loam

VCA—Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded

Map Unit Setting

Major land resource area (MLRA): MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,710 to 2,315 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Map Unit Composition

Vicente and similar soils: 40 percent
Lomapelona and similar soils: 30 percent
Castolon and similar soils: 25 percent
Dissimilar minor components: 5 percent
Minor components:
Water—3 percent
Unnamed, minor components soils—1 percent; not hydric
Unnamed, hydric minor components soils—1 percent; Landform: Proximal to channel flood plains; Geomorphic position (three-dimensional): Tread; Down-slope shape: Concave; Across-slope shape: Concave; Hydric soil rating: Yes

Description of Vicente soils

Classification

Soil taxonomic classification: Coarse-silty, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Ecological site name and identification: Loamy Bottomland, Hot Desert Shrub (R042XG733TX) (fig. 33)

Setting

Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Tread
Slope: 0 to 1 percent
Down-slope shape: Linear

Figure 33.—An area of Vicente, Lomapelona and Castolon soils, 0 to 1 percent slopes, flooded. The left side of the photograph is Mexico. Santa Elena Canyon is in the background. This map unit is in the Loamy Bottomland ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains

Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Negligible
Parent material: Stratified loamy alluvium
Depth to restrictive feature: None within 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 3.0
Calcium carbonate maximum: 13
Available water capacity: Very high (about 12.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7w
Land capability subclass (irrigated): 2w

Hydric soil rating: No
Hydrologic soil group: C

Vegetation

Existing plants: Alkali sacaton, cane bluestem, bristlegrass, western honey mesquite, cottonwood, spiny hackberry, fourwing saltbush, catclaw acacia, other trees, pink pappusgrass, vine mesquite, perennial forbs, other perennial grasses, giant sacaton, other shrubs

Typical Profile

A1—0 to 2 inches; silty clay loam
A2—2 to 10 inches; very fine sandy loam
C1—10 to 60 inches; very fine sandy loam
C2—60 to 80 inches; loam

Description of Lomapelona soils

Classification

Soil taxonomic classification: Coarse-loamy, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Ecological site name and identification: Loamy Bottomland, Hot Desert Shrub (R042XG733TX)

Setting

Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Tread
Slope: 0 to 1 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Low
Parent material: Stratified loamy alluvium
Depth to restrictive feature: None within 60 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate maximum: 5
Available water capacity: Very high (about 14.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7w
Land capability subclass (irrigated): 2w

Hydric soil rating: No
Hydrologic soil group: C

Vegetation

Existing plants: Giant sacaton, alkali sacaton, cane bluestem, vine mesquite, bristlegrass, pink pappusgrass, spiny hackberry, fourwing saltbush, catclaw acacia, cottonwood, western honey mesquite, perennial forbs, other perennial grasses, other trees, other shrubs

Typical Profile

A—0 to 8 inches; fine sandy loam
C1—8 to 42 inches; fine sandy loam
C2—42 to 60 inches; loam
C3—60 to 80 inches; sand

Description of Castolon soils

Classification

Soil taxonomic classification: Fine-silty, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Ecological site name and identification: Loamy Bottomland, Hot Desert Shrub (R042XG733TX)

Setting

Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Tread
Slope: 0 to 1 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Hyperthermic
Soil temperature regime: Hyperthermic
Soil moisture class: Aridic (torric)

Properties and Qualities

Runoff class: Low
Parent material: Stratified loamy alluvium
Depth to restrictive feature: None within 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Very slightly saline (about 2.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 3.0
Calcium carbonate maximum: 13
Available water capacity: Very high (about 12.9 inches)
Gypsum maximum: None

Interpretive Groups

Land capability subclass (nonirrigated): 7w
Land capability subclass (irrigated): 2w

Hydric soil rating: No
Hydrologic soil group: C

Vegetation

Existing plants: Giant sacaton, alkali sacaton, cane bluestem, vine mesquite, bristlegrass, pink pappusgrass, spiny hackberry, fourwing saltbush, catclaw acacia, cottonwood, western honey mesquite, perennial forbs, other perennial grasses, other trees, other shrubs

Typical Profile

A—0 to 9 inches; silty clay loam
C1—9 to 35 inches; silt loam
C2—35 to 80 inches; loam

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

There are no areas in Big Bend National Park that meet the soil requirements for prime farmland.

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. In addition, it can help to prevent 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 behavioral 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 rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational 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.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Land Capability Classification

Land capability classification in Table 11 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 criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include 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, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. (USDA, 1961)

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to Pasture and rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to Pasture and rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the 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 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture and rangeland, forestland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

Land Management

In Table 12, Table 13, Table 14, and Table 15, interpretive ratings are given for various aspects of land management and forestland management. The ratings are both descriptive and numerical.

Some rating class terms indicate the degree to which the soils are suited to a specified aspect of forestland management. *Well suited* indicates that the soil has features that are favorable for the specified management aspect and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified management aspect. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified management aspect. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. *Unsuited* indicates that the expected performance of the soil is unacceptable for the specified management aspect or that extreme measures are needed to overcome the undesirable soil properties.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified aspect of forestland management (1.00) and the point at which the soil feature is not a limitation (0.00).

Ratings in the columns *suitability for hand planting* and *suitability for mechanical planting* are based on slope, depth to a restrictive layer, content of sand, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as *well suited, moderately suited, poorly suited*, or *unsuited* to these methods of planting. It is assumed that necessary site preparation is completed before seedlings are planted.

Ratings in the column *soil rutting with equipment use* are based on depth to a water table, rock fragments on or below the surface, the Unified classification, depth to a restrictive layer, and slope. Ruts form as a result of the operation of forestland equipment. The hazard is described as *slight, moderate*, or *severe*. A rating of *slight* indicates that the soil is subject to little or no rutting, *moderate* indicates that rutting is likely, and *severe* indicates that ruts form readily.

Ratings in the column *hazard of erosion* are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The hazard is described as *slight*, *moderate*, *severe*, or *very severe*. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column *hazard of erosion on roads and trails* are based on the soil erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as *slight*, *moderate*, or *severe*. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column *suitability for roads (natural surface*) are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as *well suited*, *moderately suited*, or *poorly suited* to this use.

Ratings in the column *suitability for mechanical site preparation (deep)* are based on slope, depth to a restrictive layer, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as *well suited*, *poorly suited*, or *unsuited* to this management activity. The part of the soil from the surface to a depth of about 3 feet is considered in the ratings.

Ratings in the column *suitability for mechanical site preparation (surface)* are based on slope, depth to a restrictive layer, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as *well suited*, *poorly suited*, or *unsuited* to this management activity. The part of the soil from the surface to a depth of about 1 foot is considered in the ratings.

Ratings in the column *potential for damage to soil by fire* are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a *low*, *moderate*, or *high* potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

Ratings in the column *potential for seedling mortality* are based on flooding, ponding, depth to a water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. The soils are described as having a *low*, *moderate*, or *high* potential for seedling mortality.

Rangeland

Michael Margo, USDA-NRCS, Rangeland Management Specialist, prepared this section

Rangelands are a broad category of land that is characterized by native plant communities, which are often associated with grazing, and are managed by ecological, rather than agronomic methods. Rangeland resources are not limited to grazeable forage, but also provide wildlife habitat, water production, aesthetic value, and recreational use. At Big Bend National Park, the entire land area is classified as rangeland.

The composition and production of the natural plant community is determined mainly by soil, climate, and topography. Soils vary in their capability to produce grasses and other plants suitable for grazing. Soils that produce similar kinds and amounts of forage are grouped into an ecological site. An ecological site for rangeland is a distinctive kind of land with specific physical characteristics that makes it different from other kinds of land in its ability to produce a distinctive kind and amount of vegetation (a characteristic plant community). A total of nineteen ecological sites occur at Big Bend National Park. Ecological sites may consist of one or more soil series and can be determined directly either from the soil map or ecological site key. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of plants. Soil reaction, salt content, and a seasonal high water table are also important. The electronic "Field Office Technical Guide, (eFOTG)" which is available online at http://www.nrcs.usda.gov/technical/efotg, can provide specific information about ecological sites.

Over historical time, the combination of plants best suited to a particular soil and climate became dominant. If the soil is not excessively disturbed, this group of plants is the historic climax plant community for the site. Historic climax plant communities are not static but vary slightly from year to year and place to place.

Nearly all plant communities have undergone changes over time. Many years of improper grazing management, the absence of fire, the increase and/or invasion of certain plants, and climatic events, such as major droughts, have all interacted to affect changes in the vegetation on rangeland.

Abnormal disturbances that change the historic climax plant community include repeated overuse by livestock, excessive burning, erosion, and plowing. Grazing animals select the most palatable plants. These plants will eventually die if they are continually grazed at a severity that does not allow for recovery. Usually, these degradation processes (also called retrogression) take place over many years. If the plant community and soils have not degraded significantly, high quality native plants may return, with proper grazing management.

The Natural Resources Conservation Service and other agencies assist landowners in identifying problems and concerns, as well as opportunities to maintain or improve their rangeland resources. A rangeland ecological site may be evaluated by three distinct methods: similarity index, rangeland trend, and rangeland health.

A similarity index is a comparison of the present plant community to the historic climax plant community. A similarity index is the percentage, by weight, of historic climax vegetation that is found in the present plant community. This index provides an indication of past disturbance as well as potential for improvement.

Rangeland trend determinations assess the direction of change occurring in the present plant community compared to the historic climax plant community. The plant community may be either moving toward or away from the historic climax plant community. This rating provides information to landowners regarding the direction of change in plant community in response to present management.

Rangeland health is a determination of how the ecological processes on a rangeland ecological site are functioning. Ecological processes evaluated include water cycle, nutrient cycle, and energy flow.

How rangeland is managed affects forage production, species composition, plant health, and the ability of the vegetation to protect the soil. Rangeland management requires knowledge of the kinds of soil and of the historic climax plant community. Effective range management conserves rainfall, enhances water quality, reduces the hazard of downstream flooding, improves yields, provides forage for livestock and wildlife, enhances recreational opportunities, and protects the soil.

Knowledge of the ecological site is necessary as a basis for planning and applying the management needed to maintain or improve the desired plant community for selected uses. Such information is needed to support management objectives, determine suitable wildlife management practices, evaluate the potential for recreational uses, and determine the condition of watersheds.

Big Bend National Park occurs in two Major Land Resource Areas: MLRA 42—Southern Desertic Basins, Plains, and Mountains and MLRA 81D—Southern Edwards Plateau. The ecological sites in the MLRA 42 part of the survey are grouped into four vegetative zones: Hot Desert Shrub, Desert Grassland (fig. 34), Mixed Prairie, and Mountain Savannah. The ecological sites in MLRA 81D are in the 8-14" PZ climate zone.

Growth of native vegetation is quite variable because of large variations in annual and seasonal rainfall. Droughts are very common. Low, inconsistent rainfall combined with high evaporation rates cause a depletion in soil moisture with a corresponding decrease in forage production. Management should be flexible and closely correlated to plant growth curves and to fluctuations in seasonal and annual forage production.

A typical growth curve for native vegetation representing the percentage of total growth occurring each month for the Hot Desert Shrub vegetative zone would be:

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	0	0	5	5	10	15	25	25	10	5	0

Figure 34.—An area of Corazones very gravelly sandy loam, 1 to 8 percent slopes, in the foreground. Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes is mapped on Todd Hill, which is the skyline along the left edge of the picture. Corazones soils are assigned to the Gravelly ecological site, Hot Desert Shrub vegetative zone, and occur at elevations less than 3,500 feet. Chilicotal soils are in the Gravelly ecological site, Desert Grassland vegetative zone, and occur between 3,500 and 4,500 feet elevation. The Chisos Mountains dominate the skyline to the right. The highest mountains are mapped Rock-outcrop-Brewster complex, 20 to 70 percent slopes, and the lower foothills are mapped Lingua-Rock outcrop complex, 20 to 60 percent slopes.

A typical growth curve for native vegetation representing the percentage of total growth occurring each month for the Desert Grassland vegetative zone would be:

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	0	5	5	10	25	15	15	20	5	0	0

A typical growth curve for native vegetation representing the percentage of total growth occurring each month for the Mixed Prairie vegetative zone would be:

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	0	5	5	5	15	15	20	20	10	5	0

These growth curves show that in MLRA 42, depending on the vegetative zone, approximately 70 to 90 percent of the annual production of forage occurs in the months of June through September responding to summer rains.

A typical growth curve for native vegetation representing the percentage of total growth occurring each month for MLRA 81D would be:

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2	3	7	20	30	15	5	10	4	2	1

Table 16 shows, for each soil that supports rangeland vegetation, the ecological site and the total dry-weight production of vegetation in favorable, normal, and unfavorable years. An ecological site and the assigned vegetative or climate zone are indicated for each soil.

An *ecological site* is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristics hydrology, particularly infilitration and runoff that has developed over time, and a characteristic plant community (kind and amount of vegetation). The hydrology of the site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service.

Total dry-weight 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.

The total dry-weight production 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. Yields are adjusted to a percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as stage of maturity, exposure, amount of shade, recent rains, and unseasonable dry periods.

Ecological Sites

Table 17 shows ecological sites and soil correlation and Table 18 shows the landscape, parent material, and ecological site ID.

The following paragraphs are general descriptions for the vegetative zone or climate zone followed by a description of each ecological site within that zone. The composition of the characteristic vegetation is given for each site. The complete list of plants in the historical climax community can be found in the ecological site descriptions. A brief description of what happens to the plant community under retrogression is provided.

MLRA 81D—Southern Edwards Plateau

The Southern Edwards Plateau land resource area is located in the eastern part of the survey area along the Rio Grande. The climate and soils support a sparse stand of grasses and shrubs.

The climax vegetation is mainly drought tolerant grasses and shrubs. The dominant perennials include Chino grama, black grama, sideoats grama, cane bluestem, bush muhly, perennial threeawn, skeletonleaf goldeneye, and fourwing saltbush. Much of this resource area is now dominated by woody species such as mesquite, creosotebush, tarbush, and lechuguilla.

Flagstone Hill 8-14" PZ Ecological Site

This site includes soil mapping units; MCC—Mariscal very channery loam, 1 to 8 percent slopes; the Mariscal part of MDE—Mariscal-Rock outcrop complex, 5 to 30 percent slopes (fig. 35); and the Mariscal part of MNE—Mariscal-Terlingua complex, 10 to 30 percent slopes.

This site consists of shallow soils formed in residuum and colluvium weathered from flaggy limestone. Slopes range from 1 to 30 percent. The climax vegetation consists of drought tolerant bunchgrasses, intermixed with occasional woody shrubs and forbs.

The characteristic vegetation consists of approximately 40 percent Chino grama; 20 percent slim tridens and perennial threeawns; 10 percent black grama and bush muhly; 10 percent other perennial grasses; 8 percent desert myrtlecroton, skeletonleaf goldeneye, guayacan, and cenizo; 3 percent feather dalea, candelilla, and creosotebush; 4 percent other shrubs; and 5 percent forbs.

Figure 35.—Mariscal soils form in residuum weathered from flaggy limestone of the Cretaceous age Boquillas Formation. The Flagstone Hills ecological site of MLRA 81D—Southern Edwards Plateau supports creosotebush, feather dalea, and Chino grama. Mariscal soils are more droughty than Blackgap soils because of slower water movement through and around flags and channers, reducing the effective water storage.

Under continuous heavy grazing species such as fluffgrass, creosotebush, whitethorn acacia, dogweed, and lechuguilla increase while black grama, menodora, and other palatable plants decrease. Chino grama initially increases and as retrogression continues it begins to decrease and bare ground increases. Because of low rainfall, extremely high summer soil temperatures, and droughty soils, recovery of depleted ranges are extremely slow.

Gravelly 8-14" PZ Ecological Site

This group includes soil mapping units; STC—Strawhouse-Stillwell complex, 1 to 8 percent slopes (fig. 36); and STE—Strawhouse-Stillwell complex, 1 to 30 percent slopes.

The site consists of very shallow to very deep soils that formed in gravelly alluvium derived from limestone bedrock. Slopes range from 1 to 30 percent. The historic climax plant community consists of predominantly drought tolerant mid and shortgrasses with frequent woody shrubs and occasional forbs.

The characteristic vegetation consists of approximately 30 percent chino grama; 10 percent black grama; 5 percent bush muhly; 15 percent perennial threeawns, slim tridens, and fall witchgrass; 5 percent feather pappusgrass and red grama; 1 percent fluffgrass; 4 percent other perennial grasses; 10 percent creosotebush; 8 percent mariola, skeletonleaf goldeneye, guayacan, and cenizo; 3 percent candelilla, ocotillo, lechuguilla, and leatherstem; 2 percent range and ephedra; 2 percent other shrubs; and 5 percent forbs.

Figure 36.—This area of Strawhouse very gravelly loam in an area of Strawhouse-Stillwell complex, 1 to 8 percent slopes, supports a sparse cover of low-stature creosotebush with little grass. This soil is on a fan remnant and formed in gravelly alluvium derived from limestone. This map unit is in the Gravelly 8-14" PZ ecological site of MLRA 81D—Southern Edwards Plateau. The Santiago Mountains underlain by Cretaceous limestone form the backdrop.

Under heavy continuous grazing, creosotebush, lechuguilla, whitethorn acacia, and other shrubs slowly increase. Species such as fluffgrass, threeawns, dogweed, begin replacing palatable grasses. Because of low rainfall, extremely high summer soil temperatures, and gravelly soils, recovery of depleted rangeland is extremely slow.

Limestone Hill and Mountain 8-14" PZ Ecological Site

This site includes soil mapping units; the Blackgap part of BLD—Blackgap-Rock outcrop complex, 1 to 16 percent slopes; the Blackgap part of BLE—Blackgap-Rock outcrop complex, 10 to 30 percent slopes; and the Blackgap part of BLG—Blackgap-Rock outcrop complex, 20 to 70 percent slopes.

This site consists of very shallow to shallow soils that formed in loamy residuum over limestone bedrock (fig. 37). Slopes range from 5 to 60 percent. The climax plant community consists of short and mid grasses intermixed with occasional woody plants and forbs.

The characteristic vegetation consists of approximately 40 percent Chino grama; 10 percent black grama; 6 percent sideoats grama; 2 percent slim tridens; 5 percent other perennial grasses; 12 percent candelilla, guayacan, and creosotebush; 6 percent Big Bend silverleaf, ocotillo, and lechuguilla; 2 percent other shrubs; and 15 percent forbs.

Under heavy continuous grazing, creosotebush, lechuguilla, and other shrubs slowly increase. Species such as fluffgrass, dogweed, coldenia, croton, and paperflower replace many of the climax grasses. Total vegetative cover is greatly reduced and soil erosion is accelerated.

Figure 37.—Buffelgrass, tanglehead, lechuguilla, and candelilla on an area of Blackgap-Rock outcrop complex, 20 to 70 percent slopes. Buffelgrass is an introduced species from Africa, and is an invader on the Limestone Hill and Mountain 8-14" PZ ecological site of MLRA 81D—Southern Edwards Plateau. Buffelgrass grows on soils with hyperthermic soil temperature, but is not widespread on soils with thermic soil temperatures. The rounded gravels in the foreground are colluvium derived from a high stream terrace above the slope.

MLRA 42—Hot Desert Shrub Vegetative Zone

The Hot Desert Shrub vegetative zone occurs within the lowest elevations within the park (1,800 to 4,000 feet). The climate and soils support a sparse cover of vegetation that is characteristic of the Chihuahuan Desert.

The climax vegetation is mainly drought tolerant shrubs, cacti, and perennial grasses, generally in a widely spaced pattern with an abundance of barren soil or desert pavement among them. The dominant perennial plants include Chino grama, slim tridens, false grama, perennial threeawn, creosotebush, acacia, ocotillo, yucca, lechuguilla, and cacti.

Arroyo Ecological Site

This site includes soil mapping units; CNB—Chillon very gravelly fine sandy loam, 1 to 3 percent slopes, rarely flooded (fig. 38); and the Pantera part of RIA—Riverwash and Pantera soils, 0 to 2 percent slopes, frequently flooded.

The site consists of very deep soils that formed in loamy and gravelly alluvium from igneous and sedimentary rock. This site occurs as narrow, frequently to rarely flooded natural drainage courses which receive runoff water from adjoining sites. Slopes range from 0 to 8 percent. The climax plant community is made up of short and midgrasses associated with shrubs and trees. Vegetation varies greatly because of variability of overflow and soil.

Figure 38.—Creosotebush growing on an area of Chillon very gravelly fine sandy loam, 1 to 3 percent slopes, rarely flooded. Chillon soils are in the Arroyo ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

The historical climax plant community consists of approximately 10 percent sideoats grama and tanglehead; 7 percent black grama and cane bluestem; 4 percent sand dropseed and Chino grama; 14 percent other perennial grasses; 10 percent western honey mesquite; 8 percent catclaw acacia and creosotebush; 6 percent spiny hackberry and elbowbush; 6 percent shrubby poreleaf, baccharis, and leatherstem; 15 percent other shrubs; 5 percent desert willow; and 15 percent forbs. Under continuous heavy grazing, there is an increase in threeawn, slim tridens, and fluffgrass, as retrogression continues, woody species such as mesquite, creosotebush, and lechuguilla slowly increase.

Basalt Hill Ecological Site

This site includes soil mapping units; the Terlingua part of MNE—Mariscal-Terlingua complex, 10 to 30 percent slopes; and the Terlingua part of RTE—Rock outcrop-Terlingua complex, 10 to 30 percent slopes (fig. 39).

This site consists of shallow soils that formed in material weathered from extrusive igneous bedrock. Slopes are mostly 5 to 20 percent but range from 2 to 30 percent. This site has a climax plant community of drought tolerant woody shrubs and infrequent drought tolerant short and midgrasses and perennial forbs.

The characteristic vegetation consists of approximately 10 percent Chino grama, 10 percent tanglehead and sideoats grama; 5 percent slim tridens and fluffgrass; 5 percent other grasses; 30 percent creosotebush, leatherstem, and lechuguilla; 10 percent range ratany and whitethorn acacia; 20 percent other shrubs; 2 percent spiderling and plains blackfoot; 8 percent other forbs. Under continuous grazing, all grasses except fluffgrass will decrease. Range ratany, feather dalea, and skeletonleaf goldeneye will also decrease. Few lower productive plants will replace plants removed. Because of low rainfall, extremely high summer soil temperatures, and very shallow rocky soils, recovery of depleted rangeland is extremely slow.

Figure 39.—Very sparse vegetation cover on Rock outcrop-Terlingua complex, 10 to 30 percent slopes. Leatherstem, creosotebush, and scattered plants grow on this thin soil, which is very shallow to basalt bedrock. Limited water storage capacity because of the shallow depth, and hot soil temperatures resulting from dark colored surface fragments combine to make this a very harsh environment for plants. The Terlingua soils are in the Basalt Hill ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Clay Hill Ecological Site

This site includes soil mapping unit; MSE—Musgrave silty clay, 1 to 20 percent slopes (fig. 40).

This site consists of very shallow to shallow soils that formed over tuffaceous bedrock. Slopes range from 1 to 30 percent. The climax vegetation consists of drought tolerant short and midgrasses with occasional shrubs, cacti, and annuals.

The characteristic vegetation consists of approximately 20 percent tobosa; 15 percent false grama; 20 percent sideoats grama and Arizona cottontop; 5 percent Chino grama; 10 percent other perennial grasses; 3 percent western honey mesquite; 4 percent leatherstem and guayacan; 3 percent creosotebush and lechuguilla; 4 percent other shrubs; and 10 percent forbs. Under continuous heavy grazing, tobosa, sideoats grama, and Arizona cottontop decrease, while fluffgrass, lechuguilla, and annuals increase. Because of low rainfall, extremely high summer soil temperatures, and very shallow soils, recovery of depleted rangeland is extremely slow.

Figure 40.—Lechuguilla, purple prickly pear, leatherstem, tobosagrass, and false grama are the dominant plant species on this area of Musgrave silty clay, 1 to 20 percent slopes. The Musgrave soil is shallow to tuffaceous mudstone bedrock in the lower portion of the Chisos Formation. Musgrave soils are in the Clay Hill ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. False grama and leatherstem are indicators of the hyperthermic soil temperature.

Gravelly Ecological Site

This site includes soil mapping units; COC—Corazones very gravelly sandy loam, 1 to 8 percent slopes; COE—Corazones very gravelly sandy loam, 1 to 30 percent slopes (fig. 41); EUB—Equipaje-Agust complex, 1 to 3 percent slopes.

The site consists of very shallow to very deep soils that formed in gravelly alluvium derived from igneous bedrock. Slopes range from 1 to 30 percent. The historic climax plant community consists of predominantly drought tolerant mid and shortgrasses with frequent woody shrubs and occasional forbs.

The characteristic vegetation consists of approximately 35 percent chino grama; 10 percent black grama and bush muhly; 5 percent perennial threeawns and feather pappusgrass; 3 percent false grama and slim tridens; 2 percent fluffgrass and red grama; 5 percent other perennial grasses; 15 percent creosotebush; 10 percent ocotillo and lechuguilla, and leatherstem; 5 percent range ratany and Gregg's coldenia; 5 percent other shrubs; and 5 percent forbs; Under heavy continuous grazing, creosotebush, lechuguilla, whitethorn acacia, and other shrubs slowly increase. Species such as fluffgrass, threeawn, dogweed, begin replacing palatable grasses. Because of low rainfall, extremely high summer soil temperatures, and gravelly soils, recovery of depleted rangeland is extremely slow.

Figure 41.—An area of Corazones very gravelly sandy loam, 1 to 8 percent slopes with Chino grama, lechuguilla, creosotebush, and ocotillo. Corazones soils are in the Gravelly ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Lechuguilla is an indicator plant for the Chihuahuan Desert. Note the desert pavement.

Igneous Hill and Mountain Ecological Site

This site includes soil mapping units; the Terlingua part of RTG—Rock outcrop-Terlingua complex, 20 to 70 percent slopes; the Studybutte part of SUE—Studybutte-Rock outcrop complex, 10 to 30 percent slopes; and the Studybutte part of SUG—Studybutte-Rock outcrop complex, 20 to 60 percent slopes (fig. 42).

This site consists of very shallow to shallow soils that formed in residuum and colluvium weathered from igneous bedrock. Slopes range from 10 to 70 percent. The climax plant community consists of short and midgrasses, numerous shrubs, and frequent perennial forbs.

The characteristic plant community consists of approximately 30 percent Chino grama; 10 percent black grama; 20 percent tanglehead, Arizona cottontop, sideoats grama and slim tridens; 2 percent other perennial grasses; 25 percent feather dalea, skeletonleaf goldeneye, leatherstem, range ratany, and ocotillo. Under continuous heavy grazing, species such as lechuguilla, creosotebush, and pricklypear, fluffgrass, threeawn, and red grama increase. Palatable grasses such as black grama, sideoats grama, and tanglehead decrease.

Figure 42.—Chino grama, with lesser amounts of creosotebush and lechuguilla, forms a good vegetative cover on this area of Studybutte-Rock outcrop complex, 20 to 70 percent slopes. Plant cover and rock fragments protect the soil from raindrop impact, which can initiate the process of soil erosion. The Studybutte soils are in the Igneous Hill and Mountain ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Loamy Bottomland Ecological Site

This site includes soil mapping unit VCA—Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded.

This site consists of very deep soils that formed in loamy and clayey alluvium from igneous and sedimentary rocks. Slopes range from 0 to 3 percent. This site occurs along the flood plain of the Rio Grande (fig. 43). Species composition varies greatly in relation to degree and frequency of natural flood pulses. A wide variety of shrubs, trees, and grasses are common components of the climax plant community.

The characteristic vegetation consists of approximately 25 percent giant sacaton; 10 percent alkali sacaton; 10 percent cane bluestem and whiplash pappusgrass; 6 percent vine mesquite and bristlegrass; 10 percent other perennial grasses; 10 percent western honey mesquite and cottonwood; 2 percent other trees; 8 percent fourwing saltbush, spiny hackberry, and catclaw acacia; 10 percent other shrubs; and 4 percent forbs. Under continuous heavy grazing, mid grasses will decrease and burrograss, annual grasses, and annual forbs greatly increase. Western honey mesquite and numerous shrubs greatly increase. Introduced species such as saltcedar, bermudagrass, and buffelgrass can quickly displace native plants and dominate the site.

Figure 43.—Winter view of the Rio Grande flood plain dominated by giant cane, mesquite, and saltcedar. Giant cane and saltcedar are introduced plants, and are invaders. The flood plain is mapped as Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded. This map unit is in the Loamy Bottomland ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Overlooking the flood plain are Strawhouse soils, which are shallow to cemented caliche. The Strawhouse soils formed in rounded limestone gravel cemented by calcium carbonate, and are on stream terraces. The Strawhouse soils, part of Strawhouse-Stillwell complex, 1 to 8 percent slopes, is in the Gravelly 8-14" PZ of MLRA 81D—Southern Edwards Plateau.

Loamy Ecological Site

This site includes soil mapping units; NNB—Ninepoint clay loam, 0 to 3 percent slopes (fig. 44); NPB—Ninepoint complex, 1 to 3 percent slopes, pitted; and TOA—Tornillo loam, 0 to 2 percent slopes, occasionally flooded.

This site consists of very deep soils that formed in loamy alluvial materials from igneous and sedimentary sources. Slopes are mostly 1 to 2 percent but range from 0 to 3 percent. The climax vegetation is dominated by open stands of drought tolerant bunchgrasses, usually in a banded pattern, occasional woody shrubs, yucca, cacti, and ephemerals.

The characteristic vegetation consists of approximately 25 percent tobosa; 15 percent alkali sacaton; 9 percent cane bluestem, plains bristlegrass, and burrograss; 8 percent whiplash and pink pappusgrass; 18 percent other perennial grasses; 5 percent fourwing saltbush; 6 percent western honey mesquite, tarbush, and catclaw acacia; 4 percent other shrubs; 10 percent forbs.

Under continuous heavy grazing, alkali sacaton, tobosa, bristlegrass, and cane bluestem decrease while shrubs such as tarbush, mesquite, and catclaw acacia increase. This site is highly susceptible to soil erosion.

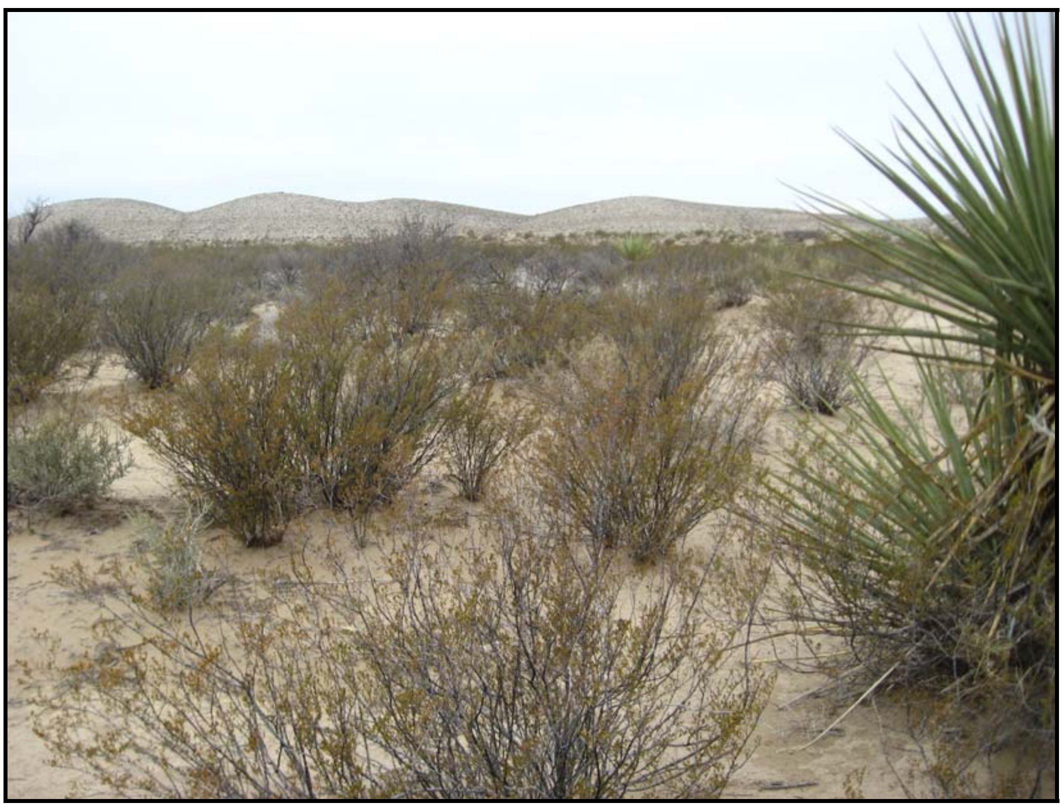

Figure 44.—An area of mostly creosotebush, with tarbush, Torrey's yucca, and western honeymesquite on Ninepoint clay loam, 0 to 3 percent slopes. Ninepoint soils are in the Loamy ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

Sandstone Hill and Mountain Ecological Site

This site includes soil mapping units; the Solis part of SKE—Solis-Rock outcrop complex, 1 to 20 percent slopes; and the Solis part of SKG—Solis-Rock outcrop complex, 20 to 60 percent slopes.

This site consists of very shallow to shallow soils that formed over soft sandstone. Slopes range from 3 to 40 percent. The climax vegetation consists of drought tolerant short and midgrasses with occasional shrubs, cacti, and annuals (fig. 45).

The characteristic vegetation consists of approximately 20 percent Chino grama; 15 percent spike, sand, and mesa dropseed; 10 percent black and sideoats grama; 5 percent perennial threeawn; 3 percent fluffgrass; 7 percent other perennial grasses; 15 percent creosotebush, ocotillo, and feather dalea; 5 percent whitethorn acacia and western honey mesquite; 5 percent other shrubs; and 10 percent forbs. Under continuous heavy grazing, midgrasses will decrease and false grama, fluffgrass, annual grasses, and annual forbs greatly increase. Woody species such as mesquite, whitethorn acacia, creosotebush, and cacti species begin to increase. Because of low rainfall, extremely high summer soil temperatures, and very shallow soils, recovery of depleted rangeland is extremely slow.

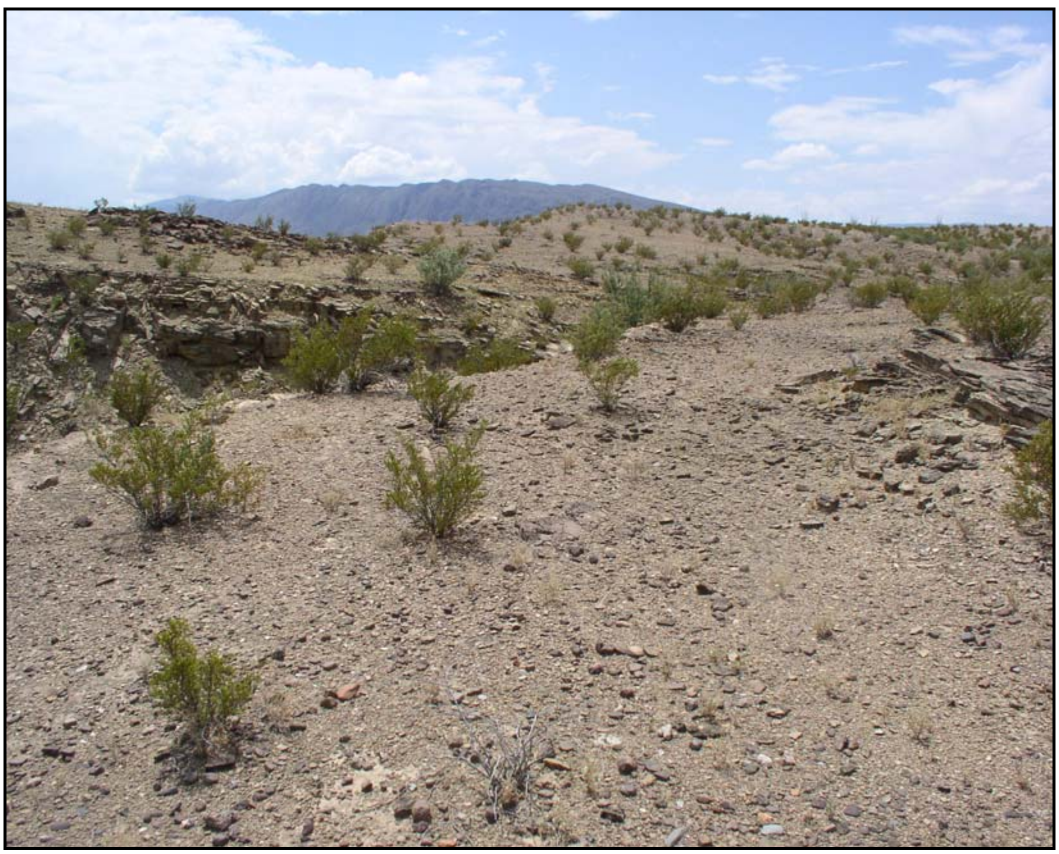

Figure 45.—Areas of Solis-rock outcrop complex, 1 to 20 percent slopes along the Rio Grande support less productive, less diverse plant communities than areas at higher elevation. Solis soils are in the Sandstone Hill and Mountain ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Less rainfall and hotter temperatures result in soil conditions too harsh for Chino grama.

Salty Clay Hill Ecological Site

This site includes soil mapping units; GEE—Geefour silty clay, 3 to 20 percent slopes; and GEF—Geefour silty clay, 10 to 45 percent slopes.

This site consists of very shallow to shallow soils that formed from shale bedrock or clayey lacustrine deposits. Slopes range from 1 to 30 percent. The climax vegetation consists of drought tolerant short and midgrasses with occasional shrubs, cacti, and annuals (fig. 46).

The characteristic vegetation consists of approximately 40 percent tobosa; 10 percent alkali sacaton; 15 percent false grama, whorled dropseed, and Hall's panicum; 5 percent perennial threeawn, feather pappusgrass, and fluffgrass; 5 percent western honey mesquite; 6 percent creosotebush and wolfberry; 5 percent mound and tublercled saltbush; 6 percent other shrubs; 8 percent forbs. Under continuous heavy grazing, tobosa, alkali sacaton, and Hall's panicum decrease while fluffgrass and annuals increase. Because of low rainfall, extremely high summer soil temperatures, and very shallow soils, recovery of depleted rangeland is extremely slow.

Figure 46.—Purple pricklypear and saltbush occupy this area of Geefour silty clay, 3 to 20 percent slopes. The gravel veneer in the foreground enhances infiltration of rainfall, and allows plants to grow in a very hot dry environment. Geefour soils are in the Salty Clay Hill ecological site, Hot Desert Shrub vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. The steeper slopes in the background have lost the gravel veneer to geological erosion; causing increased rainfall run off. Plants are unable to grow in this area.

MLRA 42—Desert Grassland Vegetative Zone

The Desert Grassland vegetative zone is mostly at elevations of 3,500 to 5,000 feet. The climate and soils support a sparse cover of grasses and shrubs.

The climax vegetation is mainly shortgrasses such as blue grama, black grama, burrograss, tobosa, and in places mid grasses such as cane bluestem, sideoats grama, Arizona cottontop, and plains bristlegrass. Primary shrubs include butterflybush, fourwing saltbush, and tarbush. Much of this zone is dominated by increasers such as creosotebush, tarbush, acacia, and mesquite.

Gravelly Ecological Site

This site includes soil mapping units; AAC—Altar gravelly sandy loam, 1 to 8 percent slopes; CIC—Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes; and CLE—Chilicotal-Paisano association, 5 to 30 percent slopes (fig. 47).

The site consists of very shallow to deep soils that formed mostly from gravelly alluvium of mixed sources. Slopes range from 1 to 16 percent. The climax plant community is dominated by drought tolerant, bunch and stoloniferous short and mid-grasses. Shrubs and half shrubs are scattered and evenly distributed. Forb production varies considerably from year to year and season to season. Small, slightly depressed

Figure 47.—Lechuguilla, mariola, skeletonleaf goldeneye, and Spanish dagger growing on an area of Paisano soils, in an area of Chilicotal-Paisano association, 5 to 30 percent slopes. Paisano soils are in the Gravelly ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. The indurated petrocalcic horizon composed of subangular igneous gravel is cemented by calcium carbonate. Along the drainageway at the base of the slope, is an area of Altar gravelly sandy loam, 1 to 8 percent slopes. Altar soils are also in the Gravelly ecological site, Desert Grassland vegetative zone.

"micro-sites" occur occasionally and support a greater abundance of midgrasses. Vegetative cover of this site will deteriorate very quickly if mismanaged and range recovery is extremely slow.

The historical climax plant community consists of approximately 15 percent black grama, 15 percent sideoats grama; 10 percent bush muhly; 5 percent Arizona cottontop, slim tridens, and perennial threeawn; 15 percent other perennial grasses; 5 percent creosotebush, 5 percent range ratany and mariola; 10 percent other shrubs; and 10 percent forbs. Under continuous heavy grazing, the plant community deteriorates to a more sparsely vegetated community with an increasing amount of bare ground. Plants such as black grama, bush muhly, sideoats grama, Arizona cottontop, cane bluestem, plains bristlegrass, and fourwing saltbush will decrease. Other plants such as threeawn, fluffgrass, mariola, catclaw mimosa, tarbush, cacti, and yucca will increase. Creosotebush increases and often becomes the dominant species. Some mesquite also invades where the soil is deeper.

Igneous Hill and Mountain Ecological Site

This site includes soil mapping units; the Leyva part of LEE—Leyva-Rock outcrop complex, 10 to 30 percent slopes (fig. 48) and the Lingua part of LGG—Lingua-Rock outcrop complex, 20 to 60 percent slopes.

Figure 48.—Leyva soils are in the Igneous Hill and Mountain ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains. Leyva soils formed in residuum weathered from trachyte. Surface rock fragments have clay coats, which originated while they existed in the subsoil, and before exposure at the surface. Sideoats grama, black grama, sotol, and lechuguilla grow on these soils.

This site consists of very shallow to shallow soils that formed in residuum and colluvium weathered from igneous bedrock and tuff. Slopes range from 8 to 60 percent. The climax vegetation is dominated by short and midgrasses with some perennial forbs and occasional woody shrubs. The exposed rock and stony nature of the soils contribute to good plant-soil-air-moisture relationships.

The characteristic plant community consists of 20 percent sideoats grama; 15 percent tanglehead; 10 percent black grama; 10 percent cane bluestem and bush muhly; 7 percent green sprangletop; 5 percent blue grama; 3 percent other perennial grasses; 3 percent skeletonleaf goldeneye; 4 percent range ratany and catclaw acacia; 1 percent mariola; 4 percent other shrubs; and 8 percent forbs.

Under continuous heavy grazing, sideoats grama, black grama, cane bluestem, tanglehead, and green sprangletop decrease. Other plants such as slim tridens, fluffgrass, perennial threeawn, lechuguilla, broom snakeweed, and annuals will increase. Woody species such as catclaw increase and often become the dominant species on some slopes.

Limestone Hill and Mountain Ecological Site

This site includes soil mapping units; the Bissett part of BIE—Bissett-Rock outcrop complex, 5 to 30 percent slopes (fig. 49); and the Bissett part of BIG—Bissett-Rock outcrop complex, 20 to 70 percent slopes.

Figure 49.—An area of Bissett-Rock outcrop complex, 5 to 30 percent slopes. Vegetation at this site includes sotol, pricklypear, Chino grama, and white acacia. Bissett soils are in the Limestone Hill and Mountain ecological site, Desert Grassland vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountains.

This site consists of very shallow to shallow soils that formed in loamy residuum over limestone bedrock. Slopes range from 1 to 70 percent. The climax vegetation is dominated by short and midgrasses in association with an abundance of perennial forbs and woody shrubs. Chino grama is generally more prevalent on south facing slopes, while sideoats grama, green sprangletop, cane bluestem, black grama, and blue grama tend to dominate the north facing slopes. The exposed rock and stony nature of the soils contribute to good plant-soil-air-moisture relationship.

The characteristic plant community consists of 15 percent sideoats grama; 10 percent cane bluestem; 15 percent black grama, blue grama, and bush muhly; 5 percent Chino grama; 10 percent other perennial grasses; 10 percent skeletonleaf goldeneye and range ratany; 2 percent feather dalea; 3 percent other shrubs; and 10 percent forbs. Under continuous heavy grazing, sideoats grama, bluestem, blue grama, black grama, and green sprangletop decrease. Other plants such as perennial threeawn, fall witchgrass, slim tridens, acacia, mariola, and other woody species will increase. Continued retrogression results in an increase in fluffgrass, red grama, annual threeawn, catclaw, and lechuguilla.

MLRA 42—Mixed Prairie Vegetative Zone

The Mixed Prairie vegetative zone includes intermountain prairies and valleys and rolling to steep hills and mountain slopes, generally between 4,500 and 6,000 feet elevation. The climate and soils support a climax vegetation of short and midgrasses as co-dominants, with only occasional low shrubs and trees.

The climax vegetation is mainly sideoats grama, cane bluestem, blue grama, and black grama. The woody vegetation such as butterflybush, oaks, daleas, and acacias occur primarily in draws and headers, and on rocky slopes of hills and mountains.

Foothill Slope Ecological Site

This site includes soil mapping unit HRE—Hurds very cobbly loam, 10 to 30 percent slopes (fig. 50).

This site consists of shallow to very deep that formed in gravelly alluvium weathered from igneous bedrock. Slopes range from 1 to 30 percent. The climax vegetation is dominated by a mix of both short and midgrasses. Numerous perennial forbs and occasional shrubs and trees occur in association with the perennial grasses.

The characteristic vegetation consists of approximately 15 percent sideoats grama; 15 percent cane bluestem; 20 percent blue grama and black grama; 15 percent green sprangletop; tanglehead and plains bristlegrass; 15 percent other grasses; 3 percent skeletonleaf goldeneye; 4 percent elbowbush and catclaw acacia; 6 percent other shrubs; 1 percent juniper; 1 percent other trees; and 5 percent forbs. Under continuous heavy grazing, sideoats grama, blue grama, and other midgrasses are initially replaced in the plant community by threeawn, fall witchgrass, and other shortgrasses. With further deterioration of the plant community, plants such as mariola, catclaw, mesquite, and pricklypear increase.

Igneous Hill and Mountain Ecological Site

This site includes soil mapping unit; the Brewster part of RKG—Rock outcrop-Brewster complex, 20 to 70 percent slopes.

This site consists of very shallow to shallow soils that formed materials weathered from igneous bedrock. Slopes range from 5 to 70 percent. The climax vegetation is dominated by a mixture of both short and midgrasses. Numerous perennial forbs and occasional shrubs and trees occur in association with the perennial grasses. Shrubs and trees are most prevalent in areas with abundant igneous rock outcrops.

Figure 50.—The foreground is an area of Hurds very cobbly loam, 10 to 30 percent slopes. Hurds soils are in the Foothill Slope ecological site Mixed Prairie vegetative zone of MLRA 42—Southern Desertic Basins, Plains, and Mountain. The steeper areas in the background are areas of Rock outcrop-Brewster complex, 20 to 70 percent slopes. Brewster soils are in the Igneous Hill and Mountain ecological site, Mixed Prairie vegetative zone.

The characteristic vegetation consists of approximately 10 percent sideoats grama; 10 percent black grama; 10 percent cane bluestem; 10 percent Texas bluestem and little bluestem; 10 percent tanglehead and blue grama; 5 percent plains lovegrass; 20 percent other perennial grasses; 4 percent feather dalea and range ratany; 4 percent other shrubs; 3 percent gray oak and redberry juniper; 4 percent other trees; and 5 percent forbs. Under continuous heavy grazing, the bluestem, sideoats grama, tanglehead and other mid grasses are initially replaced in the plant community by threeawn, fall witchgrass, and other short grasses. With further deterioration of the plant community, plants such as juniper, catclaw, and pricklypear continue to increase.

Limestone Hill and Mountain Ecological Site

This site includes soil mapping units; ADE—Altuda very cobbly silt loam, 10 to 30 percent slopes; and the Altuda part of ADG—Altuda-Rock outcrop complex, 20 to 70 percent slopes (fig. 51).

This site consists of very shallow to shallow soils that formed in loamy residuum over limestone bedrock. Slopes range from 10 to 70 percent. The climax vegetation is dominated by short and midgrasses. Some woody shrubs, occasional trees, and forbs also occur. Shrubs are generally most prevalent in headers and on rough broken slopes.

Figure 51.—An area of Altuda-Rock outcrop complex, 20 to 70 percent slopes. Altuda soils are in the Limestone Hill and Mountain ecological site, Mixed Prairie vegetative zone. This map unit occurs at the highest elevation within the Mixed Prairie vegetative zone and supports trees such as Mexican pinyon, redberry juniper, and mountain mahogany.

The characteristic vegetation consists of approximately 15 percent sideoats grama; 15 percent curlyleaf muhly; 10 percent green sprangletop; 14 percent little bluestem and cane bluestem; 15 percent blue grama, black grama and hairy grama; 2 percent New Mexico feathergrass; 9 percent other grasses; 2 percent agarito and mountain mahogany; 9 percent other shrubs; 4 percent redberry juniper and Mexican pinyon pine; and 5 percent forbs. Under continuous heavy grazing, sideoats grama, green sprangletop, cane bluestem, and little bluestem will decrease. Plants such as slim tridens, and perennial threeawn will increase. As retrogression continues, annual plants and unpalatable species such as catclaw, mesquite, and fluffgrass will increase.

MLRA 42—Mountain Savannah Vegetative Zone

The Mountain Savannah vegetative zone is mostly at elevations of 5,600 to 7,800 feet. Characteristic vegetation consists of numerous species of oaks, junipers, conifers, shrubs, and mid and tallgrasses. Cool-season grasses are also a common component. Woody plant vegetation is strongly influenced by aspect.

Igneous Hill and Mountain Ecological Site

This site includes soil mapping units; the Liv and Mainstay parts of LMF—Liv-Mainstay-Rock outcrop complex, 20 to 45 percent slopes; and Puerta and Madrone parts of PUF—Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes.

This site consists of shallow to moderately deep soils that formed in materials weathered from igneous bedrock and tuff. Slopes range from 5 to 45 percent. The climax vegetation consists of both mid and tallgrasses with scattered trees. Numerous perennial forbs and occasional shrubs also occur in association with the grasses and trees.

The characteristic vegetation consists of approximately 15 percent bull muhly; 20 percent Texas and little bluestem; 8 percent sideoats grama; 10 percent blue grama and cane bluestem; 15 percent other grasses; 5 percent Mexican pinyon pine; 6 percent alligator juniper and gray oak; 9 percent other trees; 4 percent mountain mahogany and evergreen sumac; 1 percent catclaw mimosa; 5 percent other shrubs; and 2 percent forbs. Under heavy continuous grazing, bluestem, grama, and muhly will decrease while catclaw mimosa, juniper, oak, and shade tolerant grasses will begin increasing. Fire suppression will also allow trees and shrubs to increase at the expense of shade intolerant grasses.

MLRA 70C—Central New Mexico Highlands

Loamy Ecological Site

This site includes soil mapping unit; the Lazarus part of PUF—Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes.

This site occurs on nearly level valley floors located within the Chisos Mountains. Soils are very deep loams. The reference plant community is a mid and shortgrass dominated grassland with few scattered shrubs and trees.

The characteristic vegetation consists of approximately 25 percent blue grama and sideoats grama; 15 percent cane bluestem and little bluestem; 10 percent finestem needlegrass; 10 percent vine mesquite and wolftail; 5 percent hairy grama, bulb panicum, and pinyon rice grass; 5 percent alligator juniper and pinyon pine; 2 percent agarito and skeletonleaf goldeneye; 2 percent globemallow and snoutbean; 15 percent other grasses; 3 percent other shrubs and trees; 8 percent other forbs. Under continuous heavy grazing, plants such as blue grama and vine mesquite decrease while finestem needlegrass increases and can eventually dominate the site.

Recreation

The soils of the survey area are rated in Table 19 and Table 20 according to limitations that affect their suitability for recreation. The ratings are both descriptive and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables 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 sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in Table 19 and Table 20 can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

Camp areas (fig. 52) 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 ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Foot traffic and equestrian trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Mountain bike and off-road vehicle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a seasonal high water table, ponding, flooding, and texture of the surface layer.

Figure 52.—Boot Cabin, as it looked in 1982. Interpretations for camp sites are provided in the Tables section.

Wildlife

Stephen A. Nelle, wildlife biologist, Natural Resources Conservation Service, and Raymond Skiles, wildife biologist, National Park Service, helped prepare 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.

Wildlife is one of the more important natural resources in the park. The variety of soils, topography, climate and vegetation supports an amazing diversity of wildlife. Of the approximately 950 land-dwelling species of wildlife that occur in Texas over 400 of them can be found in Big Bend National Park.

Historically, the kinds and numbers of wildlife have changed considerably since settlement by Europeans. Prior to early settlement, the grasslands and mountains of Big Bend National Park supported bighorn sheep, mule deer, white-tailed deer, Mexican gray wolf, black bear, and mountain lion plus many species of smaller animals. Reasons for the demise of these species included unregulated hunting and trapping, overgrazing, and diseases from domestic sheep.

Despite the losses that have occurred, Big Bend National Park still supports an abundance of wildlife. The basic habitat needs of any wildlife population are food, cover, water and space in the right combination and arrangement. Each species of animal has its own unique requirements for these habitat elements. In order for wildlife to inhabit an area, the land must either naturally provide the habitat needs, or it must be managed by humans so that specific habitat needs are met.

Soils have a great influence on the kinds and amounts of plants that are available for wildlife food and cover. The soils in the survey area are grouped into ecological sites according to the kinds, amounts, and proportions of plants which the soils and climate can support. Ecological sites vary in their ability to meet habitat needs. Soils and geology influence the distribution of surface water used by wildlife. The past and present management of the land also influences wildlife habitat. Therefore, a good understanding of soils, ecological sites, and their response to management is important to proper wildlife habitat management. For detailed information on ecological sites, refer to the “Rangeland” section of this soil survey.

About 76 native species of mammals occur in Big Bend National Park. Of these, about 30 kinds of rodents can be found including various species of ground squirrel (fig. 53), pocket gophers, pocket mouse, kangaroo rat, mouse, cotton rat, wood rat, badger, and porcupine. The burrowing activities of most rodents are considered beneficial, providing penetration and additional organic matter. Most rodents eat seeds and foliage, while some consume insects. Many of the seeds eaten include noxious or invading species. If rodent numbers climb to high levels, they can have a detrimental effect on the range resource. An abundance of natural predators normally prevents this from happening. Other small mammals include 15 species of bats, opossum, mole, and desert shrew.

Four kinds of rabbits occur in the area. The Davis Mountain cottontail, and the Davis Mountain (Eastern) cottontail are restricted to the higher elevations of the Chisos Mountains where it is associated with oak, pinyon, and juniper woodland. The Audubon’s cottontail lives at lower elevations. The jackrabbit is very common and can be detrimental to the vegetative resource when their numbers become excessive. Predators, however, play an important role in helping to keep their numbers in balance.

Figure 53.—A pair of ground squirrels watching tourists. Ground squirrels are one of many rodent species that occur in the park.

About 14 predatory mammals exist including raccoon, ringtail, several kinds of skunk, badger, fox, coyote, bobcat, mountain lion, and a small number of black bear. The beneficial role of predators has been described. However, when predator numbers become excessive, they can have a very serious impact upon wildlife and livestock.

Large mammals that occur include mule deer, white-tailed deer, elk, and javelina. Mule deer (fig. 54) are the most abundant large animal in the park. Very low populations occur across most of the gravelly ecological sites in the desert shrub zone, and in areas with poor water distribution.

White-tailed deer and Carmen mountain white-tailed deer occur with mule deer in the higher elevations of the Chisos mountains.

Both species of deer prefer to feed on broadleaf forbs which are higher in nutritional quality than either browse or grass. However, because of the seasonal and unpredictable availability of annual forbs, and a lack of preferred perennial forbs, deer must utilize browse to make up the bulk of their diet. Some of the more important forbs include spurge, bladderpod, croton, menodora, globe mallow, sida, sticky selloa, milkwort, greenthread, broom snakeweed, plantago, false ragweed, hairy tubetongue, fleabane, wild buckwheat, ditaxis, and snoutbean. The more important browse plants include whitethorn acacia, catclaw acacia, Roemer's acacia, dalea, skeletonleaf goldeneye, guayacan, desert olive, apache plume, fourwing saltbush, hackberry, kidneywood, skunkbush sumac, evergreen sumac, littleleaf sumac, mountain mahogany, cenizo, oak, juniper, granjeno, butterfly bush, prickly pear, candelillia, and lechuguilla.

Deer require substantial areas of moderate to thick brush, not only for food, but also for cover and shade. Thick areas of grass among the brush are preferred fawning cover. Periodic die-offs and poor reproduction rates because of drought and poor nutrition keep mule deer numbers lower in most areas. Excessive predation, especially by mountain lions, keeps populations suppressed in some areas.

Figure 54.—A mule deer buck wandering the brush at Big Bend National Park. Mule deer are one of several deer species found in the park, and are the most abundant deer.

Elk have spread as far south as Big Bend National Park, mostly remaining in the northern extremities of the park. There is no evidence to suggest that elk were ever native in Brewster County or Big Bend National Park.

The javelina occurs in the park and is most abundant in areas of thick brush. Javelina eat primarily the pads and fruit of pricklypear, and the flower stalks, leaves, and roots of lechuguilla, sotol, and yucca. At higher elevations, they eat acorns and juniper berries. They also eat some grasses, forbs, and browse as well as insects, rodents, and carrion.

The desert bighorn sheep was once common in the mountains of Brewster County. Unregulated market hunting severely hurt bighorn populations in the late 1800's. Overgrazing by domestic sheep damaged the habitat and spread bluetongue disease into the bighorn population. The native bighorn sheep is now extinct in Texas. Restoration efforts since the 1950's have attempted to introduce bighorn from Arizona into Black Gap Wildlife Management Area in southern Brewster County, adjacent to Big Bend National Park. Successful (so far) restoration efforts have been carried out on Black Gap Wildlife Management Area since the 1990’s, and have resulted in a bighorn population using Big Bend National Park since the late 1990’s. Restoration efforts are also being carried out on the Elephant Mountain Wildlife Management Area in northern Brewster County.

The bird life of Brewster County is also quite diverse. Over 400 species have been recorded. These species nest in the park area.

Each of the bird species has its own unique habitat requirements. Some prefer the oak-juniper woodlands found at higher elevations, while others find their needs met in the sparsely vegetated desert shrublands.

Birds associated with water are found primarily along the Rio Grande River, the perennial streams in the Chisos Mountains, and the numerous springs found scattered throughout the area. These birds include several kinds of ducks, grebes, coots, herons, egrets, sandpipers, and the belted kingfisher.

Raptorial birds of prey are common and include red-tailed hawk, Swainson's hawk, Harris hawk, kestrel, peregrine falcon, prairie falcon, and several kinds of owls. Golden eagles are present yearlong with peak numbers between October and March. Eagles are known to predate deer and fawns, however their main food does include rabbits. Turkey vultures and black vultures are the primary carrion eaters. Ravens will carrion insects, rodents, and reptiles.

A large group of birds are almost exclusively insect eaters. The more common ones include nighthawk, poorwill, gnatcatcher, flycatcher, swallow, wren, warbler, and vireo. The loggerhead shrike and roadrunner not only eat insects but also small reptiles and mice. Another large group of birds which eat seeds, fruits, or insects include verdin, thrush, mockingbird, thrashers, waxwing, tanager, cardinal, pyrrhuloxia, grosbeak, bunting, towhee, sparrow, blackbird, cowbird, meadowlark, oriole, and finch.

Six species of upland birds can be found in Big Bend National Park. Both the mourning dove and white-winged dove occur. The three kinds of quail are the scaled quail, Gambel's quail, and Mearn's quail. The Mearn's quail are limited to the mountain areas of the Chisos Mountains, where they inhabit oak-juniper-pinyon woodlands. Gambel's quail are found primarily in the draws and along the Rio Grande River. Scaled quail are the most numerous and are commonly found throughout the area except in the higher mountain elevations.

Scaled quail spend their entire life in a rather small area and therefore must have all their habitat needs closely arranged. Quail numbers range from very abundant to very few from year to year based on rainfall and nesting success. Nesting cover ideally consists of large clumps of grass left ungrazed from the previous year. Quail feed primarily on the hard seeds of forbs, grasses, and woody plants as well as insects and succulent greens when available. Some of the better scaled quail food plants in the survey area include cowpen daisy, pigweed, croton, spurge, broom snakeweed, Russian thistle, menodora, buffalobur, Hall's panicum, plains bristlegrass, johnsongrass, mesquite, whitethorn acacia, tasajillo, lechuguilla, wolfberry, and desert willow. Quail can derive water from insects, greens, and fruits. However during extended dry periods when these moist foods are not available, quail will readily drink from surface water, and the populations do better when water is available.

The highest diversity is in the normally dry desert lowlands. Amphibians emerge to breed in ephemeral pools after rains. Permanent water bodies have fewer species because of persistence of predators (aquatic beetles, fish, snakes, and other mammals). Amphibians, including several kinds of frogs and toads are located in wet or seasonally wet areas such as creeks, seeps, springs, ponds, and moist canyons.

A large number of reptiles inhabit the survey area. Several kinds of turtles are associated with permanent water. The desert box turtle spends its life on land. Two species of geckos are found. Over twenty species of lizards occur including the earless, collared, horned, spiny, and side blotched lizards, several species of whiptail lizards and two species of skink.

Over thirty species of snakes are found, most of them harmless to man and an important part of the natural balance. Some of the nonvenomous snakes include several kinds of rat snake, hognose snake, king snake, milk snake, coach whip, bull snake, water snake, patchnose snake, blackhead snake, ringneck snake, and garter snake. Venomous snakes include the Trans-Pecos copperhead, and four species of rattlesnakes: western diamondback, Mojave, mottled rock, and blacktail.

The water resources of Big Bend National Park that are inhabited by fish are largely limited to the Terlingua Creek, Tornillo Creek, and the Rio Grande River. Native fish species include, flathead catfish, channel catfish, and blue catfish. Other fish include freshwater drum, buffalo, and gar. Primary forage fishes include gizzard shad, bluegill, and green and longear sunfishes along with a host of smaller fish including shiners, minnows, redhorse, chub, and gambusia.

Wildlife is a valuable part of the natural resources in the survey area. Wildlife has aesthetic value, enriching the lives of people who enjoy seeing them. They have ecological value, with each species playing a role in the complex balance of nature. Some species may have scientific value that is not yet recognized.

Wildlife Habitat

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.

Table 21, Table 22, Table 23, and Table 24 show the degree and kind of soil limitations that affect various kinds of habitat for wildlife. The tables show limitations of the soils for desertic herbaceous plants; habitat for burrowing mammals and reptiles; riparian herbaceous plants; and riparian shrubs, vines, and trees, This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting areas for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the element or kind of habitat. *Not limited indicates* that the soil has features that are very favorable for the element or kind of habitat. Good performance and very low maintenance can be expected. *Slightly limited* indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Creating, improving, or maintaining habitat is impractical or impossible.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Ratings for *desertic herbaceous plants* indicate the limitation of the soils as a growing medium for a diverse desertic herbaceous plant community composed of plants adapted to an arid or semiarid environment. The soil properties and features that affect the growth of these plants are soil texture, available water capacity, the presence of excess salts in the soil, soil reaction (pH), soil moisture and temperature regimes, depth to a high water table, and the amount of rock fragments on the soil surface. Examples of desertic herbaceous plants are Chino grama, Black grama, mariola, skeletonleaf goldeneye, fluffgrass, and burrograss.

Ratings for *habitat for burrowing mammals and reptiles* indicate the limitation of the soil for maintaining or increasing local populations of specific burrowing animals. The soil properties and features that affect the preservation of these species are flooding, ponding, depth to bedrock or a cemented pan, depth to a high water table, sandy layers, clayey layers, a high content of organic matter, and high concentrations of rock fragments. Examples of burrowing mammals and reptiles are gophers, badgers, lizards, rattlesnakes, and bull snakes.

Ratings for *upland native herbaceous plants* indicate the limitation of the soils as a growing medium for a diverse upland herbaceous plant community. This community is adapted to soils that are drier than the common soils in moist riparian and wetland zones but that are not as dry as the soils in upland desert areas. The soil properties and features that affect the ability of these species to thrive include soil texture, available water capacity, the presence of excess salts in the soil, soil moisture and temperature regimes, depth to a high water table, and rock fragments on the soil surface. Examples of upland native herbaceous plants are black grama, slim tridens, sideoats grama, blue grama, curlyleaf muhly, pine muhly, New Mexico Feathergrass, and finestem needlegrass.

Ratings for *upland desertic shrubs and trees* provide guidelines for determining soil quality as a medium for growing a diverse upland herbaceous plant community which is adapted to soil conditions in an arid or semiarid environment that is drier than that common to moist riparian and wetland zones and subhumid, humid, or tropical areas. Soil properties and features that affect the ability of these species to thrive include: soil texture, available water capacity, depth to high water table, the presence of excess salts in the soil, soil reaction (pH), soil moisture and temperature regimes, and the presence of rock fragments at the soil surface. Examples of upland desertic shrubs and trees are creosotebush, lechuguilla, ocotillo, whitethorn acacia, western honey mesquite.

Ratings for *upland shrubs and vines* indicate the limitation of the soils as a growing medium for a diverse upland shrub and vine community. This community is adapted to soils that are drier than those common in the moist riparian and wetland zones but that are not so dry as those in upland desert areas. The soil properties and features that affect the ability of these species to thrive include soil texture, content of organic matter, available water capacity, depth to bedrock or a cemented pan, the presence of excess salts in the soil, soil moisture and temperature regimes, depth to a high water table, and rock fragments on the soil surface. Examples of upland shrubs and vines used by birds are catclaw acacia, viscid acacia, Warnock condalia, tasajillo, lotebush, algerita, elbowbush, wolfberry, sumac, Spanish dagger, and hackberry.

Ratings for *upland deciduous trees* provide guidelines for determining soil quality as a medium for growing a diverse upland deciduous tree community that meet specific local habitat requirements for targeted and non-targeted species of wildlife. Typically, deciduous trees require better soil conditions than geographically related conifers. The soil properties and features that affect the ability of these species to thrive include available water capacity, depth to high water table, depth to bedrock or pan, and soil moisture and temperature regime. Examples of upland deciduous trees are bigtooth maple, velvet ash, and madrone.

Ratings for *upland coniferous trees* provide guidelines for determining soil quality as a medium for growing a diverse upland coniferous tree community that meet specific local habitat requirements for targeted and non-targeted species of wildlife. Typically, coniferous trees can subsist in harsher soil conditions than geographically related hardwoods and the soil properties and features that affect the ability of these species to thrive include available water capacity, depth to high water table, depth to bedrock or pan, and soil moisture and temperature regime. Examples of upland coniferous trees are Douglas fir, ponderosa pine, and southwestern white pine.

Ratings for *upland mixed deciduous and coniferous* trees indicate the limitation of the soils as a growing medium for a diverse upland deciduous-coniferous tree community that meets specific local habitat requirements for targeted and non-targeted wildlife species. A mixed deciduous-coniferous forest can subsist under a wide variety of soil conditions. Typically, better soil conditions are required to maintain the deciduous species, but many of these species adapt to harsher conditions. The soil properties and features that affect the ability of the deciduous and coniferous trees to thrive include available water capacity, depth to a high water table and its seasonal duration, depth to bedrock or a cemented pan, and soil moisture and temperature regimes.

Ratings for *riparian herbaceous plants* indicate the limitation of the soils as a growing medium for herbaceous plants that are adapted to soil conditions that are wetter than those common in the drier upland areas. The soils suitable for this habitat generally are on flood plains, in depressions, on bottomland, in drainageways adjacent to streams, or in any other area where the soil is either saturated for some period during the year or is subject to periodic overflow from ponding or flooding. The soil properties and features that affect the ability of riparian herbaceous plants to persist include soil texture, content of organic matter, depth to a high water table, the frequency and duration of ponding and flooding, the presence of excess salts in the soil, rock fragments, and the soil temperature regime. Examples of riparian herbaceous plants are globemallow, alkali sacaton, giant sacaton, and burrobush.

Ratings for *riparian shrubs, vines, and trees* indicate the limitation of the soils as a growing medium for shrubs, vines, and trees that are adapted to soil conditions that are wetter than those common in the drier upland areas. The soils suitable for this habitat generally are on flood plains, in depressions, on bottomland, in drainageways adjacent to streams, in areas of springs and seeps, or in any other area where the soil is either saturated for some period during the year or is subject to periodic overflow from ponding or flooding. The soil properties and features that affect the ability of riparian shrubs, vines, and trees to persist include available water capacity, depth to a high water table, the frequency and duration of ponding and flooding, the presence of excess salts in the soil, and the soil temperature regime. Examples of riparian shrubs, vines, and trees are spiny hackberry, cottonwood, desert willow, willow species, little walnut, baccharis, screwbean mesquite, and saltcedar.

Hydric Soils

In this section, hydric soils are defined and described and the hydric soils in the survey area, if present, are listed.

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for each of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 1995). These criteria are used to identify a phase of a soil series that normally is associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 1998) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils in this survey area are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and others, 1998).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The only identified hydric soils in Big Bend National Park, are in the Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded soil mapping unit. About 1 percent of the unnamed minor components are hydric soils that occur in concave areas.

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. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading "Soil Properties."

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 between the surface and a depth of 5 to 7 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 should 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 particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, 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 kinds 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and 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

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 25 and Table 26 shows the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

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 soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential) (fig. 55), and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Landscaping requires soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sanitary Facilities

Table 27 and Table 28 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction, and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Figure 55.—This segment of Route 12 that crosses a stratum of Pen Clay has been repaired numerous times. Geefour silty clay occurs where the material, seen in the roadcut, is exposed at the surface. The high shrink-swell of the smectite clay deteriorates the pavement, necessitating continual maintenance of the road surface. The Chisos Mountains are in the background.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

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. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, 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. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

A *trench sanitary landfill* is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed.

Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution. Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill.

Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse.

The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

In an *area sanitary landfill*, solid 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. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

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 the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid.

Construction Materials

Table 29 and Table 30 provides information about the soils as potential sources of gravel, sand, topsoil, reclamation material, and roadfill. Normal compaction, minor processing, and other standard construction practices are assumed.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 29, only the likelihood 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 Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

The soils are rated *good, fair*, or *poor* as potential sources of sand and gravel. A rating of good or fair means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated *good, fair*, or *poor* as potential sources of reclamation material, roadfill, and topsoil. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of reclamation material, roadfill, or topsoil. The lower the number, the greater the limitation.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

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 whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a 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 AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

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. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

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 31 provides 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; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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. Embankments that have zoned construction (core and shell) are not considered. 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.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained 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. Samples are taken from some typical profiles and tested in the laboratory to determine particle-size distribution, plasticity, and compaction characteristics.

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 to characterize key soils.

The estimates of soil properties are shown in tables. They include physical and chemical soil properties, erosion properties, engineering index properties, soil organic carbon, water and soil features, and physical and chemical analyses of selected soils.

Engineering Index Properties

Table 32 provides the engineering classifications and the range of index properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

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 mm across. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, 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 (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches across 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, CL-ML.

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 across is classified in one of seven groups from A-1 through A-7 on the basis of particle-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 10 inches across and 3 to 10 inches across 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 across based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 mm, 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 particle-size distribution, liquid limit, and plasticity index are generally 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 generally omitted in the table.

Physical Soil Properties

Table 33 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle-size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle-sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 mm in diameter. In Table 33, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 mm in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle-size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar or 1/10 bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 mm in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

*Permeability (*Ksat*)* refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (K-sat). The estimates in the table indicate the rate of water movement, in inches per hour, 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 and septic tank absorption fields.

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 soil layer. The capacity varies, depending on soil properties that affect retention of water. 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.

Linear extensibility (shrink-swell potential) refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3 bar or 1/10 bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In Table 33, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 mm in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion Properties

Erosion factors are shown in table 34 as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of several factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) 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 and on soil structure and permeability. *Value*s of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Depth to the upper and lower boundaries of each layer is indicated.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 mm in size.

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 susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. A description of the wind erodibility groups is available in the National Soil Survey Handbook (http://soils.usda.gov/technical/handbook/).

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion.

There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Soil Properties

Table 35 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases 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. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil 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.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 mm in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 mm in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

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 (dS/m) or decisiemens per meter (dS/m) 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.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Soil Organic and Inorganic Carbon

Table 36 displays soil organic carbon (SOC) and soil inorganic carbon (SIC) in kilograms per square meter to a 2-meter depth or to representative top depth of any bedrock kind or any cemented soil horizon.

SOC and *SIC* are reported on a volumetric whole soil basis, corrected for representative rock fragments in the database. The soil organic carbon is converted from horizon soil organic matter content of the less than 2mm fraction of the soil. If soil organic matter in the database is NULL, SOC is assumed to be zero. The soil inorganic carbon is converted from horizon calcium carbonate content of the less than 2mm fraction of the soil. If horizon calcium carbonate in the database is NULL, SIC is assumed to be zero. A weighted average of all horizons is used in the calculations.

Water Features

Table 37 provides estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 37 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 21 indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

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 little or no horizon development.

Also considered is 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.

Soil Features

Table 38 provides estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes 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 results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete 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 also is expressed as *low, moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 39, and the results of chemical analysis in table 40. The data are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are typical of the series. They are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by Soil Characterization Laboratory, Texas A&M University at College Station, Texas, and the National Soil Survey Laboratory, USDA-NRCS, Lincoln, Nebraska.

Depth to the upper and lower boundaries of each layer is indicated.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 mm across. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (USDA, 1996).

Sand—(0.05- to 2.0-mm fraction) weight percentages of material less than 2 mm (3A1)
Silt—(0.002 to 0.05-mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1)
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1)

Coarse fragments, percentage—(3A2A1)
Extractable cations—ammonium acetate pH 7.0, ICP; calcium (6N2e, 6N2f), magnesium (6O2d, 6O2e), sodium (6P2b, 6P2c), potassium (6Q2b, 6Q2c)
Cation-exchange capacity—sum of cations (4B4b1)
Base saturation—ammonium acetate, pH 7.0 (4B4c1)
Organic carbon—wet combustion. Walkley-Black modified acid-dichromate, ferric sulfate titration (6A1c, obsolete)
Reaction (pH)—1:1 water dilution (4C1a2a1)
Calcium carbonate equivalent—(6E1)
Electrical conductivity—saturation extract (4F2b1)
Sodium adsorption ratio (4F3b)

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1998 and 1999). 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. Table 41 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve 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 *Aridisol.*

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 Calcid (*Cal*, meaning lime, plus *id*, from Aridisol).

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; type of saturation; 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 Haplocalcid (*Haplo*, meaning minimal horizonation, plus *calcids*, the suborder of the Aridisols that has a calcic horizon).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Ustic* identifies the subgroup which is wetter than the subgroup that typifies the great group. An example is Ustic Haplocalcids.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, 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, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is *loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids.*

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each 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" (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1999) and in "Keys to Soil Taxonomy" (Soil Survey Staff, 1998). Unless otherwise indicated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

Agust Series

Classification: Coarse-loamy, mixed, superactive, hyperthermic Ustic Haplocalcids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Alluvial fans and terraces
Parent material: Loamy gravelly alluvium and colluvium
Slope: 1 to 3 percent
Elevation: 2,630 to 3,330 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Agust gravelly fine sandy loam in an area of Equipaje-Agust complex, 1 to 3 percent slopes. Big Bend National Park, Brewster County, TX; USGS Dagger Flat, Texas 7.5 minute topographic quadrangle; UTM Easting: 676676 m, UTM Northing: 3281879 m, UTM Zone 13.

A—0 to 2 inches; pale brown (10YR 6/3) gravelly fine sandy loam, brown (10YR 4/3), moist; weak medium granular structure; very friable, slightly hard, slightly sticky, slightly plastic; moderate excavation difficulty; 5 percent nonflat subrounded indurated igneous gravel and 10 percent nonflat subrounded indurated limestone gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—2 to 11 inches; pale brown (10YR 6/3) gravelly fine sandy loam, brown (10YR 4/3), moist; weak medium subangular blocky structure; very friable, slightly hard, slightly sticky, slightly plastic; moderate excavation difficulty; 15 percent distinct carbonate coats on rock fragments; 5 percent nonflat subrounded indurated igneous gravel and 10 percent nonflat subrounded indurated limestone gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—11 to 28 inches; light yellowish brown (10YR 6/4) gravelly loamy sand, dark yellowish brown (10YR 4/4), moist; weak medium subangular blocky structure; very friable, slightly hard, slightly sticky, slightly plastic; moderate excavation difficulty; 10 percent distinct carbonate coats on rock fragments; 5 percent nonflat subrounded indurated igneous gravel and 25 percent nonflat subrounded indurated limestone gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—28 to 80 inches; light yellowish brown (10YR 6/4) very gravelly fine sandy loam, dark yellowish brown (10YR 4/4), moist; slightly sticky, slightly plastic; moderate excavation difficulty; 5 percent nonflat subrounded indurated igneous gravel and 30 percent nonflat subrounded indurated limestone gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: 11 to 36 inches over unconsolidated loamy and sandy sediments
Depth to calcic horizon: 6 to 30 inches
Coarse fragments: Mostly igneous and limestone and range from 12 mm to as much as 200 mm in diameter, but most are less than 75 mm

Surface fragments: 5 to 30 percent
Particle-size control section (weighted average):
Clay content: 10 to 18 percent
Coarse fragments: 15 to 35 percent

A horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 3 or 4 moist
Chroma: 3 or 4, dry or moist
Texture: Loamy fine sand, sandy loam, or fine sandy loam
Rock fragments: 5 to 35 percent mixed igneous and limestone fragments
Effervescence: Slight to violent
Reaction: Neutral to moderately alkaline

Bk horizon

Hue: 5YR to 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 or 4, dry or moist
Texture: Loamy sand, sandy loam, or fine sandy loam
Rock fragments: 5 to 35 percent mixed igneous and limestone fragments
Calcium carbonate equivalent: 5 to 15 percent by weight
Effervescence: Strong to violent
Reaction: Slightly alkaline or moderately alkaline

C horizon

Hue: 5YR to 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 or 4, dry or moist
Texture: Loamy sand, sandy loam, or fine sandy loam
Coarse fragments: Gravelly or very gravelly
Calcium carbonate equivalent: 5 to 15 percent
Effervescence: Strong to violent
Reaction: Slightly alkaline or moderately alkaline

Altar Series

Classification: Loamy-skeletal, mixed, superactive, thermic Ustic Haplocambids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Fan terraces
Parent material: Colluvium and residuum weathered from limestone bedrock
Slope: 1 to 8 percent
Elevation: 2,680 to 4,895 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Typical Pedon

Altar gravelly sandy loam in an area of Altar gravelly sandy loam, 1 to 8 percent slopes; Big Bend National Park, Brewster County, TX; USGS Panther Junction, Texas 7.5 minute topographic quadrangle; UTM Easting: 670452 m, UTM Northing: 3245922 m, UTM Zone 13.

A—0 to 7 inches; brown (10YR 5/3) gravelly sandy loam, brown (10YR 4/3), moist; weak fine subangular blocky structure parting to weak very fine granular; very friable, slightly hard, slightly sticky, slightly plastic; common very fine and common fine roots; 30 percent nonflat subangular indurated igneous gravel; very slightly effervescent; neutral; clear smooth boundary.

Bw—7 to 19 inches; brown (10YR 5/3) extremely gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure parting to weak very fine granular; very friable, slightly hard, slightly sticky, slightly plastic; common very fine and common fine roots; 5 percent nonflat subrounded indurated igneous cobbles and 60 percent nonflat subrounded indurated igneous gravel; very slightly effervescent; neutral; gradual smooth boundary.

C—19 to 80 inches; yellowish brown (10YR 5/4) extremely gravelly coarse sandy loam, dark yellowish brown (10YR 4/4), moist; single-grain; very friable, slightly hard, slightly sticky, slightly plastic; common very fine, common fine, and common medium roots; 10 percent nonflat subrounded indurated igneous cobbles and 60 percent nonflat subrounded indurated igneous gravel; strongly effervescent; neutral.

Range in Characteristics

Soil moisture: Ustic aridic soil moisture regime
Rock fragments: 35 to 80 percent gravel and cobbles

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 2 to 6, dry or moist
Texture: Sandy loam
Rock fragments: 15 to 80 percent gravel and cobbles
Organic matter: Less than 1 percent
Reaction: Neutral

Bw horizon

Hue: 5YR to 10YR
Value: 2 to 7 dry, 2 to 6 moist
Chroma: 2 to 6, dry or moist
Texture: Sandy loam, loam, sandy clay loam, or clay loam
Clay content: 10 to 30 percent
Rock fragments: 35 to 80 percent gravel and cobbles
Reaction: Neutral

C horizon

Hue: 7.5YR or 10YR
Value: 2 to 6 dry, 2 to 4 moist
Chroma: 2 to 8, dry or moist
Texture: Sand, coarse sand, loamy sand, coarse sandy loam, sand loam, or loam
Rock fragments: 35 to 90 percent gravel and cobble
Other features: In some pedons the C horizon is not present. In some pedons a buried Btb horizon is present at depths of 30 inches or more. These horizons have hue of 2.5YR or 5YR and contain more clay than is typical of the C horizon.
Reaction: Neutral

Altuda Series

Classification: Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderate

Landform: Mountain slopes, ridges
Parent material: Colluvium and residuum weathered from limestone bedrock
Slope: 10 to 70 percent
Elevation: 4,025 to 6,940 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 180 to 220 days

Typical Pedon

Altuda very cobbly silt loam (fig. 56) in an area of Altuda-Rock outcrop complex, 20 to 70 percent slopes. Big Bend National Park, Brewster County, TX; USGS Sue Peaks, Texas 7.5 minute topographic quadrangle; UTM Easting: 694040 m, UTM Northing: 3257792 m, UTM Zone 13.

Ak—0 to 6 inches; brown (7.5YR 4/2) very cobbly silt loam, dark brown (7.5YR 3/2), moist; moderate medium granular structure; friable, hard, slightly sticky, slightly plastic; very high excavation difficulty; 60 percent carbonate coats on rock fragments; 1 percent nonflat subangular indurated limestone stones, 20 percent nonflat subangular indurated limestone gravel, and 30 percent nonflat subangular indurated limestone cobbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

Bk—6 to 10 inches; dark grayish brown (10YR 4/2) very cobbly silt loam, dark brown (7.5YR 3/2), friable, hard, slightly sticky, slightly plastic; very high excavation difficulty; 60 percent carbonate coats on bedrock; 5 percent medium carbonate masses in cracks; 2 percent nonflat subangular indurated limestone stones, 15 percent nonflat subangular indurated limestone gravel, and 35 percent nonflat subangular indurated limestone cobbles; violently effervescent; moderately alkaline; gradual wavy boundary.

R—10 to 20 inches; limestone bedrock.

Range in Characteristics

Soil moisture: Aridic ustic moisture regime
Depth to hard limestone bedrock: 6 to 19 inches
Coarse fragments: 35 to 75 percent

A horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3, dry or moist
Texture: Loam, silt loam, silty clay loam, or clay loam
Clay content: 20 to 35 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3, dry or moist
Texture: Loam, silt loam, silty clay loam, or clay loam
Clay content: 20 to 35 percent
Calcium carbonate equivalent: 55 to 70
Carbonate coats: Few threads and films, pendants up to 20 mm thick on fragments, and undersides of fragments
Effervescence: Strong or violent
Reaction: Moderately alkaline

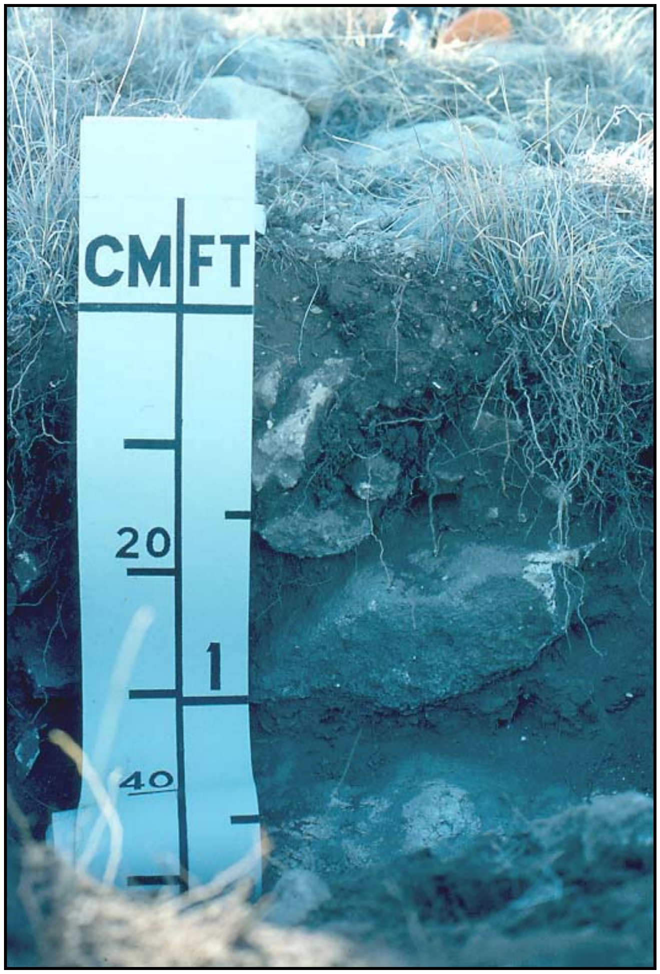

Figure 56.—Profile of Altuda very cobbly silt loam, in an area of Altuda-Rock outcrop complex, 20 to 70 percent slopes. The parent material is coarsely fractured limestone bedrock. (Scale in CM—Centimeters, FT—Feet)

R layer

Kind: Limestone
Calcium carbonate: Range from thin coatings to seams and cracks filled with secondary calcium carbonate

Bissett Series

Classification: Loamy-skeletal, carbonatic, thermic Lithic Ustic Haplocalcids
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills
Parent material: Colluvium and residuum weathered from limestone
Slope: 5 to 60 percent
Elevation: 2,695 to 5,815 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Typical Pedon

Bissett very gravelly loam (fig. 57) in an area of Bissett-Rock outcrop complex, 20 to 70 percent slopes. Big Bend National Park, Brewster County, TX; USGS Dagger Flat, Texas 7.5 minute topographic quadrangle; UTM Easting: 690520 m, UTM Northing: 3267471 m, UTM Zone 13.

A—0 to 3 inches; brown (10YR 5/3) very gravelly loam, brown (10YR 4/3), moist; weak medium granular structure; slightly hard, friable, common very fine and fine roots, 55 percent nonflat subangular indurated limestone gravel; strongly effervescent; moderately alkaline; clear smooth.

Bk—3 to 17 inches; brown (10YR 5/3) very gravelly clay loam, brown (10YR 4/3), moist; weak medium granular structure; slightly hard, friable; common very fine and fine roots; 60 percent distinct carbonate coats on rock fragments; 20 percent nonflat subangular indurated limestone cobbles, and 35 percent nonflat subangular indurated limestone gravel; violently effervescent; moderately alkaline; abrupt smooth.

R—17 to 27 inches; limestone bedrock.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to bedrock: 6 to 20 inches
Calcium carbonate equivalent: 40 to 80 percent by volume
Organic carbon: 0.3 to 0.9 percent in horizons above lithic contact

A horizon

Hue: 7.5YR or 10YR
Value: 4 or 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Loam
Rock fragments: 25 to 60 percent, but averages greater than 35 percent
Calcium carbonate coats: Few to many coatings of calcium carbonate and pendants on lower surfaces.
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR
Value: 4 or 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Loam or clay loam
Rock fragments: 25 to 60 percent, but averages greater than 35 percent
Calcium carbonate coats: Few to many coatings of calcium carbonate and pendants on lower surfaces.
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

R layer

Kind: Limestone bedrock

Blackgap Series

Classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Haplocalcids
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderate

Figure 57.—Profile of Bissett very gravelly loam in an area of Bissett-Rock outcrop complex, 20 to 70 percent slopes. Bissett soils contain more than 35 percent coarse fragments, and are shallow soils over limestone. (Scale in centimeters)

Landform: Hills, ridges
Parent material: Residuum and colluvium derived from thick-bedded limestone bedrock
Slope: 1 to 60 percent
Elevation: 1,725 to 4,635 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Blackgap very gravelly loam (fig. 58) in an area of Blackgap-Rock outcrop complex, 10 to 30 percent slopes. Big Bend National Park, Brewster County, TX; USGS Rio Grande, Texas 7.5 minute topographic quadrangle; UTM Easting: 696679 m, UTM Northing: 3232058 m, UTM Zone 13.

Ak—0 to 5 inches; light brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 5/4), moist; weak fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; very high excavation difficulty; 30 percent carbonate coats on rock fragments; 10 percent nonflat subangular indurated limestone cobbles, and 40 percent nonflat subangular indurated limestone gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bk—5 to 11 inches; light brown (7.5YR 6/4) extremely cobbly silt loam, brown (7.5YR 5/4), moist; weak fine granular structure; friable, slightly hard, slightly sticky, slightly plastic; very high excavation difficulty; 65 percent carbonate coats on bedrock; 25 percent nonflat subangular indurated limestone cobbles, and 35 percent nonflat subangular indurated limestone gravel; strongly effervescent; moderately alkaline; abrupt irregular boundary.

R—11 to 21 inches; limestone bedrock.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to bedrock: 7 to 20 inches
Rock fragments: 35 to 80 percent with 10 to 35 percent gravel, 20 to 45 percent cobbles, and 0 to 20 percent stones
Calcium carbonate equivalent: More than 40 percent
Particle-size control section (weighted average):
Clay content: 18 to 27 percent

A horizon

Hue: 7.5YR to 2.5Y
Value: 5 to 8, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Loam or silt loam
Clay content: 15 to 27 percent
Rock fragments: 25 to 60 percent, but average greater than 40 percent
Calcium carbonate coatings: Faint coats up to pendants 25 mm thick on rock fragments
Effervescence class: Strong or violent
Reaction: Moderately alkaline

Figure 58.—Profile of Blackgap very gravelly loam in an area of Blackgap-Rock outcrop complex, 10 to 30 percent slopes. Hard limestone bedrock ranges in depth from 7 to 20 inches (18 cm to 51 cm). (Scale in CM—centimeters, FT—feet)

Bk horizon

Hue: 7.5YR to 2.5Y
Value: 5 to 8, dry or moist
Chroma: 3 to 5, dry or moist
Texture: Very fine sandy loam, fine sandy loam, or silt loam
Clay content: 15 to 27 percent
Rock fragments: 25 to 60 percent, but averages greater than 40 percent
Calcium carbonate coatings: Faint coats up to pendants 25 mm thick on rock fragments
Effervescence class: Violent
Reaction: Moderately alkaline

R layer

Kind: Limestone bedrock
Cementation: Strongly cemented or indurated
Calcium carbonate coats: On fracture surfaces

Brewster Series

Classification: Loamy-skeletal, mixed, superactive, thermic Aridic Lithic Haplustolls
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderately slow
Landform: Igneous hills and mountains
Parent material: Colluvium and residuum weathered from igneous bedrock
Slope: 20 to 45 percent
Elevation: 4,120 to 7,480 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 180 to 220 days

Typical Pedon

Brewster very gravelly loam in an area of Rock outcrop-Brewster complex, 20 to 60 percent slopes. Big Bend National Park, Brewster County, TX; USGS The Basin, Texas 7.5 minute topographic quadrangle; UTM Easting: 668158 m, UTM Northing: 3241424 m, UTM Zone 13.

A—0 to 4 inches; reddish gray (5YR 5/2) dry, very gravelly loam, dark reddish brown (5YR 3/2) moist; weak medium granular structure; very friable, slightly hard, nonsticky, nonplastic; 40 percent nonflat igneous gravel, and 10 percent nonflat igneous cobbles; noneffervescent; neutral; very abrupt irregular boundary.
R—4 to 14 inches; indurated rhyolite bedrock.

Range in Characteristics

Soil moisture: Aridic ustic moisture regime
Depth to bedrock: 4 to 20 inches
Rock fragments: 35 to 80 percent with 25 to 70 percent gravel, 0 to 25 percent cobbles, and 0 to 20 percent stones
Reaction: Slightly acid to slightly alkaline

A horizon

Hue: 5YR to 10YR
Value: 3 to 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Loam, silt loam, or clay loam

Clay content: 18 to 35 percent
Effervescence: None or slight

R layer

Kind: Rhyolite, trachyte, basalt, and quartz bedrock
Calcium carbonate coatings: Few on faces of fracture planes, in some pedons
Secondary carbonates: Less than 5 percent

Castolon Series

Classification: Fine-silty, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Flood plains of large rivers
Parent material: Stratified loamy alluvium
Slope: 0 to 1 percent
Elevation: 1,710 to 2,315 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days
Flooding frequency: Occasionally

Typical Pedon

Castolon silty clay loam in an area of Vicente, Lomapelona, and Castolon soils 0 to 1 percent slopes, flooded. Big Bend National Park, Brewster County, TX; USGS Castolon, Texas 7.5 minute topographic quadrangle; UTM Easting: 38391 m, UTM Northing: 3225857 m, UTM Zone 13.

A1—0 to 1 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3), moist; weak medium platy structure; very friable, slightly hard; many very fine pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.
A2—1 to 9 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3), moist; weak medium granular structure; very friable, slightly hard; common fine roots; common fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.
C1—9 to 18 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3), moist; massive; very friable, slightly hard; common fine roots; common fine pores; strongly effervescent; moderately alkaline; gradual smooth boundary.
C2—18 to 35 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4), moist; massive; very friable, slightly hard; common fine roots; common fine pores; strongly effervescent; moderately alkaline; gradual smooth boundary.
C3—35 to 80 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4), moist; massive; very friable, slightly hard; common fine roots; common very fine pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: Greater than 60 inches
Stratification: Common strata of finer or coarser material 1 to 24 inches thick
Salinity: Not saline to moderately saline
Reaction: Slightly alkaline or moderately alkaline
Particle-size control section (weighted average):
Clay content: 18 to 35 percent

A horizon

Hue: 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 5, dry or moist
Texture: Very fine sandy loam, fine sandy loam, or silty clay loam
Clay content: 5 to 45 percent
Effervescence: Slight or strong

C horizon

Hue: 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 5, dry or moist
Texture: Silt, silt loam, silty clay loam, loam, clay loam, or clay
Clay content: 18 to 45 percent
Effervescence: Slight or strong

Chilicotal Series

Classification: Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Fan remnants
Parent material: Loamy and gravelly piedmont sediments
Slope: 1 to 30 percent
Elevation: 2,510 to 4,855 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Typical Pedon

Chilicotal very gravelly fine sandy loam (fig. 59) in an area of Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes. Big Bend National Park, Brewster County, TX; USGS Panther Junction, Texas 7.5 minute topographic quadrangle; UTM Easting: 672072 m, UTM Northing: 3249676 m, UTM Zone 13.

A—0 to 2 inches; brown (7.5YR 5/4) dry, very gravelly fine sandy loam; brown (7.5YR 4/4) moist; weak fine granular structure; very friable, slightly hard; many fine and medium roots; 40 percent subangular nonflat igneous gravel; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—2 to 7 inches; brown (7.5YR 4/4) dry, very gravelly loam; brown (7.5YR 4/4) moist; weak fine subangular blocky structure; very friable, slightly hard; common fine roots; 1 percent fine threadlike finely disseminated carbonates; 40 percent nonflat subangular indurated igneous gravel; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk1—7 to 14 inches; brown (7.5YR 5/4) very gravelly loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; friable, slightly hard; common fine roots; common carbonate coats on bottom surfaces of rock fragments; 10 percent threadlike finely disseminated carbonates; 50 percent nonflat subangular indurated igneous gravel and 2 percent nonflat subangular indurated igneous cobbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—14 to 23 inches; brown (7.5YR 5/4) very gravelly clay loam, brown (7.5YR 4/4), moist; weak fine subangular blocky structure; friable, slightly hard; common fine roots; 30 percent carbonate coats on rock fragments; 15 percent threadlike carbonate, finely

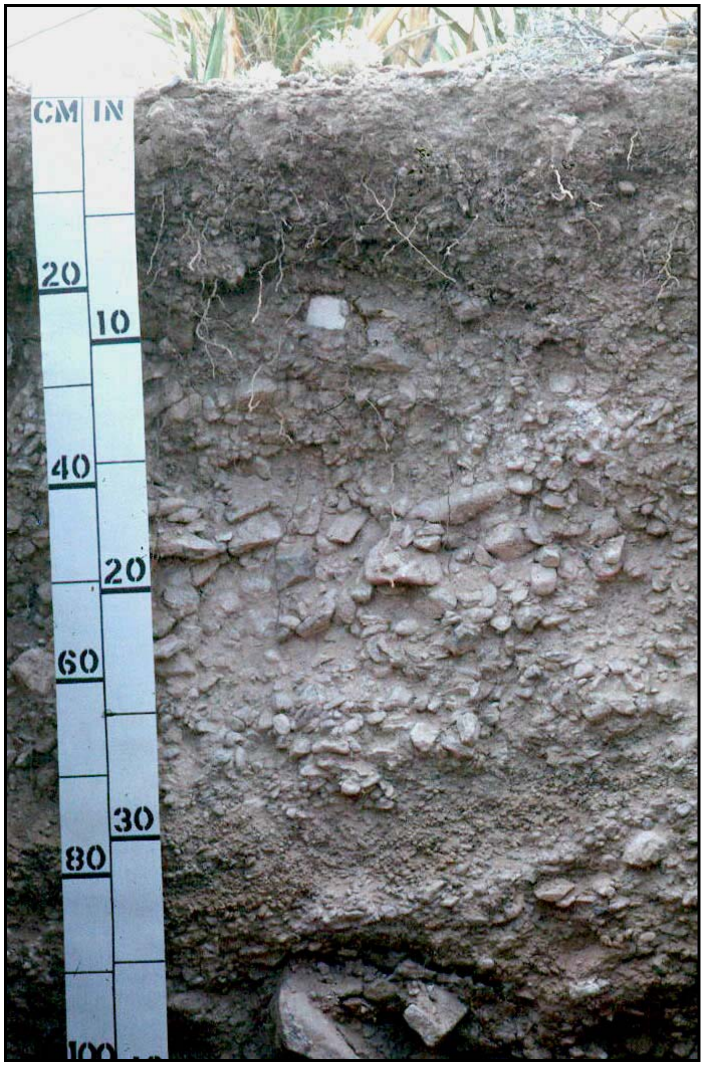

Figure 59.—Chilicotal very gravelly fine sandy loam in an area of Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes. Rock fragments comprise more than 35 percent of the 10- to 40-inch control section. (Scale in CM—centimeters, IN—inches)

disseminated; 55 percent nonflat subangular indurated igneous gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk3—23 to 28 inches; brown (7.5YR 5/4) extremely gravelly loam, brown (7.5YR 4/4), moist; moderate very fine granular structure; friable, slightly hard; common very fine roots; 40 percent carbonate coats on rock fragments; 15 percent threadlike carbonate, finely disseminated; 60 percent nonflat subangular indurated igneous gravel; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bk4—28 to 40 inches; light brown (7.5YR 6/4) extremely gravelly loam, brown (7.5YR 5/4), moist; weak very fine granular structure; friable, very hard; few very fine roots; 40 percent carbonate coats on rock fragments; 70 percent nonflat subangular indurated 2 to 75 mm igneous fragments; upper 3 inches is weakly cemented, becoming moderately cemented in lower part; violently effervescent; moderately alkaline; clear smooth boundary.

Bk5—40 to 51 inches; pink (7.5YR 7/4) very gravelly sandy loam, brown (7.5YR 5/4), moist; weak very fine granular structure; very friable, slightly hard; few very fine roots; 60 percent carbonate coats on rock fragments; 50 percent nonflat subangular indurated igneous gravel; violently effervescent; moderately alkaline; clear smooth boundary.

Bk6—51 to 80 inches; pink (7.5YR 7/4) extremely gravelly sandy loam, brown (7.5YR 5/4), moist; weak very fine granular structure; friable, slightly hard; few very fine roots; 15 percent carbonate coats on rock fragments; 70 percent nonflat subangular indurated igneous gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to calcic horizon: 6 to 12 inches
Solum thickness: More than 80 inches
Rock fragments: 35 to 70 percent
Particle-size control section (weighted average):
Clay content: 15 to 27 percent
Calcium carbonate equivalent: 10 to 50 percent, averages 10 to 40 percent

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, fine sandy loam, or sandy clay loam
Effervescence: Slight
Reaction: Moderately alkaline

Bw and Bk horizons

Hue: 7.5YR or 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, fine sandy loam, loam, or clay loam
Calcium carbonate equivalent: 8 to 35 percent
Effervescence: Bw—slight; Bk—strong or violent
Reaction: Moderately alkaline in the upper part; moderately alkaline or strongly alkaline in the lower part

Chillon Series

Classification: Loamy-skeletal, mixed, superactive, hyperthermic Ustic Haplocambids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Low terraces, flood-plain steps
Parent material: Gravelly alluvium derived from igneous and sedimentary rock
Slope: 1 to 3 percent
Elevation: 1,850 to 4,295 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days
Flooding frequency: Rare

Typical Pedon

Chillon very gravelly fine sandy loam in an area of Chillon very gravelly fine sandy loam, 1 to 3 percent slopes, rarely flooded. Big Bend National Park, Brewster County, TX;

USGS San Vicente, Texas 7.5 minute topographic quadrangle; UTM Easting: 693172 m, UTM Northing: 3230088 m, UTM Zone 13.

A—0 to 5 inches; yellowish brown (10YR 5/4) very gravelly fine sandy loam, brown (10YR 5/3), moist; weak medium subangular blocky structure parting to weak very fine subangular blocky structure; slightly hard, very friable; few very fine roots; 55 percent nonflat subrounded indurated igneous gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

Bw—5 to 42 inches; yellowish brown (10YR 5/4) very gravelly fine sandy loam, brown (10YR 5/3), moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; few very fine roots; 5 percent nonflat subrounded indurated igneous cobbles and 46 percent nonflat subrounded indurated igneous gravel; strongly effervescent; moderately alkaline (pH 8.1); clear smooth boundary.

C—42 to 80 inches; light yellowish brown (10YR 6/4) very gravelly coarse sandy loam, pale brown (10YR 6/3), moist; single-grain; 5 percent nonflat subrounded indurated igneous cobbles and 46 percent nonflat subrounded indurated igneous gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: More than 60 inches
Calcium carbonate equivalent: Less than 5 percent

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 7, dry or moist
Chroma: 3 to 6, dry or moist
Texture: Sandy loam, fine sandy loam, or loam
Clay content: 5 to 18 percent
Coarse fragments: More than 35 percent igneous gravel
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bw horizon

Hue: 5YR to 10YR
Value: 4 to 6, dry or moist
Chroma: 3 to 6, dry or moist
Texture: Coarse sandy loam, sandy loam, fine sandy loam, or loam
Clay content: 5 to 18 percent
Coarse fragments: More than 35 percent igneous gravel
Effervescence: Strong or violent
Reaction: Moderately alkaline

C horizon

Hue: 7.5YR or 10YR
Value: 4 to 6, dry or moist
Chroma: 3 to 6, dry or moist
Texture: Coarse sandy loam, sandy loam, fine sandy loam, loam, or clay loam
Clay content: 5 to 35 percent
Secondary calcium carbonate: 10 to 20 percent visible calcium carbonate in the form of fine, weakly cemented concretions and masses
Effervescence: Strong or violent
Reaction: Moderately alkaline

Corazones Series

Classification: Loamy-skeletal, mixed, superactive, hyperthermic Ustic Haplocalcids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Pediments
Parent material: Gravelly alluvium derived from igneous and sedimentary rock
Slope: 1 to 30 percent
Elevation: 1,860 to 4,295 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Corazones very gravelly sandy loam (fig. 60) in an area of Corazones very gravelly sandy loam, 1 to 8 percent slopes. Big Bend National Park, Brewster County, TX; USGS San Vicente, Texas 7.5 minute topographic quadrangle; UTM Easting: 692441 m, UTM Northing: 3230798 m, UTM Zone 13.

A—0 to 4 inches; pink (7.5YR 7/4) very gravelly sandy loam, brown (7.5YR 5/4), moist; weak medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; 45 percent nonflat igneous gravel; strongly effervescent; moderately alkaline; clear smooth boundary.
Bk1—4 to 13 inches; pink (7.5YR 7/4) very gravelly loam, brown (7.5YR 5/4), moist; weak medium granular structure; friable, hard, slightly sticky, slightly plastic; 25 percent prominent carbonate coats on rock fragments; 3 percent nonflat igneous cobbles, and 47 percent nonflat igneous gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bk2—13 to 31 inches; pink (7.5YR 7/4) extremely gravelly loam, brown (7.5YR 5/4), moist; weak fine granular structure; friable, hard, slightly sticky, slightly plastic; 20 percent prominent carbonate coats on rock fragments; 15 percent nonflat igneous cobbles, and 45 percent nonflat igneous gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bk3—31 to 55 inches; pink (7.5YR 7/4) extremely gravelly loam, brown (7.5YR 5/4), moist; massive; friable, slightly hard, slightly sticky, slightly plastic; 5 percent distinct carbonate coats on rock fragments; 12 percent nonflat igneous cobbles, and 48 percent nonflat igneous gravel; strongly effervescent; moderately alkaline; diffuse smooth boundary.
BCk—55 to 80 inches; light brown (7.5YR 6/4) extremely gravelly sandy loam, brown (7.5YR 5/4), moist; weak fine granular structure; very friable, loose, slightly sticky, slightly plastic; 80 percent nonflat igneous gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to calcic horizon: 4 to 25 inches
Solum thickness: Greater than 80 inches
Surface fragments: A desert pavement of igneous gravel covers from 75 to 95 percent of the surface
Particle-size control section (weighted average):
Clay content: 7 to 18 percent

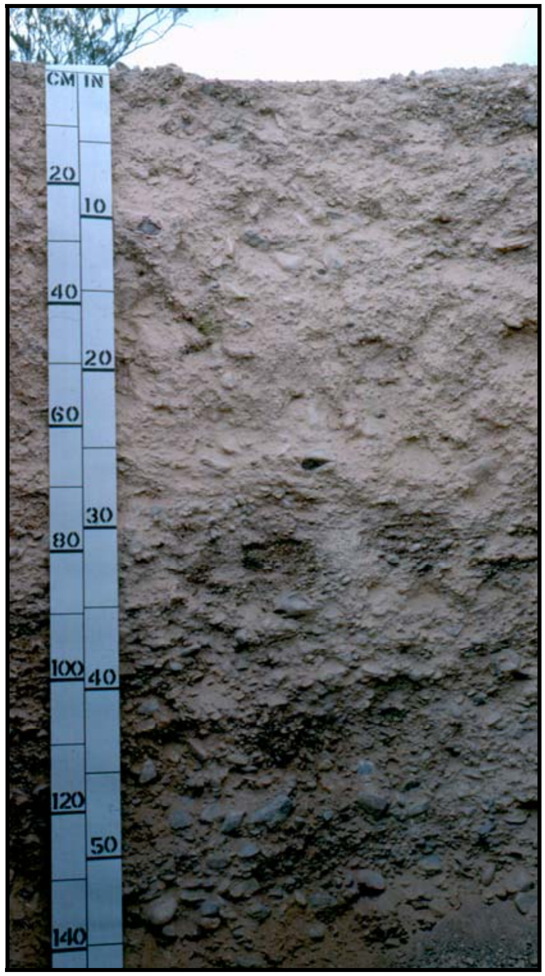

Figure 60.—Profile of Corazones very gravelly sandy loam in an area of Corazones very gravelly sandy loam, 1 to 8 percent slopes. Corazones soils formed in gravelly alluvium, and are on pediments. The gravels are readily observable at a depth of 30 inches (76 cm). (Scale in CM-centimeters, IN-inches)

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam or loam
Coarse fragments: 15 to 60 percent gravel and cobbles
Calcium carbonate content: 5 to 15 percent
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Bw horizon (where present)

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam or loam
Coarse fragments: 15 to 60 percent gravel and cobbles

Calcium carbonate content: 5 to 15 percent
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR
Value: 5 to 8, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Loamy coarse sand, loamy sand, coarse sandy loam, sandy loam, or loam
Coarse fragments: 35 to 80 percent gravel and cobbles
Calcium carbonate: 15 to 30 percent
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Equipaje Series

Classification: Coarse-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Piedmont slopes, alluvial fans, and stream terraces
Parent material: Loamy alluvium derived from igneous and sedimentary rock
Slope: 1 to 3 percent
Elevation: 2,630 to 3,330 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Equipaje fine sandy loam, in an area of Equipaje-Agust complex, 1 to 3 percent slopes. Big Bend National Park, Brewster County, TX; USGS Twin Peaks, Texas 7.5 minute topographic quadrangle; UTM Easting: 672209 m, UTM Northing: 3273748 m, UTM Zone 13.

A—0 to 2 inches; light yellowish brown (10YR 6/4) dry, stratified, fine sandy loam; brown (10YR 4/3) moist; weak medium platy structure; few very fine roots; 1 percent subrounded igneous gravel; deposition strata up to 1 inch thick and very evident, lenses of loamy coarse sand are associated with strata; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw1—2 to 5 inches; brown (10YR 5/3) dry, stratified, fine sandy loam; brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; many very fine, common fine, and few medium roots; 3 percent distinct very pale brown (10YR 8/2), dry, carbonate coats on rock fragments; 1 percent subrounded igneous gravel; deposition strata up to 1 inch thick and very evident, lenses of loamy coarse sand are associated with strata; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw2—5 to 18 inches; light yellowish brown (10YR 6/4) dry, fine sandy loam; dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure parting to weak fine and medium subangular blocky; many very fine and common fine roots; 20 percent distinct very pale brown (10YR 8/2), dry, carbonate coats on rock fragments; 2 percent subrounded igneous gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw3—18 to 26 inches; light yellowish brown (10YR 6/4) dry, fine sandy loam; yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; many very fine and common fine roots; 60 percent distinct very pale brown (10YR 8/2), dry, carbonate coats on rock fragments; 8 percent subrounded igneous gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw4—26 to 53 inches; light yellowish brown (10YR 6/4) dry, sandy loam; dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; common very fine and common fine roots; 60 percent distinct very pale brown (10YR 8/2), dry, carbonate coats on rock fragments; 5 percent subrounded igneous gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw5—53 to 80 inches; yellowish brown (10YR 5/4) dry, fine sandy loam; dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular structure; few very fine and few fine roots; common medium tubular high continuity pores; 25 percent distinct very pale brown (10YR 8/2), dry, carbonate coats on rock fragments; 1 percent faint very pale brown (10YR 8/2), dry, carbonate coats on all faces of peds; 3 percent subrounded igneous gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: More than 60 inches
Rock fragments: 0 to 15 percent, mainly igneous gravel; in any one horizon of some pedons, may range to 35 percent but the weighted average within the particle-size control section is less than 15 percent
Calcium carbonate equivalent: 2 to 5 percent
Reaction: Neutral to moderately alkaline
Particle-size control section (weighted average):
Clay content: 10 to 18 percent

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Fine sandy loam
Clay content: 7 to 18 percent
Effervescence: Slight or strong

Bw horizon

Hue: 7.5YR or 10YR
Value: 4 to 7, dry or moist
Chroma: 3 to 6, dry or moist
Texture: Sandy loam or fine sandy loam
Clay content: 7 to 18 percent
Effervescence: Slight or strong

Geefour Series

Classification: Clayey, smectitic, calcareous, hyperthermic, shallow Ustic Torriorthents
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Slow
Landform: Erosional hillslopes associated with badlands, above desert basin floors
Parent material: Colluvium and clayey residuum weathered from mudstone
Slope: 3 to 45 percent
Elevation: 1,810 to 4,560 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Geefour silty clay (fig. 61) in an area of Geefour silty clay, 3 to 20 percent slopes. Big Bend National Park, Brewster County, TX; USGS Terlingua, Texas 7.5 minute topographic quadrangle; UTM Easting: 643225 m, UTM Northing: 3236625 m, UTM Zone 13.

A1—0 to 6 inches; brown (7.5YR 5/3) silty clay, brown (7.5YR 4/3), moist; moderate medium subangular blocky structure; very hard, very firm; few very fine roots; strongly effervescent; moderately alkaline; clear smooth.

A2—6 to 15 inches; brown (7.5YR 5/3) silty clay, brown (7.5YR 4/3), moist; moderate medium subangular blocky structure; very hard, very firm; few very fine roots; 1 percent fine distinct threadlike salt crystals with sharp boundaries in matrix; 1 percent fine distinct irregular carbonate masses with clear boundaries in matrix; slightly effervescent; moderately alkaline; clear smooth.

Cd—15 to 25 inches; gray (10YR 5/1) noncemented mudstone that has silty clay texture, dark grayish brown (10YR 4/2), moist; massive with moderate medium and coarse angular rock structure; extremely hard, extremely firm; 1 percent fine distinct threadlike salt crystals with sharp boundaries in cracks; 1 percent fine distinct irregular carbonate masses with clear boundaries in cracks; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime

Depth to mudstone: 3 to 20 inches

Surface fragments: Most areas have a desert pavement of coarse fragments of 50 to 80 percent gravel, 10 to 40 percent cobbles, and 0 to 10 percent stones, covering 40 to 90 percent of the surface

Figure 61.—A profile of Geefour silty clay in an area of Geefour silty clay, 10 to 45 percent slopes. The Geefour Series consists of silty clay A horizons over densic material. (Scale in centimeters)

A1 horizon

Hue: 7.5YR to 5Y
Value: 6 or 7 dry, 4 to 6 moist
Chroma: 2 to 4, dry or moist
Coarse fragments: 0 to 15 percent igneous gravel
Texture: Silty clay loam, silty clay, or clay
Effervescence: Slight to strong
Reaction: Moderately alkaline or strongly alkaline

A2 or BC horizon

Hue: 10YR to 5Y
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 4, dry or moist
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Pararock fragments: 5 to 35 percent noncemented mudstone fragments
Effervescence: Slight to strong
Reaction: Moderately alkaline or strongly alkaline

Cd layer

Hue: 10YR to 5Y
Value: 4 to 7, dry or moist
Chroma: 1 to 4, dry or moist
Texture: Mudstone that has texture of silty clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Effervescence: Slight to strong
Reaction: Moderately alkaline or strongly alkaline
Other features: Dense mudstone that slakes in water

Hurds Series

Classification: Loamy-skeletal, mixed, superactive, thermic Aridic Argiustolls
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans and terraces
Parent material: Colluvium and alluvium derived from igneous rock
Slope: 10 to 30 percent
Elevation: 4,020 to 6,525 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 180 to 220 days

Typical Pedon

Hurds very cobbly loam in an area of Hurds very cobbly loam, 10 to 30 percent slopes. Big Bend National Park, Brewster County, TX; USGS The Basin, Texas 7.5 minute topographic quadrangle; UTM Easting: 668142 m, UTM Northing: 3241278 m, UTM Zone 13.

A1—0 to 7 inches; dark reddish gray (5YR 4/2) very cobbly loam, dark reddish brown (5YR 2.5/2), moist; moderate medium granular structure; very friable, slightly hard; 15 percent nonflat angular indurated igneous gravel and 20 percent nonflat angular indurated igneous cobbles; noneffervescent; slightly acid; clear smooth boundary.

A2—7 to 10 inches; dark reddish gray (5YR 4/2) very cobbly loam, dark reddish brown (5YR 3/2), moist; moderate fine granular structure; very friable, slightly hard; 20

percent nonflat angular indurated igneous gravel and 25 percent nonflat angular indurated igneous cobbles; noneffervescent; slightly acid; clear smooth boundary.

Bt1—10 to 22 inches; reddish brown (5YR 5/3) very cobbly sandy clay loam, reddish brown (5YR 4/3), moist; moderate medium subangular blocky structure; friable, slightly hard; 10 percent distinct clay films on rock fragments; 20 percent distinct clay films on all faces of peds; 20 percent nonflat subangular indurated igneous gravel and 25 percent nonflat angular indurated igneous cobbles; noneffervescent; slightly acid; clear smooth boundary.

Bt2—22 to 33 inches; reddish brown (5YR 5/3) very cobbly sandy clay loam, reddish brown (5YR 4/3), moist; moderate medium subangular blocky structure; friable, slightly hard; 10 percent distinct clay films on all faces of peds; 25 percent nonflat subangular indurated igneous gravel and 30 percent nonflat angular indurated igneous cobbles; noneffervescent; slightly acid; clear smooth boundary.

Bt3—33 to 80 inches; reddish brown (5YR 4/3) very cobbly sandy clay loam, dark reddish brown (5YR 3/3), moist; moderate medium subangular blocky structure; friable, slightly hard; 5 percent faint clay films on all faces of peds; 20 percent nonflat subangular indurated igneous gravel and 25 percent nonflat angular indurated igneous cobbles; noneffervescent; slightly acid.

Range in Characteristics

Soil moisture: Aridic ustic moisture regime
Solum thickness: More than 80 inches
Thickness of mollic epipedon: 10 to 20 inches thick
Particle-size control section (weighted average):
Clay content: 18 to 35 percent

A horizon

Hue: 5YR or 7.5YR
Value: 4 or 5 dry, 2.5 or 3 moist
Chroma: 2 or 3, dry or moist
Texture: Sandy loam, loam, or sandy clay loam
Coarse fragments: 15 to 50 percent, comprising 15 to 50 percent gravel and 0 to 15 percent cobbles and stones
Effervescence: None
Reaction: Slightly acid or neutral

Bt horizon

Hue: 5YR or 7.5YR
Value: 3 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, or sandy clay loam with lamellae of sandy clay loam, clay loam, or sandy clay
Rock fragments: 15 to 70 percent, comprising 35 to 70 percent gravel, cobbles 2 to 20 percent, and 0 to 20 percent stones
Effervescence: None
Reaction: Moderately acid or slightly acid

C horizon (where present)

Hue: 5YR or 7.5YR
Value: 4 to 6, dry or moist
Chroma: 3 or 4, dry or moist
Texture: Loamy sand, sandy loam, or loam

Rock fragments: 15 to 70 percent, comprising 35 to 70 percent gravel, 2 to 20 percent cobbles, and 0 to 20 percent stones
Reaction: Moderately acid or slightly acid

Lazarus Series

Classification: Fine-loamy, mixed, superactive, mesic Pachic Argiustolls
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Drainageways of hillslopes and fan piedmonts
Parent material: Alluvium derived from sandstone, limestone, and shale
Slope: 0 to 3 percent
Elevation: 5,575 to 7,780 feet
Mean annual precipitation: 18 to 26 inches
Mean annual air temperature: 56 to 59 degrees F
Frost-free period: 160 to 200 days

Typical Pedon

(The Lazarus soils mapped in Big Bend National Park, are considered a taxadjunct to the Lazarus series because the particle-size control section is fine-loamy instead of fine-silty.)

Lazarus loam in an area of Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes. Big Bend National Park, Brewster County, TX; USGS Emory Peak, Texas 7.5 minute topographic quadrangle; UTM Easting: 663921 m, UTM Northing: 3236237 m, UTM Zone 13.

A—0 to 5 inches; black (10YR 3/2) loam, black (10YR 2/2), moist; moderate medium subangular blocky structure parting to moderate fine granular; loose, loose; common very fine, common fine, and few medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.
Bt1—5 to 18 inches; black (10YR 3/2) clay loam, very dark brown (10YR 2/2), moist; strong fine and medium subangular blocky structure parting to moderate fine granular; friable, moderately hard; common very fine, common fine, and few medium roots; 20 percent distinct clay films on all faces of peds; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bt2—18 to 24 inches; black (10YR 3/2) clay loam, black (10YR 2/2), moist; strong fine and medium subangular blocky structure parting to moderate fine granular; friable, moderately hard; common very fine, common fine, common medium, and common coarse roots; 20 percent distinct clay films on all faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.
Bt3—24 to 36 inches; black (10YR 3/2) clay loam, black (10YR 2/2), moist; strong fine and medium subangular blocky structure parting to strong very fine and fine subangular blocky; friable, moderately hard; common very fine and common fine roots; 10 percent distinct clay films on all faces of peds; 3 percent subangular medium limestone gravel; violently effervescent; moderately alkaline; gradual smooth boundary.
Btk—36 to 80 inches; dark gray (10YR 4/2) clay loam, very dark gray (10YR 3/2), moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; firm, hard; 10 percent distinct carbonate coats on rock fragments; 10 percent clay films on all faces of peds; 3 percent subangular medium limestone gravel; violently effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic ustic moisture regime
Depth to base of mollic epipedon: Greater than 20 inches

Depth to base of argillic horizon: Greater than 40 inches
Particle-size control section (weighted average):
Clay content: 27 to 35 percent
Rock fragment content: Less than 1 percent

A horizon

Hue: 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 to 4 dry, 2 or 3 moist
Texture: Silt loam or loam
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Bt horizon

Hue: 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 to 4 dry, 2 or 3 moist
Texture: Silt loam, silty clay loam, or clay loam
Clay content: 27 to 35 percent
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

Leyva Series

Classification: Clayey-skeletal, mixed, superactive, thermic Lithic Ustic Haplargids
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderately slow
Landform: Pediments, hills and mountains
Parent material: Colluvium and residuum from weathered from rhyolite
Slope: 10 to 30 percent
Elevation: 2,460 to 5,435 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Typical Pedon

Leyva very gravelly loam (fig. 62) in an area of Leyva-Rock outcrop complex, 10 to 30 percent slopes. Big Bend National Park, Brewster County, TX; USGS The Basin, Texas 7.5 minute topographic quadrangle; UTM Easting: 667516m, UTM Northing: 3248102 m, UTM Zone 13.

A—0 to 4 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2), moist; moderate fine and medium subangular blocky structure parting to moderate very fine granular; friable, slightly hard, moderately sticky, moderately plastic; common very fine, common fine, and common medium roots; 10 percent angular igneous cobbles, and 35 percent angular igneous gravel; noneffervescent; neutral; clear smooth boundary.

Bt—4 to 15 inches; brown (7.5YR 4/3) very gravelly clay loam, dark brown (7.5YR 3/3), moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky structure; friable, moderately hard; common very fine and common fine roots; 20 percent distinct clay films on rock fragments and 20 percent distinct clay films on all faces of peds; 10 percent angular igneous cobbles, and 45 percent angular igneous gravel; noneffervescent; neutral; very abrupt smooth boundary.

R—15 to 25 inches; very strongly cemented rhyolite bedrock.

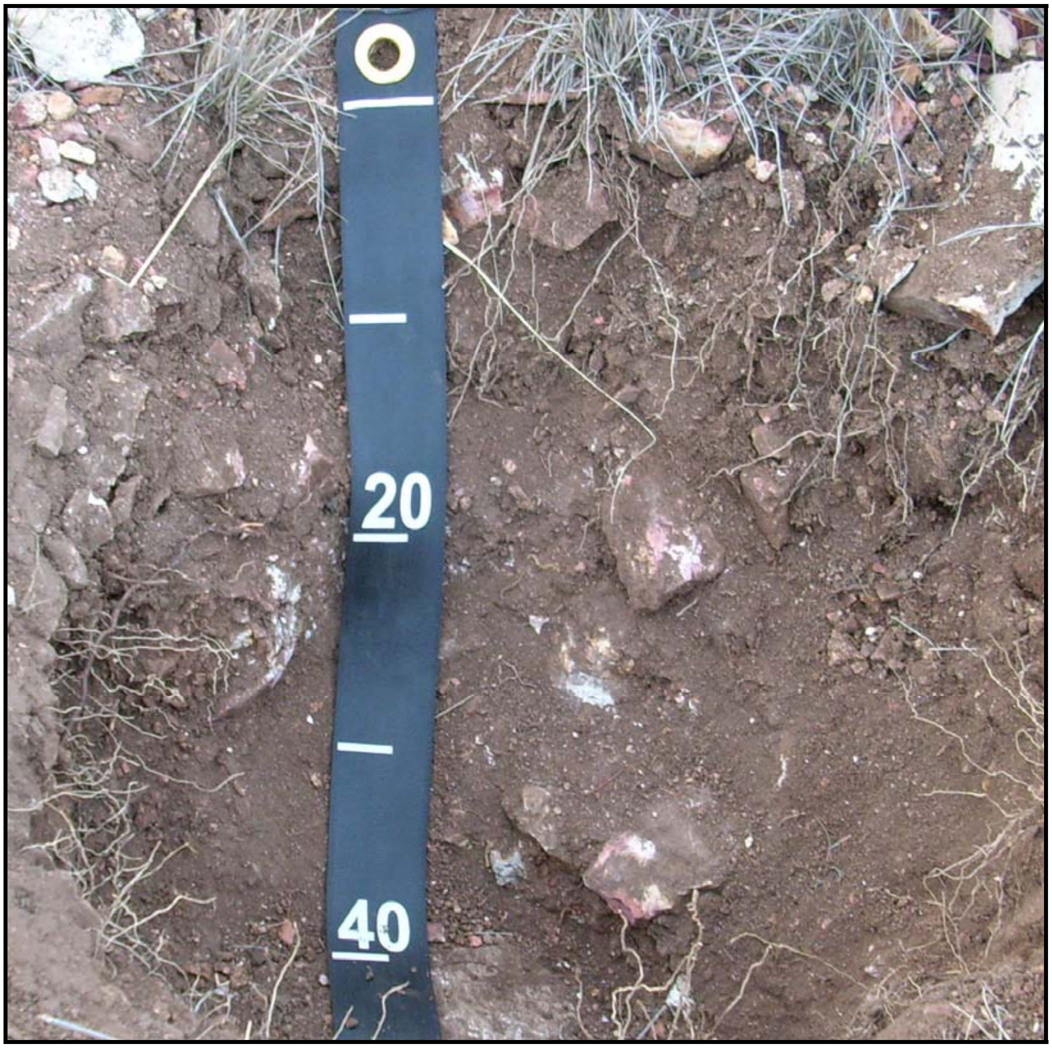

Figure 62.—Profile of Leyva very gravelly loam in an area of Leyva-Rock outcrop complex, 10 to 30 percent slopes. Leyva soils contain more than 35 percent coarse fragments and are very shallow and shallow. The surface layer is very gravelly loam, about 4 inches (10 cm) thick. The subsoil from 4 to 15 inches (10 to 38 cm) is very gravelly clay loam. The substratum is rhyolite bedrock. (Scale in centimeters)

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to bedrock: 8 to 18 inches
Rock fragments: 35 to 80 percent gravel, cobbles, or stones
Reaction: Moderately acid to slightly alkaline
Calcium carbonate equivalent: Less than 3 percent
Particle-size control section (weighted average):
Clay content: 35 to 45 percent

A horizon

Hue: 5YR or 7.5YR
Value: 3 or 4 dry, 2.5 or 3 moist
Chroma: 2 to 4 dry, 2 or 3 moist
Texture: Loam

Clay content: 17 to 35 percent
Coarse fragments: 20 to 70 percent
Effervescence: None
Reaction: Neutral

Bt horizon

Hue: 5YR or 7.5YR
Value: 3 to 5 dry, 2.5 to 4 moist
Chroma: 2 to 4, dry or moist
Texture: Clay loam or clay
Clay content: 36 to 48 percent
Coarse fragments: 45 to 80 percent
Effervescence: None
Reaction: Neutral

R layer

Kind: Rhyolite bedrock
Hardness: Strongly cemented to indurated

Lingua Series

Classification: Loamy-skeletal, mixed, superactive, nonacid, thermic Lithic Ustic Torriorthents
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Hillslopes
Parent material: Residuum weathered mainly from igneous bedrock
Slope: 20 to 60 percent
Elevation: 2,385 to 7,365 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Typical Pedon

Lingua very gravelly sandy clay loam (fig. 63) in an area of Lingua-Rock outcrop complex, 20 to 60 percent slopes. Big Bend National Park, Brewster County, TX; USGS Grapevine Hills, Texas 7.5 minute topographic quadrangle; UTM Easting: 674981 m, UTM Northing: 325453 m, UTM Zone 13.

A1—0 to 5 inches; brown (7.5YR 4/3) very gravelly sandy clay loam, dark brown (7.5YR 3/2), moist; weak fine subangular blocky structure; 54 percent nonflat subangular indurated igneous gravel; noneffervescent; neutral; clear smooth boundary.
A2—5 to 13 inches; brown (7.5YR 4/4) extremely gravelly sandy clay loam, dark brown (7.5YR 3/3), moist; weak fine subangular blocky structure; 62 percent nonflat subangular indurated igneous gravel; noneffervescent; neutral; abrupt smooth boundary.
R—13 to 23 inches; very strongly cemented rhyolite bedrock.

Range in Characteristics

Soil moisture: Ustic aridic soil moisture regime.
Depth to igneous bedrock: 4 to 15 inches
Organic carbon content: Less that 2 percent
Surface fragments: 60 to 90 percent

Figure 63.—Profile of Lingua very gravelly sandy clay loam in an area of Lingua-Rock outcrop complex, 20 to 60 percent slopes. Lingua soils are very shallow and shallow over trachyte bedrock. (Scale in Centimeters)

Reaction: Neutral to moderately alkaline
Particle-size control section (weighted average):
Clay content: 18 to 35 percent

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 5, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Loam, sandy clay loam, or clay loam
Coarse fragments: 35 to 80 percent; mostly gravel but some cobbles
Calcium carbonate equivalent: 0 to about 1 percent
Effervescence: None in the upper part, and none to slight in the lower part

R layer

Kind: Rhyolite bedrock
Cementation: Very strongly cemented or indurated

Liv Series

Classification: Clayey-skeletal, smectitic, thermic Pachic Paleustolls
Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills and mountains
Parent material: Colluvium and residuum weathered from trachyte
Slope: 20 to 45 percent
Elevation: 4,615 to 7,180 feet
Mean annual precipitation: 18 to 26 inches
Mean annual air temperature: 56 to 59 degrees F
Frost-free period: 160 to 200 days

Typical Pedon

Liv very gravelly clay loam in an area of Liv-Mainstay-Rock outcrop complex, 20 to 45 percent slopes. Big Bend National Park, Brewster County, TX; USGS The Basin, Texas 7.5 minute topographic quadrangle; UTM Easting: 665536 m, UTM Northing: 3238012 m, UTM Zone 13.

A—0 to 9 inches; brown (7.5YR 4/2) very gravelly clay loam, dark brown (7.5YR 3/2), moist; weak medium granular structure; very friable, hard, moderately sticky, moderately plastic; 10 percent nonflat subangular indurated trachyte cobbles, and 45 percent nonflat subrounded indurated trachyte gravel; noneffervescent; neutral; clear smooth boundary.
Bt1—9 to 23 inches; reddish brown (5YR 4/3) very gravelly clay, dark reddish brown (5YR 3/3), moist; moderate fine subangular blocky structure; firm, hard, very sticky, very plastic; 20 percent distinct clay films on all faces of peds; 10 percent distinct clay films on rock fragments; 10 percent nonflat subangular indurated trachyte cobbles, and 40 percent nonflat subrounded indurated trachyte gravel; noneffervescent; neutral; clear smooth boundary.
Bt2—23 to 38 inches; reddish brown (5YR 4/3) extremely cobbly clay, dark reddish brown (5YR 3/3), moist; moderate fine subangular blocky structure; firm, hard, very sticky, very plastic; 10 percent distinct clay films on all faces of peds; 20 percent nonflat subrounded indurated trachyte gravel, and 45 percent nonflat subangular indurated trachyte cobbles; noneffervescent; neutral; abrupt irregular boundary.
R—38 to 48 inches; trachyte bedrock; very strongly cemented; broken boundary.

Range in Characteristics

Soil moisture: Aridic ustic moisture regime
Depth to soft bedrock: 20 to 40 inches
Thickness of the mollic epipedon: More than 20 inches
Rock fragments: 35 to 80 percent angular igneous fragments

A horizon

Hue: 7.5YR or 10YR
Value: 3 or 4, dry or moist
Chroma: 2, dry or moist
Texture: Sandy loam, loam, silt loam, or clay loam
Rock fragments: 35 to 60 percent trachyte gravels or cobbles

Effervescence: None
Reaction: Slightly acid or neutral

Bt horizon

Hue: 5YR to 10YR
Value: 3 to 5, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Clay
Clay content: 50 to 70 percent
Coarse fragments: 35 to about 80 percent by volume, and are angular trachyte or rhyolite
Reaction: Slightly acid or neutral

R layer

Kind: Igneous bedrock or tuff
Cementation: Very strongly cemented
Calcium carbonate: Few to many, masses, in some pedons

Lomapelona Series

Classification: Coarse-loamy, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Stratified loamy alluvium
Slope: 0 to 1 percent
Elevation: 1,710 to 2,315 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Lomapelona fine sandy loam in an area of Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded. Big Bend National Park, Brewster County, TX; USGS Castolon, Texas 7.5 minute topographic quadrangle; UTM Easting: 641467 m, UTM Northing: 3225294 m, UTM Zone 13.

A—0 to 8 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3), moist; weak fine granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.
C1—8 to 42 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3), moist; single-grain; loose, slightly hard, slightly sticky, nonplastic; strongly effervescent; moderately alkaline; gradual wavy boundary.
C2—42 to 60 inches; brown (10YR 5/3) loam, brown (10YR 4/3), moist; single-grain; loose, slightly hard, moderately sticky, moderately plastic; common very fine, common fine, and common medium roots; 2 percent nonflat subrounded indurated igneous gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.
C3—60 to 80 inches; light yellowish brown (10YR 6/4) sand, light olive brown (10YR 5/4), moist; single-grain; loose, slightly hard, nonsticky, nonplastic; few fine roots; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Stratitification: Common strata of finer or coarser material that are 1 to 24 inches thick

Thickness of Ap horizon: 8 to 14 inches
Solum thickness: More than 60 inches
Salinity: Not saline to strongly saline
Reaction: Slightly alkaline to strongly alkaline
Particle-size control section (weighted average):
  Clay content: Less than 18 percent

A horizon

Hue: 10YR
Value: 3 to 5, dry or moist
Chroma: 3 or 4, dry or moist
Texture: Very fine sandy loam, fine sandy loam, loam, sandy clay loam, silt loam, silty clay loam, clay loam, or clay
Clay content: 5 to 45 percent
Effervescence: Slight or strong

C horizon

Hue: 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 5, dry or moist
Texture: Sand, loamy fine sand, loamy very fine sand, sandy loam, fine sandy loam, very fine sandy loam, loam, sandy clay loam, silt, silt loam, silty clay loam, clay loam, or clay
Clay content: 2 to 45 percent
Effervescence: Slight or strong

Madrone Series

Classification: Clayey-skeletal, smectitic, mesic Typic Paleustalfs
Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Mountain slopes
Parent material: Residuum and colluvium weathered from igneous bedrock
Slope: 20 to 45 percent
Elevation: 5,575 to 7,780 feet
Mean annual precipitation: 18 to 26 inches
Mean annual air temperature: 56 to 59 degrees F
Frost-free period: 160 to 200 days

Typical Pedon

Madrone very gravelly loam, in an area of Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes. Big Bend National Park, Brewster County, TX; USGS Emory Peak, Texas 7.5 minute topographic quadrangle; UTM Easting: 665487 m, UTM Northing: 3235867 m, UTM Zone 13.

A—0 to 4 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2), moist; weak medium granular structure; slightly hard, friable, moderately sticky and moderately plastic; common very fine roots; 35 percent nonflat igneous gravel; noneffervescent; neutral; clear smooth boundary.
E—4 to 6 inches; pinkish gray (7.5YR 6/2) very gravelly loam, brown (7.5YR 4/2), moist; weak very fine subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common very fine roots; 35 percent nonflat igneous gravel; noneffervescent; slightly acid; clear smooth boundary.
Bt1—6 to 19 inches; reddish brown (5YR 5/3) very gravelly clay, reddish brown (5YR 4/3), moist; moderate medium subangular blocky structure; very hard, very firm, very

sticky and very plastic; few very fine roots; many clay films on all faces of peds; 45 percent nonflat igneous gravel, and 2 percent nonflat igneous cobbles; noneffervescent; moderately acid; gradual smooth boundary.

Bt2—19 to 32 inches; reddish brown (5YR 5/4) very gravelly clay, reddish brown (5YR 4/4), moist; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; many clay films on all faces of peds; 50 percent nonflat igneous gravel, and 3 percent nonflat igneous cobbles; noneffervescent; strongly acid; abrupt wavy boundary.

R—32 to 42 inches; rhyolite bedrock.

Range in Characteristics

Soil moisture: Typic ustic moisture regime
Depth to bedrock: 21 to 40 inches
Rock fragments: 35 to 80 percent; 15 to 50 percent igneous gravel, 5 to 40 percent igneous cobbles, and 0 to 30 percent igneous stones

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Sandy loam, loam, silt loam, or clay loam
Rock fragments: 35 to 80 percent
Effervescence: None
Reaction: Slightly acid or neutral

E horizon

Hue: 7.5YR or 10YR
Value: 6 or 7 dry, 4 moist
Chroma: 2 or 3, dry or moist
Texture: Sandy loam, loam, or clay loam
Rock fragments: 35 to 80 percent
Effervescence: None
Reaction: Slightly acid or neutral

Bt horizon

Hue: 5YR to 10YR
Value: 4 or 5, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Clay or silty clay
Clay content: 45 to 60 percent
Rock fragments: 35 to 60 percent
Effervescence: None
Reaction: Very strongly acid to moderately acid

R layer

Kind: Rhyolite or trachyte bedrock

Mainstay Series

Classification: Clayey-skeletal, smectitic, thermic Aridic Lithic Argiustolls
Depth class: Shallow
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills and mountains

Parent material: Colluvium and residuum weathered from igneous bedrock
Slope: 20 to 45 percent
Elevation: 4,615 to 7,180 feet
Mean annual precipitation: 18 to 26 inches
Mean annual air temperature: 56 to 59 degrees F
Frost-free period: 160 to 200 days

Typical Pedon

Mainstay very gravelly loam in an area of Liv-Mainstay-Rock outcrop complex, 20 to 45 percent slopes. Big Bend National Park, Brewster County, TX; USGS The Basin, Texas 7.5 minute topographic quadrangle; UTM Easting: 665240 m, UTM Northing: 3238918 m, UTM Zone 13.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) dry, very gravelly loam; very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, and moderately plastic; 50 percent nonflat igneous gravel; noneffervescent; neutral; clear smooth boundary.
Bt1—5 to 11 inches; reddish brown (7.5YR 4/3) dry, very gravelly clay; dark reddish brown (5YR 3/3) moist; strong medium angular blocky structure parting to strong fine angular blocky; very hard, very firm, very sticky, and very plastic; many clay films on all faces of peds and on rock fragments; 20 percent nonflat subangular indurated igneous cobbles, and 35 percent nonflat igneous gravel; noneffervescent; neutral; clear smooth boundary.
Bt2—11 to 18 inches; reddish brown (7.5YR 5/3) dry, very gravelly clay; reddish brown (5YR 4/3) moist; strong fine angular blocky structure; very hard, very firm, very sticky, and very plastic; many clay films on all faces of peds and on rock fragments; 20 percent nonflat subangular indurated igneous cobbles, and 35 percent nonflat igneous gravel; noneffervescent; neutral; abrupt irregular boundary.
R—18 to 28 inches; indurated rhyolite bedrock; noneffervescent.

Range in Characteristics

Soil moisture: Aridic ustic moisture regime
Depth to igneous bedrock: 10 to 20 inches
Rock fragments: 35 to 80 percent igneous gravel, cobbles, and stones

A horizon

Hue: 7.5YR to 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2, dry or moist
Texture: Fine sandy loam, loam, or silt loam
Effervescence: None to slight
Reaction: Neutral or slightly alkaline

Bt horizon

Hue: 5YR to 10YR
Value: 3 to 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Clay
Clay content: 50 to 70 percent
Calcium carbonate: Few masses occur in the lower part of some pedons
Effervescence: None to strong
Reaction: Slightly acid to slightly alkaline

R layer

Kind: Hard igneous bedrock

Mariscal Series

Classification: Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Torriorthents
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Limestone hills and plateaus
Parent material: Residuum and colluvium weathered from limestone and shale
Slope: 1 to 30 percent
Elevation: 1,820 to 3,930 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Mariscal extremely channery loam (fig. 64) in an area of Mariscal-Rock outcrop complex, 5 to 30 percent slopes. Big Bend National Park, Brewster County, TX; USGS Boquillas, Texas 7.5 minute topographic quadrangle; UTM Easting: 694458 m, UTM Northing: 323031 m, UTM Zone 13.

A—0 to 2 inches; pale brown (10YR 6/3) extremely channery loam, brown (10YR 4/3) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky, nonplastic; common fine and medium roots; 55 percent limestone channers and 5 percent flagstones; violently effervescent; moderately alkaline; abrupt smooth boundary.

Ak—2 to 5 inches; pale brown (10YR 6/3) extremely channery loam, brown (10YR 5/3) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, nonplastic; few fine roots; 55 percent limestone channers and 5 percent flagstones; lower side of channers coated with calcium carbonate; violently effervescent; moderately alkaline; abrupt smooth boundary.

Rk—5 to 10 inches; platy fractured limestone that has secondary coatings of calcium carbonate in seams and between plates; gradual smooth boundary.

R—10 to 40 inches; interbedded limestone bedrock 1 to 2 feet thick with layers of marl 1 to 10 inches thick.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to limestone bedrock: 4 to 20 inches
Particle-size control section (weighted average):
Calcium carbonate equivalent: 40 to 70 percent in the fine-earth fraction and ranges to 80 percent when less than 20 mm fragments are included
Rock fragments: 35 to 85 percent channers or flagstone

A horizon

Hue: 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, loam, or silt loam
Clay content: 10 to 30 percent
Rock fragments: Flaggy or channery limestone and caliche
Calcium carbonate: Faint films to pendants up to 10 mm thick
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

Figure 64.—Profile of Mariscal very channery loam, in an area of Mariscal-Rock outcrop complex, 5 to 30 percent slopes. Note the varying thickness of the fractured limestone bedrock and interbedded marl. (Scale in CM-centimeters, FT-feet)

Ak horizon

Hue: 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, loam, or silt loam
Clay content: 10 to 30 percent
Rock fragments: Flaggy or channery limestone and caliche
Calcium carbonate: Faint films to pendants up to 10 mm thick
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

BCk horizon (where present)

Hue: 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, loam, or silt loam
Clay content: 10 to 30 percent
Rock fragments: Flaggy or channery limestone and caliche
Calcium carbonate: Faint films to pendants up to 10 mm thick
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

R layer

Kind: Limestone bedrock that contains 10 to 50 percent caliche, chalk, or marl
Other features: Layers of the materials above are 0.25 to 10 inches thick

Musgrave Series

Classification: Clayey, mixed, superactive, calcareous, hyperthermic, shallow Ustic Torriorthents
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderately slow
Landform: Scarps and erosional uplands
Parent material: Residuum weathered from tuff
Slope: 1 to 20 percent
Elevation: 2,020 to 3,575 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Musgrave silty clay (fig. 65) in an area of Musgrave silty clay, 1 to 20 percent slopes. Big Bend National Park, Brewster County, TX; USGS Cerro Castellan, Texas 7.5 minute topographic quadrangle; UTM Easting: 645929 m, UTM Northing: 3226134 m, UTM Zone 13.

A—0 to 6 inches; light reddish brown (5YR 6/4), silty clay, reddish brown (5YR 5/4), moist; moderate fine and medium subangular blocky structure; hard, firm; few very fine and fine roots; 7 percent gypsum masses; very slightly effervescent; moderately alkaline; clear smooth boundary.
Cy—6 to 19 inches; light reddish brown (5YR 6/4), silty clay, reddish brown (5YR 5/4), moist; massive; hard, firm; 5 percent gypsum masses; very slightly effervescent; moderately alkaline; clear smooth boundary.
Cdy—19 to 41 inches; reddish brown (2.5YR 5/4), noncemented weathered tuff that has silty clay texture, reddish brown (2.5YR 4/4), moist; massive; 3 percent gypsum masses in cracks; very slightly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to weathered tuff bedrock: 4 to 20 inches
Calcium carbonate equivalent: Less than 15 percent
Surface fragments: 35 to 95 percent; kind—ignimbrite, tuff, limestone, and chert; size—gravels, cobbles, stones, and boulders
Particle-size control section (weighted average):
Clay content: 35 to 55 percent

A horizon

Hue: 5YR to 2.5Y
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Silty clay loam or silty clay
Clay content: 35 to 50 percent
Rock fragments: 0 to 15 percent
Calcium carbonate equivalent: 0 to 15 percent
Gypsum: 0 to 5 percent
SAR: 5 to 15
Effervescence: Very slight to violent
Reaction: Neutral to moderately alkaline

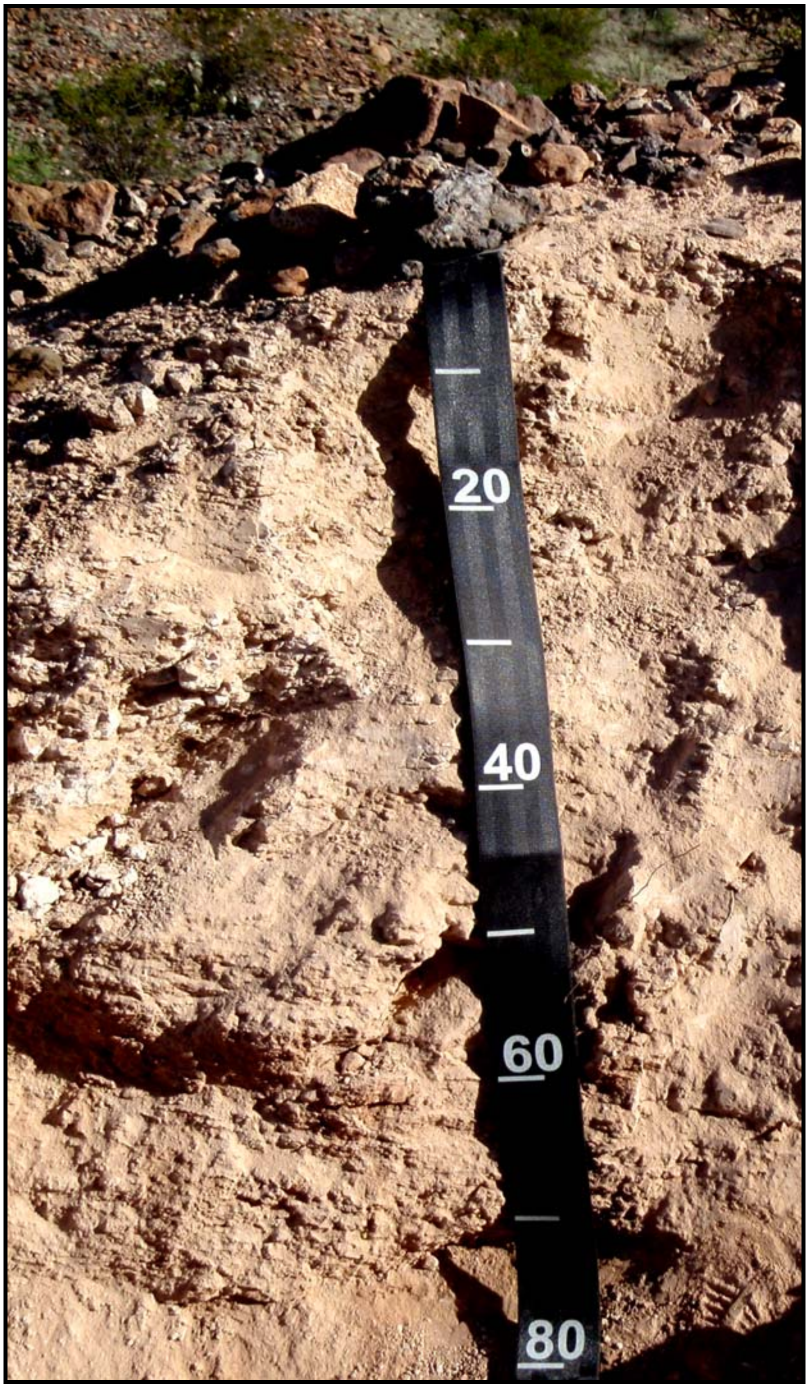

Figure 65.—Profile of Musgrave silty clay in an area of Musgrave silty clay, 1 to 20 percent slopes. Musgrave soils very shallow or shallow densic material. The densic material begins at a depth of about 48 cm. (Scale in centimeters)

Cy or C horizon

Hue: 5YR to 2.5Y
Value: 5 to 7, dry or moist
Chroma: 1 to 3, dry or moist

Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 55 percent
Pararock fragments: 5 to 75 percent weathered tuff fragments that slake in water
Calcium carbonate equivalent: 0 to 15 percent
Gypsum: 0 to 5 percent
SAR: 5 to 15
Effervescence: None to slight
Reaction: Neutral to moderately alkaline

Cd or Cdy layer

Kind: Weakly to moderately weathered tuff bedrock
Gypsum crystals: In some pedons, in cracks

Ninepoint Series

Classification: Fine-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial flats
Parent material: Calcareous alluvium derived from limestone and mudstone
Slope: 0 to 3 percent
Elevation: 1,835 to 3,430 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Ninepoint clay loam (fig. 66) in an area of Ninepoint clay loam, 0 to 3 percent slopes. Big Bend National Park, Brewster County, TX; USGS Twin Peaks, Texas 7.5 minute topographic quadrangle; UTM Easting: 668885 m, UTM Northing: 3276331 m, UTM Zone 13.

A—0 to 4 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3), moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable, slightly hard, moderately sticky, moderately plastic; few fine and common very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw1—4 to 12 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4), moist; strong coarse subangular blocky structure parting to strong fine subangular blocky; friable, moderately hard, moderately sticky, moderately plastic; few fine and common very fine roots; common fine high-continuity tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw2—12 to 31 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4), moist; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; friable, moderately hard, moderately sticky, moderately plastic; common very fine roots; common fine high-continuity tubular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bw3—31 to 80 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4), moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; friable, moderately hard, moderately sticky, moderately plastic; common very fine roots; common fine high-continuity tubular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: More than 60 inches

Figure 66.—Profile of Ninepoint clay loam in an area of Ninepoint clay loam, 0 to 3 percent slopes. Ninepoint soils have textures of clay loam throughout. These soils are very susceptible to water erosion because of the clay loam textures, and lack of vegetation. (Scale in centimeters)

Calcium carbonate equivalent: Less than 40 percent
Particle-size control section (weighted average):
Clay content: 20 to 35 percent

A horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 3 or 4 moist
Chroma: 3 or 4, dry or moist
Texture: Clay loam or silty clay loam
Clay content: 28 to 40 percent

Calcium carbonate equivalent: 10 to 30 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bw horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4, dry or moist
Texture: Sandy clay loam, clay loam, or silty clay loam
Clay content: 28 to 40 percent
Calcium carbonate equivalent: 15 to 30 percent, generally disseminated
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Paisano Series

Classification: Loamy-skeletal, carbonatic, thermic, shallow Calcic Petrocalcids
Depth class: Very shallow or shallow to a petrocalcic horizon
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Fan remnants
Parent material: Gravelly alluvium derived from mixed sources
Slope: 5 to 8 percent
Elevation: 2,595 to 4,855 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 62 to 67 degrees F
Frost-free period: 210 to 250 days

Typical Pedon

Paisano very gravelly fine sandy loam (fig. 67) in an area of Chilicotal-Paisano association, 5 to 30 percent slopes. Big Bend National Park, Brewster County, TX; USGS Panther Junction, Texas 7.5 minute topographic quadrangle; UTM Easting: 679666m, UTM Northing: 3237854 m, UTM Zone 13.

Ak—0 to 1 inches; light brown (7.5YR 6/4) very gravelly fine sandy loam, brown (7.5YR 4/4), moist; weak medium granular structure; very friable, slightly hard, slightly sticky, slightly plastic; 20 percent carbonate coats on rock fragments; 45 percent nonflat igneous gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—1 to 4 inches; light brown (7.5YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4), moist; moderate medium granular structure; very friable, slightly hard, slightly sticky, slightly plastic; 60 percent carbonate coats on rock fragments; 50 percent nonflat igneous gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

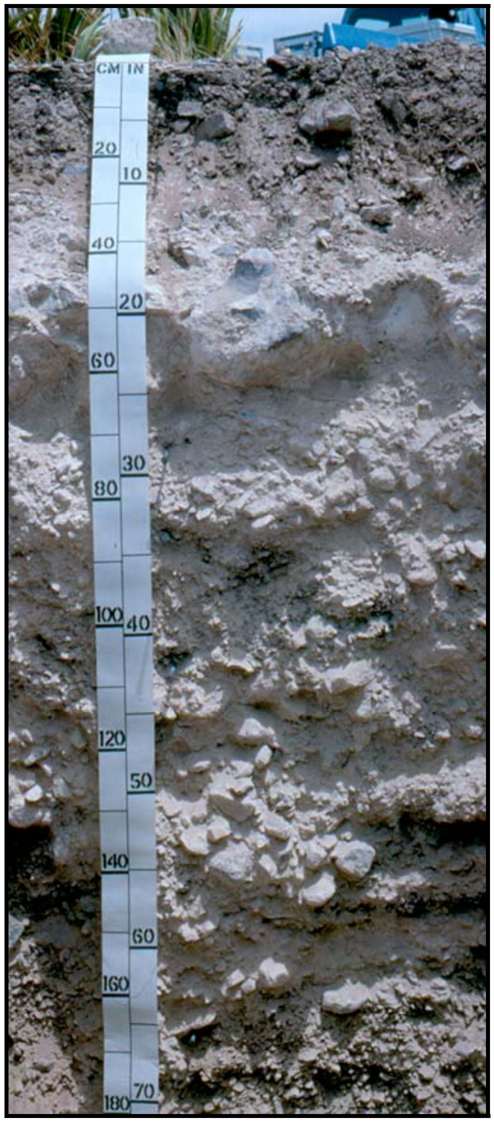

Figure 67.—Profile of Paisano very gravelly fine sandy loam in an area of Chilicotal-Paisano association, 5 to 30 percent slopes. Paisano soils are very shallow or shallow to a petrocalcic horizon. The petrocalcic horizon is at a depth of about 12 inches. Paisano soils formed from gravelly alluvium derived from mixed sources. (Scale in CM—Centimeters, IN—inches)

Bk2—4 to 12 inches; light brown (7.5YR 6/4) very gravelly sandy clay loam, brown (7.5YR 4/4), moist; moderate medium subangular blocky structure; high excavation difficulty; 60 percent carbonate coats on rock fragments; 50 percent nonflat igneous gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

Bkkm—12 to 16 inches; pinkish white (7.5YR 8/2) cemented material, pink (7.5YR 8/3), moist; massive; strongly cemented; strongly effervescent; gradual wavy boundary.

BCk—16 to 62 inches; pink (7.5YR 7/4) very gravelly loam, brown (7.5YR 5/4), moist; massive; very friable, slightly hard, slightly sticky, slightly plastic; 30 percent carbonate coats on rock fragments; 55 percent nonflat igneous gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to petrocalcic layer: 5 to 20 inches
Rock fragments: 35 to 60 percent. Fragments are mainly less than 3 inches in diameter, and are siliceous, sandstone, limestone and strongly cemented calcium carbonate pan fragments. Cobbles range from 0 to 10 percent
Reaction: Slightly alkaline or moderately alkaline throughout

Ak horizon

Hue: 7.5YR or 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 5, dry or moist
Texture: Sandy loam, fine sandy loam, or loam
Clay content: 12 to 20 percent
Rock fragments: 35 to 60 percent
Calcium carbonate equivalent: 20 to 50 percent
Effervescence: Strong or violent

Bk horizon or (Bw horizon, where present)

Hue: 7.5YR or 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 5, dry or moist
Texture: Sandy loam, loam, or sandy clay loam
Clay content: 12 to 20 percent
Rock fragments: 35 to 60 percent
Calcium carbonate equivalent: 25 to 55 percent
Effervescence: Strong or violent

Bkkm horizon

Hue: 7.5YR or 10YR
Value: 6 to 8, dry or moist
Chroma: 1 to 5, dry or moist
Thickness: 4 to 9 inches
Cementation: Indurated and continuous, except for scattered cracks and pockets
Effervescence: Strong or violent

BCk horizon

Hue: 7.5YR or 10YR
Value: 6 to 8, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, loam, or sandy clay loam
Rock fragments: 35 to 60 percent
Effervescence: Strong or violent

Pantera Series

Classification: Sandy-skeletal, mixed, hyperthermic Ustic Torrifluvents
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Flood plains
Parent material: Sandy and gravelly alluvium derived from mixed sources
Slope: 0 to 2 percent

Elevation: 1,735 to 4,140 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Pantera gravelly sand in an area of Riverwash and Pantera soils, 0 to 2 percent slopes, frequently flooded. Big Bend National Park, Brewster County, TX; USGS Cerro Castellan, Texas 7.5 minute topographic quadrangle; UTM Easting: 653759 m, UTM Northing: 3234731 m, UTM Zone 13.

A—0 to 10 inches; pale brown (10YR 6/3) gravelly sand, brown (10YR 5/3), moist; single-grain; loose, soft, nonsticky, nonplastic; 15 percent nonflat subrounded indurated igneous gravel; violently effervescent; moderately alkaline; clear wavy boundary.
C1—10 to 36 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3), moist; single-grain; very friable, slightly hard, nonsticky, nonplastic; 5 percent nonflat subrounded indurated igneous cobbles and 30 percent nonflat subrounded indurated igneous gravel; violently effervescent; moderately alkaline; gradual wavy boundary.
C2—36 to 80 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3), moist; single-grain; very friable, slightly hard, nonsticky, nonplastic; 10 percent nonflat subrounded indurated igneous cobbles, and 35 percent nonflat subrounded indurated igneous gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: 6 to 15 inches over 40 to 80 or more inches of unconsolidated, stratified, loamy, gravelly, or cobbly alluvial materials
Particle-size control section (weighted average):
Texture: Loamy sand, sand
Clay content: 3 to 15 percent

A horizon

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Sand, loamy sand, sandy loam, fine sandy loam, or loam
Rock fragments: 35 to 65 percent
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

C horizon

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Loamy sand or sandy loam
Rock fragments: 35 to 95 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Puerta Series

Classification: Clayey-skeletal, smectitic, mesic Alfic Lithic Argiustolls
Depth class: Shallow
Drainage class: Well drained

Permeability: Moderately slow
Landform: Hills and mountains
Parent material: Gravelly residuum weathered from igneous bedrock
Slope: 20 to 45 percent
Elevation: 5,575 to 7,780 feet
Mean annual precipitation: 18 to 26 inches
Mean annual air temperature: 56 to 59 degrees F
Frost-free period: 160 to 200 days

Typical Pedon

Puerta very gravelly silt loam, in an area of Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes. Big Bend National Park, Brewster County, TX; USGS Emory Peak, Texas 7.5 minute topographic quadrangle; UTM Easting: 665442 m, UTM Northing: 3235993 m, UTM Zone 13.

A—0 to 4 inches; brown (7.5YR 4/2) very gravelly silt loam, dark brown (7.5YR 3/2), moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 40 percent nonflat igneous gravel, and 3 percent nonflat igneous cobbles; noneffervescent; neutral; abrupt smooth boundary.
E—4 to 5 inches; brown (7.5YR 5/2) very gravelly loam, brown (7.5YR 4/2), moist; moderate very fine subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine roots; 40 percent nonflat igneous gravel; noneffervescent; slightly acid; abrupt smooth boundary.
Bt1—5 to 15 inches; reddish brown (5YR 5/3) very gravelly clay, dark reddish brown (5YR 3/2), moist; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic; common very fine roots; common very fine pores; 10 percent distinct clay films on all faces of peds; 40 percent nonflat igneous gravel, and 2 percent nonflat igneous cobbles; noneffervescent; slightly acid; clear smooth boundary.
Bt2—15 to 19 inches; reddish brown (5YR 5/4) very gravelly clay, reddish brown (5YR 4/4), moist; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; many pores; 20 percent distinct clay films on all faces of peds; 40 percent nonflat igneous gravel, and 2 percent nonflat igneous cobbles; noneffervescent; slightly acid; abrupt irregular boundary.
R—19 to 29 inches; rhyolite bedrock.

Range in Characteristics

Soil moisture: Typic ustic moisture regime
Depth to igneous bedrock: 11 to 20 inches
Coarse fragments: 35 to 80 percent consisting of 20 to 50 percent gravel, 5 to 35 percent cobbles, and 0 to 25 percent stones; some pedons have stones 10 to 24 inches in diameter

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Sandy loam, silt loam, or loam
Effervescence: None
Reaction: Slightly acid or neutral

E horizon

Hue: 5YR to 10YR
Value: 4 to 7, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Sandy loam or loam

Effervescence: None
Reaction: Slightly acid or neutral

Bt horizon

Hue: 5YR to 10YR
Value: 4 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Clay
Clay content: 50 to 70 percent
Effervescence: None
Reaction: Slightly acid or neutral

R layer

Kind: Extrusive igneous rock mostly of rhyolite and trachyte

Solis Series

Classification: Loamy, mixed, superactive, calcareous, hyperthermic, shallow Ustic Torriorthents
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Hills
Parent material: Residuum weathered from soft sandstone
Slope: 1 to 45 percent
Elevation: 1,850 to 4,055 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Solis fine sandy loam in an area of Solis-Rock outcrop complex, 1 to 20 percent slopes. Big Bend National Park, Brewster County, TX; USGS San Vicente, Texas 7.5 minute topographic quadrangle; UTM Easting: 685853 m, UTM Northing: 3220859 m, UTM Zone 13.

A1—0 to 2 inches; light yellowish brown (10YR 6/4) dry, fine sandy loam; yellowish brown (10YR 5/4) moist; weak medium granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common fine roots; 5 percent weakly cemented fine and medium sandstone gravel; slightly effervescent; moderately alkaline; clear smooth boundary.
A2—2 to 6 inches; light brown (7.5YR 6/4) dry, fine sandy loam; brown (7.5YR 5/4) moist; single-grain; very friable, slightly hard, slightly sticky, slightly plastic; common fine roots; 10 percent weakly cemented fine and medium sandstone gravel; slightly effervescent; moderately alkaline; clear wavy boundary.
Cr1—6 to 22 inches; very pale brown (10YR 7/4) dry, fractured platy sandstone with moderate cementation; sandstone can be cut with spade and is breakable by hand; strongly effervescent; moderately alkaline; abrupt wavy boundary.
Cr2—22 to 28 inches; light yellowish brown (10YR 6/4) dry, coarsely fractured platy sandstone with moderate cementation; sandstone fractures out in very coarse blocks; thin calcium carbonate coats on some fracture surfaces; strongly effervescent; moderately alkaline; abrupt smooth boundary.
2Cd—28 to 38 inches; light brownish gray (10YR 6/2) dry, finely fractured mudstone; common thin coatings of calcium carbonate on fracture faces; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to soft sandstone bedrock: 4 to 20 inches
Coarse fragments: 5 to 35 percent sandstone
Reaction: Moderately alkaline

A horizon

Hue: 7.5YR or 10YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 6, dry or moist
Texture: Fine sandy loam or loam
Effervescence: Slight or strong

C horizon (where present)

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 6, dry or moist
Texture: Fine sandy loam or loam
Effervescence: Slight or strong

CR layer

Hue: 10YR to 5Y
Value: 5 to 7, dry or moist
Chroma: 3 to 5, dry or moist
Kind: Fractured platy or massive sandstone
Hardness: Less than 3 on Moh's scale
Calcium carbonate coatings: On the fracture surfaces in some pedons
Effervescence: Strong

2Cd layer (where present)

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 1 to 3, dry or moist
Kind: Mudstone
Other features: Thin layers of this mudstone occur irregularly throughout this geological material
Calcium carbonate coatings: Thin coatings on fracture surfaces in some pedons
*Effervescence: S*trong

Stillwell Series

Classification: Loamy-skeletal, carbonatic, hyperthermic Sodic Ustic Haplocalcids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Fan remnants
Parent material: Gravelly alluvium derived from limestone
Slope: 1 to 30 percent
Elevation: 1,725 to 3,730 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Stillwell very gravelly sandy loam (fig. 68) in an area of Strawhouse-Stillwell complex, 1 to 8 percent slopes. Big Bend National Park, Brewster County, TX; USGS San Vicente, Texas 7.5 minute topographic quadrangle; UTM Easting: 684606 m, UTM Northing: 3263508 m, UTM Zone 13.

A—0 to 3 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3), moist; weak fine granular structure; very friable, slightly hard; 5 percent nonflat subrounded indurated limestone cobbles and 40 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline; clear smooth boundary.

Bk1—3 to 12 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3), moist; weak fine granular structure; very friable, slightly hard; 3 percent distinct carbonate coats on rock fragments; 5 percent nonflat subangular indurated limestone cobbles and 45 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—12 to 22 inches; very pale brown (10YR 7/3) very gravelly sandy loam, pale brown (10YR 6/3), moist; single-grain; friable, slightly hard; 5 percent distinct carbonate coats on rock fragments; 5 percent nonflat subrounded indurated limestone cobbles and 45 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—22 to 30 inches; very pale brown (10YR 8/3) very gravelly sandy loam, pale brown (10YR 6/3), moist; single-grain; friable, slightly hard; 5 percent distinct carbonate coats on rock fragments; 10 percent nonflat subrounded indurated limestone cobbles and 50 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2BCk1—30 to 49 inches; pink (7.5YR 7/4) extremely gravelly coarse sandy loam, brown (7.5YR 5/4), moist; weak fine granular structure; very friable, soft, nonsticky, nonplastic; 4 percent distinct carbonate coats on rock fragments; 5 percent nonflat subrounded indurated limestone cobbles and 65 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

2BCk2—49 to 80 inches; pink (7.5YR 7/4) extremely gravelly coarse sandy loam, brown (7.5YR 5/4), moist; weak fine granular structure; very friable, soft, nonsticky, nonplastic; 4 percent distinct carbonate coats on rock fragments; 65 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to calcic horizon: 4 to 12 inches
Solum thickness: More than 80 inches
Particle-size control section (weighted average):
  Clay content: 6 to 18 percent
  Rock fragments: 40 to 80 percent limestone gravel and cobbles

A horizon

Hue: 7.5YR or 10YR
Value: 5 to 7 dry, 4 moist
Chroma: 2 to 4, dry or moist
Texture: Coarse sandy loam, sandy loam, fine sandy loam, or loam
Rock fragments: 35 to 60 percent, primarily gravel size
Calcium carbonate equivalent: 35 to 70 percent
Effervescence: Violent
Reaction: Moderately alkaline

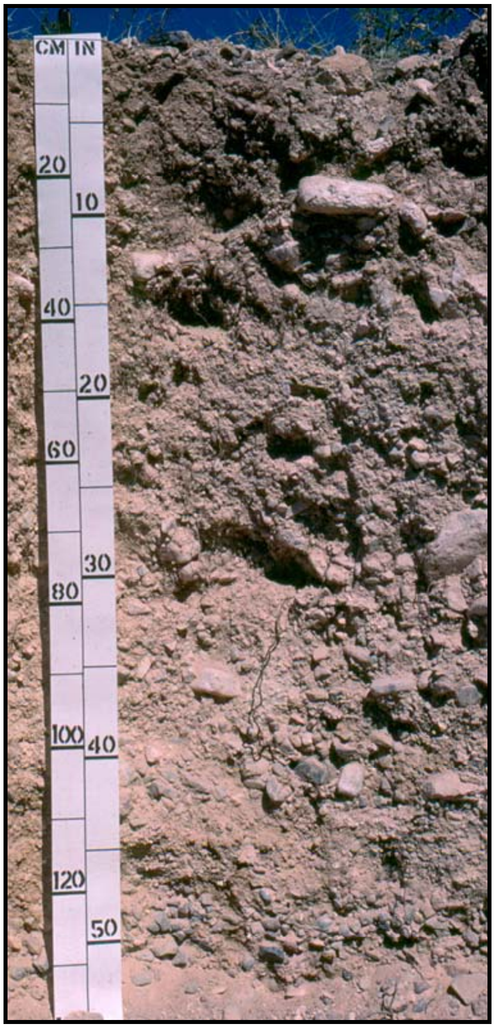

Figure 68.—Profile of Stillwell very gravelly coarse sandy loam in an area of Stillwell-Rock outcrop complex, 1 to 8 percent slopes. Stillwell soils are very deep, and contain about 40 to 80 percent coarse fragments throughout the profile. (Scale in CM—centimeters, IN—inches)

Bk horizon

Hue: 7.5YR or 10YR
Value: 6 to 8 dry, 4 to 6 moist
Chroma: 2 to 4, dry or moist
Texture: Coarse sandy loam, sandy loam, fine sandy loam, or loam
Rock fragments: 35 to 60 percent, primarily gravel size
Calcium carbonate equivalent: 40 to 70 percent
Effervescence: Violent
Reaction: Moderately alkaline

2BCk horizon

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist

Texture: Loamy coarse sand, coarse sandy loam, sandy loam, or loam
Rock fragments: 35 to 85 percent
Calcium carbonate equivalent: 40 to 80 percent
Effervescence: Violent
Reaction: Moderately alkaline

Strawhouse Series

Classification: Loamy-skeletal, carbonatic, hyperthermic, shallow Calcic Petrocalcids
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Fan remnants
Parent material: Gravelly alluvium and pedisediment derived from limestone
Slope: 1 to 8 percent
Elevation: 1,725 to 3,730 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Strawhouse very gravelly loam in an area of Strawhouse-Stillwell complex, 1 to 8 percent slopes. Big Bend National Park, Brewster County, TX; USGS McKinney Springs, Texas 7.5 minute topographic quadrangle; UTM Easting: 684552 m, UTM Northing: 3263348 m, UTM Zone 13.

Ak—0 to 5 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3), moist; weak medium subangular blocky structure; very friable, slightly hard; 40 percent faint carbonate coats on rock fragments; 40 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline; clear smooth boundary.

Bk—5 to 15 inches; very pale brown (10YR 7/4) very gravelly loam, yellowish brown (10YR 5/4), moist; weak medium subangular blocky structure; very friable, slightly hard; 100 prominent carbonate coats on rock fragments; 5 percent nonflat subangular very strongly cemented petrocalcic gravel, and 35 percent nonflat subrounded indurated limestone gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

Bkkm—15 to 19 inches; white (10YR 8/1) cemented material; massive; strongly cemented; 50 percent limestone gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

CBk—19 to 80 inches; pinkish white (7.5YR 8/2), very gravelly loam, light brown (7.5YR 6/4), moist; massive; firm, slightly hard; 50 percent subrounded limestone gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to petrocalcic horizon: 4 to 20 inches
Calcium carbonate equivalent: More than 40 percent
Particle-size control section (weighted average):
Texture: Sandy loam, loam
Clay content: 15 to 27 percent

Ak horizon

Hue: 7.5YR or 10YR
Value: 6 to 8 dry, 4 to 6 moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam or loam

Clay content: 15 to 27 percent fragment
Coarse fragments: 35 to 60 percent limestone and caliche gravel
Effervescence: Violent
Reaction: Moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR
Value: 6 to 8 dry, 4 to 6 moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam or loam
Clay content: 15 to 27 percent
Coarse fragments: 35 to 60 percent limestone and caliche gravel and cobbles
Effervescence: Violent
Reaction: Moderately alkaline

Bkkm horizon

Hue: 7.5YR or 10YR
Value: 7 or 8, dry or moist
Chroma: 1 to 5, dry or moist
Cementation: Strongly cemented in upper part; decreases with depth
Laminar cap: Some pedons have an indurated laminar cap, 2 to 5 mm thick
Thickness: 4 to 9 inches
Effervescence: Violent
Reaction: Moderately alkaline

CBk horizon

Hue: 7.5YR or 10YR
Value: 6 to 8, dry or moist
Chroma: 1 to 5, dry or moist
Texture: Stratified coarse sandy loam, sandy loam, or loam
Rock fragments: More than 35 percent
Effervescence: Violent
Reaction: Moderately alkaline

Studybutte Series

Classification: Loamy-skeletal, mixed, superactive, nonacid, hyperthermic Lithic Ustic Torriorthents
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Hillslopes
Parent material: Residuum and colluvium weathered from siliceous igneous bedrock
Slope: 10 to 60 percent
Elevation: 2,260 to 4,815 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Studybutte very gravelly loam (fig. 69) in an area of Studybutte-Rock outcrop complex, 20 to 60 percent slopes. Big Bend National Park, Brewster County, TX; USGS Tule Mountain, Texas 7.5 minute topographic quadrangle; UTM Easting: 649779 m, UTM Northing: 3249467 m, UTM Zone 13.

Figure 69.—Profile of Studybutte very gravelly loam, in an area of Studybutte-Rock outcrop complex, 20 to 60 percent slopes. In this photograph, cobbles are observed, however, gravel-sized coarse fragments dominate in the soil profile. Studybutte soils are very shallow and shallow to igneous bedrock. (Scale in centimeters)

A1—0 to 3 inches; reddish brown (5YR 5/3) very gravelly loam, dark reddish brown (5YR 3/3), moist; weak medium granular structure; friable, hard; common fine roots; 50 percent nonflat subangular igneous gravel; noneffervescent; slightly alkaline; clear smooth boundary.

A2—3 to 6 inches; reddish brown (5YR 5/3) very gravelly loam, dark reddish brown (5YR 3/3), moist; weak medium granular structure; friable, hard; common fine roots; 55 percent nonflat angular igneous gravel; slightly effervescent; slightly alkaline; abrupt irregular boundary.

R—6 to 16 inches; indurated, igneous bedrock.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to igneous bedrock: 4 to 19 inches
Rock fragments: 35 to 80 percent, 25 to 60 percent gravel, 0 to 20 percent cobbles, and 0 to 20 percent stones
Reaction: Neutral to moderately alkaline
Particle-size control section (weighted average):
Clay content: 15 to 25 percent

A horizon

Hue: 5YR to 10YR
Value: 4 to 6 dry, 3 moist
Chroma: 2 to 4, dry or moist
Texture: Sandy loam, loam, or sandy clay loam
Clay content: 15 to 27 percent
Effervescence: None to slight

R layer

Kind: Igneous
Other features: Fractures less than 4 inches apart
Calcium carbonate coats: In some pedons, on fracture surfaces

Terlingua Series

Classification: Loamy-skeletal, mixed, superactive, calcareous, hyperthermic Lithic Ustic Torriorthents
Depth class: Very shallow or shallow
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Hillslopes, ridges
Parent material: Colluvium and residuum weathered from basalt
Slope: 10 to 60 percent
Elevation: 1,885 to 3,930 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Terlingua very gravelly sandy loam in an area of Rock outcrop-Terlingua complex, 10 to 30 percent slopes. Big Bend National Park, Brewster County, TX; USGS, Texas 7.5 minute topographic quadrangle; UTM Easting: 651381 m, UTM Northing: 3218657 m, UTM Zone 13.

A—0 to 4 inches; yellowish brown (10YR 5/4) dry, very gravelly sandy loam; dark yellowish brown (10YR 4/4) moist; moderate very fine granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common roots; 45 percent nonflat subangular indurated basalt gravel and 5 percent nonflat subangular indurated basalt cobbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Bk—4 to 8 inches; yellowish brown (10YR 5/4) dry, very gravelly loam; dark yellowish brown (10YR 4/4) moist; weak very fine granular structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots; 50 percent distinct carbonate coats on rock fragments; 45 percent nonflat subangular indurated basalt gravel and 5 percent nonflat subangular indurated basalt cobbles; basalt gravel coated with carbonate; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Crk1—8 to 12 inches; weak red (2.5YR 5/2) dry, partially weathered igneous bedrock; 10 percent platy carbonate laminae in cracks; carbonate coats on bedrock; many seams of calcite; rock weathered to 0.5 cm thick plates that are coated with carbonate on upper and lower surfaces; neutral; clear wavy boundary.

Crk2—12 to 16 inches; weak red (2.5YR 5/2) dry, partially weathered igneous bedrock; 2 percent platy carbonate laminae in cracks; carbonate coats on bedrock; few seams of calcite; neutral; abrupt wavy boundary.

R—16 to 26 inches; igneous bedrock; very strongly cemented; common calcite and opal interbedded bodies.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Depth to lithic contact: 8 to 20 inches
Rock fragments: 35 to about 70 percent; 0 to 30 percent stones, 0 to 40 percent cobbles, and 50 to 100 percent gravel
Surface fragments: 50 to 80 percent igneous gravel, cobbles, stones, and boulders

A horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4, dry or moist
Texture: Coarse sandy loam, sandy loam, or loam
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4, dry or moist
Texture: Coarse sandy loam, sandy loam, or loam
Calcium carbonate: On coarse fragments and in seams
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

CR layer

Kind: Basalt bedrock
Fracture intervals: 1 to 4 inches
Calcium carbonate coats: In fractures

R layer

Kind: Igneous or basalt bedrock
Hardness: 4 or less on Moh's scale

Tornillo Series

Classification: Fine-loamy, mixed, superactive, hyperthermic Ustifluventic Haplocambids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial flats
Parent material: Calcareous loamy alluvium
Slope: 0 to 2 percent
Elevation: 1,905 to 3,195 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Tornillo loam (fig. 70) in an area of Tornillo loam, 0 to 2 percent slopes, occasionally flooded. Big Bend National Park, Brewster County, TX; USGS Solis, Texas 7.5 minute topographic quadrangle; UTM Easting: 688804 m, UTM Northing: 3221522 m, UTM Zone 13.

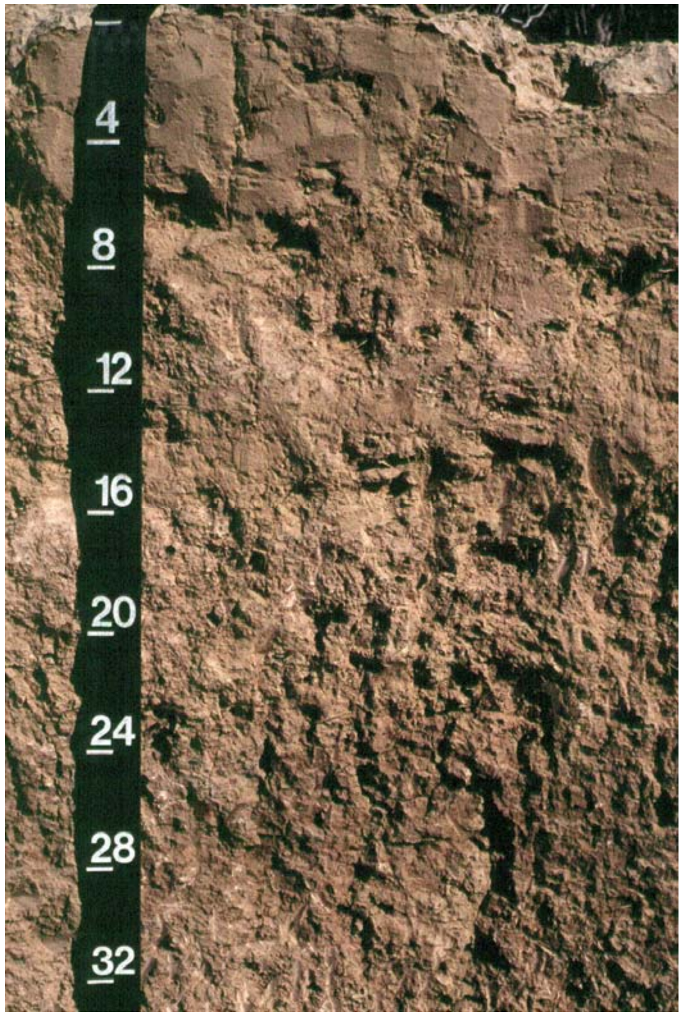

Figure 70.—Profile of Tornillo loam in an area of Tornillo loam, 0 to 2 percent slopes, occasionally flooded. Tornillo soils are stratified from depositional events. They are very deep soils. (Scale in centimeters)

A1—0 to 5 inches; grayish brown (10YR 5/2) dry loam; dark grayish brown (10YR 4/2) moist; weak medium granular structure; very friable, hard, moderately sticky, slightly plastic; violently effervescent; moderately alkaline; clear smooth boundary.

A2—5 to 19 inches; pale brown (10YR 6/3) dry loam; brown (10YR 4/3) moist; moderate medium subangular blocky structure; friable, hard, moderately sticky, slightly plastic; violently effervescent; moderately alkaline; clear smooth boundary.

Bw1—19 to 26 inches; pale brown (10YR 6/3) dry, stratified, gravelly sandy loam; brown (10YR 5/3) moist; weak fine subangular blocky structure; very friable, slightly hard, slightly sticky, slightly plastic; 15 percent nonflat subrounded indurated 2 to 75 mm igneous and sedimentary gravel; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bw2—26 to 48 inches; light yellowish brown (10YR 6/4) dry, stratified loam; yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; friable, hard, moderately sticky, moderately plastic; violently effervescent; moderately alkaline; clear smooth boundary.

Bw3—48 to 80 inches; pale brown (10YR 6/3) dry, stratified loam; yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; firm, very hard, moderately sticky, moderately plastic; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: 60 to more than 80 inches
Reaction: Moderately alkaline
Particle-size control section (weighted average):
Clay content: 18 to 35 percent
Rock fragments: 0 to 15 percent igneous and sedimentary gravel
Calcium carbonate equivalent: Less than 10 percent

A horizon

Hue: 7.5YR or 10YR
Value: 5 to 7 dry, 4 moist
Chroma: 2 to 4, dry or moist
Texture: Fine sandy loam, silt loam, loam, sandy clay loam, clay loam, or silty clay loam
Effervescence: Strong or violent

Bw horizon

Hue: 7.5YR or 10YR
Value: 5 to 8, dry or moist
Chroma: 2 to 6, dry or moist
Texture: Fine sandy loam, sandy loam, silt loam, loam, sandy clay loam, clay loam, or silty clay loam
Other features: Varying textures and organic matter content. Bedding planes are evident in most horizons below 30 inches
Calcium carbonate: Films and threads in lower part of some pedons
Effervescence: Strong or violent

Vicente Series

Classification: Coarse-silty, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Stratified loamy alluvium
Slope: 0 to 1 percent
Elevation: 1,710 to 2,315 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 68 to 72 degrees F
Frost-free period: 240 to 280 days

Typical Pedon

Vicente silty clay loam, in an area of Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded. Big Bend National Park, Brewster County, TX; USGS Castolon, Texas 7.5 minute topographic quadrangle; UTM Easting: 638405 m, UTM Northing: 3225887 m, UTM Zone 13.

A1—0 to 2 inches; pale brown (10YR 6/3) silty clay loam; brown (10YR 5/3) moist; weak medium platy structure; very friable, slightly hard, moderately sticky, moderately plastic; many very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

A2—2 to 10 inches; pale brown (10YR 6/3) very fine sandy loam; brown (10YR 4/3) moist; weak medium granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common fine roots; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—10 to 18 inches; brown (10YR 5/3) very fine sandy loam; brown (10YR 4/3) moist; single-grain; very friable, slightly hard, slightly sticky, slightly plastic; common fine roots; strongly effervescent; slightly alkaline; gradual smooth boundary.

C2—18 to 32 inches; pale brown (10YR 6/3) very fine sandy loam; brown (10YR 4/3) moist; single-grain; very friable, slightly hard, slightly sticky, slightly plastic; common fine roots; strongly effervescent; slightly alkaline; gradual smooth boundary.

C3—32 to 49 inches; pale brown (10YR 6/3) very fine sandy loam; brown (10YR 4/3) moist; single-grain; very friable, slightly hard, slightly sticky, slightly plastic; common fine roots; strongly effervescent; slightly alkaline; gradual smooth boundary.

C4—49 to 60 inches; brown (10YR 5/3) very fine sandy loam; dark brown (10YR 3/3) moist; massive; firm, hard, slightly sticky, slightly plastic; strongly effervescent; slightly alkaline; gradual smooth boundary.

C5—60 to 80 inches; brown (10YR 5/3) loam; dark brown (10YR 3/3) moist; massive; firm, hard, slightly sticky, slightly plastic; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil moisture: Ustic aridic moisture regime
Solum thickness: Greater than 60 inches
Rock fragments: 0 to 5 percent
Stratification: Common with 1- to 24-inch bands of finer or coarser material
Salinity: Not saline to strongly saline
Reaction: Slightly alkaline to strongly alkaline
Particle-size control section (weighted average):
Clay content: 4 to 18 percent

A horizon

Hue: 10YR
Value: 3 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Very fine sandy loam, silt loam, loam, silty clay loam, or clay loam
Clay content: 15 to 35 percent
Effervescence: Strong or violent

C horizon

Hue: 10YR
Value: 3 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Very fine sandy loam, silt loam, loam, silty clay loam, or clay loam
Clay content: 15 to 35 percent; averages less than 18 percent
Effervescence: Strong or violent

Formation of the Soils

This section defines soil, describes the factors and processes of soil formation, and relates the factors and processes to the soils of Big Bend National Park.

Soil

Soil is a dynamic medium forming a living shell of varying thickness over the rocky crust of the Earth. Soil, as used in this publication, is defined as a natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter *or* the ability to support rooted plants in a natural environment.

This definition is expanded from the definition in the 1975 version of *Soil Taxonomy* which required soils be capable to support plants. This soil survey acknowledges eroded Geefour soils, where pedogenesis has transformed the mudstone bedrock parent material but where the physical and chemical environment is too harsh for higher plants to grow. Following the 1975 definition of soil, the previous soil survey of Big Bend National Park classified these areas as Badland, a miscellaneous area, not soil (Soil Survey Staff, 1975 and 1986).

The upper limit of soil is air or shallow water. At its margins soil grades to deep water or to areas of rock outcrop that do not support plants. Soil grades at its lower limit to bedrock or to earthy materials virtually devoid of roots, animals, or marks of other biologic activity. For purposes of classification, the lower boundary of soil is arbitrarily set at 80 inches (203 cm). In soils where either biological activity or current pedogenic processes extend to depths greater than 80 inches, the lower limit of the soil for classification purposes is still 80 inches (203 cm). (Soil Survey Staff, 2003)

Though soils and landscapes may appear chaotic and difficult to understand, orderly relationships do exist between the properties of soils and the environments within which soils exist. Once the soil-environment relationships have been elucidated, soils scientists are able to predict soil properties that are hidden and invisible below the soil surface, based on evidence available at the surface. Environmental factors, conveniently grouped under five major headings, govern soil-forming processes. These processes act on the initial parent material and relief to result in the soil properties found at the present time.

Factors of Soil Formation

This section describes the factors of soil formation to include living organisms, climate, time, relief, and parent material, and relates the factors to the soil formation in Big Bend National Park. Also, the processes of horizon differentiation and the surface geology within the survey area are described

Soil is the result of the interaction of five soil forming factors. (Jenny, 1941) These factors determine the unique properties and characteristics of a soil at any given location. The five soil forming factors are: (1) the *living organisms* that live in and on the soil; (2) the different *climates* to which the parent material and soil have been exposed; (3) the length of *time* development forces have acted upon the soil; (4) the *relief* or topographic features of the landscape; and (5) the type and mineralogical composition of the *parent* *material*. The interrelationship of these factors is very complex and it is difficult to isolate the effects of any one factor. The effect of the factors also varies from place to place, but the interaction of the factors ultimately determines the kind of soil that forms. The term "pedogenesis" (soil genesis) is often used to connote the process of soil formation.

Factors can be classified as passive (parent material and relief) or active (climate and organisms).

Living Organisms

Plant, animal, and microbial life affect many soil processes such as the physical and chemical weathering of bedrock and parent material, the rates of organic matter decomposition and biochemical transformation, and plant nutrient cycling. Plant roots grow into bedrock and parent material, breaking it loose into individual particles and exert strong pressures to force open joints in rock and unconsolidated materials, making them more porous. Organic matter is incorporated into the soil solum through root growth and death and also provides an organic mulch at the soil surface by plant litter. In ecosystems with poor soil nutrition or low available moisture, plants can cycle nutrients from great depths or pull water from relatively dry materials in the soil, making them available to other plants and animals.

Animals have an impact on soil formation. Creatures such as ants, earthworms, cicada larvae, mice, moles, prairie dogs, and badgers live and burrow in the soil. Their activities mix layers and concentrate soil particles, while also increasing porosity, permeability, and recycling plant matter and nutrients. Certain soil bacteria participate symbiotically with plants in the basic enzymatic transformations of nitrification, and nitrogen fixation and are responsible for reduction and oxidation processes that induce sulfur oxidation, iron mobilization, and many other biochemical and geochemical transformations in the soil. (Brady, 1974) Actinomycetes are bacteria-like fungi that are of great importance in the decomposition of soil organic matter and are also partly responsible for the aroma of fresh soil. Certain species of fungi may aid or speed the accumulation of calcium carbonate within desert soils. (Monger et al., 1991)

Field research by ecologists is revealing the importance that algae and spore producing plants play in the health and stability of fragile soils in dry regions. Cryptogamic soil crusts form on and directly under the soil surface when symbiotic communities of algae, fungi, mosses, and lichens flourish (fig. 71). These crusts are characteristically dark and lumpy and can become well developed on sandy, saline, or gypsiferous soils which lack gravel lags or desert pavements. Cryptogamic crusts are important because they provide surface aggregation that stabilizes and protects otherwise sparsely vegetated soils from the hazards of water erosion and soil blowing. (Anderson et al, 1982; Brotherson et al, 1983) Other benefits which cryptogam crusts provide is adding organic matter, fixing atmospheric nitrogen, increasing water infiltration, and protecting moisture within the upper inch of soil. (Dunne, 1989).

Humans alter the soil by building structures, manipulating rangeland plants for livestock, harvesting or chaining trees, and by leveling, tilling, planting, and irrigating for crop production. All of these activities can cause serious soil erosion and ecosystem degradation if land users are not careful and do not practice good soil conservation techniques.

Climate

Climate plays an important role in the formation of soils. Climate is a dynamic factor that fluctuates diurnally, monthly and yearly in the mid-latitudes in response to the seasons. It has also undergone significant global changes during the long span of geologic time. A change in climate alters the balance of other soil forming factors, and soils may display morphologic features that formed under the influence of past climates. Many soils in dry regions which have argillic horizons overlying well developed calcic

Figure 71.—Multi-colored lichens adorn the surface of exposed bedrock in the Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes soil map unit. Lichens represent the initial stage in primary plant succession, which accompanies weathering and soil development.

horizons probably display the effects of former climates. The early Holocene epoch was a time of continent-wide climatic change and increasingly arid conditions, especially in the western parts of the United States.

Precipitation, temperature, and wind have had a major effect on the formation of soils in Big Bend National Park. The area has a climate ranging from arid to subhumid, with mild, dry winters and hot summers. Rainfall, evaporation rate, temperature, wind, and length of growing season are some of the climatic factors that influence soil formation.

In Far West Texas, precipitation is positively related to “eastness” and elevation, temperature; and frost-free periods are negatively related to “southness” and elevation. Mean annual precipitation increases about 1 inch for each 50 miles east in longitude, and increases about 2.5 inches for each 1,000-foot increase in elevation. Mean annual air temperature decreases by about 1 degree F for each 50 miles north in latitude and decreases about 2.45 degrees F for each 1,000-foot increase in elevation. Mean length of the frost-free period decreases 8.2 days for each 50 miles north of the equator and decreases 12 days for each 1,000-foot increase in elevation.

Because of differences in elevation, a wide range of soil temperature and moisture regimes exist within Big Bend National Park. Soil temperature regimes in the survey area range from mesic in the high Chisos Mountains to hyperthermic at elevations lower than 3,500 feet. Temperature affects the rate of biological activity, the rate of decomposition of organic matter, and the rate of certain chemical reactions. Within these temperature regimes, rates of many processes can effectively double for every 10 degree C rise in temperature. (Brady, 1974)

Big Bend National Park has a distinct summer precipitation pattern with 60 percent of rain falling during the months from June through September. The area does not consistently receive significant winter precipitation.

Soils at the higher elevations receive much more winter precipitation than those at lower elevations. Spring months are normally dry and windy with little rainfall. The strong spring winds intensify the dry climate and deplete any soil moisture through high evaporation rates.

Precipitation falling during small summer thundershowers when evapotranspiration rates are high, penetrates to only very shallow depths. Summer moisture typically comes as heavy rainfall from high-intensity thunderstorms of short duration. These summer monsoon storms, occurring between July and September, are isolated in extent and undependable in occurrence. Much of the moisture that falls from such high intensity storms runs off the soil surfaces and is unavailable for plant growth.

Soil moisture affects the species composition and productivity of plant communities, the rate of organic matter accumulation and decomposition, the rate of leaching of chemical compounds, and the degree of illuviation of soil colloids. Within certain limits, increasing amounts of soil moisture will result in greater soil development by increasing the amounts and rates of processes acting upon the soil.

Water moving through the soil carries calcium carbonate and clay particles downward from the surface layer and deposits them as the water slows. As the calcium carbonate accumulates, it forms calcic horizons. Chilicotal and Corazones soils have an accumulation of calcium carbonate.

Time

Time is the fourth dimension of physical universe. The length of time that parent materials have been exposed to the effects of climate and living organisms is an important factor in soil development. Soil age is the measure of this length of time and is important in identifying soil properties and characteristics. In general, the longer duration of time that a soil has been forming, the stronger degree of expression its diagnostic horizons will have.

The development of carbonate (Bk) horizons of pedogenic origin is a common occurrence in the survey area and is closely related to soil age. (USDA, 2003) The formation of Bk horizons can be divided into several identifiable and differentiable stages of maturity of which qualitative and sometimes quantitative age distinctions can be made between soils. This is often a useful and important tool in identifying landform types and positions.

Refer to the sequence of diagnostic subsurface horizons and soil series on gravelly surficial deposits.

Relief

“In studying the geology of the Chisos country, one must constantly bear in mind that the terranes which we now find exposed at the surface have been laid bare from under a covering of overlying rocks measuring from two to ten thousand feet in depth.” (Udden, 1907)

Relief has an important influence on soil formation, through the effects of elevation, slope gradient, and aspect. Slope gradient determines the rate and speed of surface runoff and the hazard of soil erosion by water. The Geefour soil has a high rate of surface runoff. Water erosion removes soil material as quickly as it forms, resulting in minimal soil development.

Aspect, or the geographic direction that a slope faces, can also affect soil formation. In the northern hemisphere, steep north-facing slopes have cooler (fig. 72), more moderate temperatures and more effective soil moisture than steep south-facing slopes (fig 73). Madrone soils typically occur on north-facing slopes at the highest elevations in the Chisos Mountains that support a few ponderosa pine trees.

Figure 72.—North aspect on Corazones very gravelly sandy loam, 1 to 30 percent slopes. The north aspect has more cover of grass (Chino grama) with creosotebush and ocotillo.

Figure 73.—South aspect and north aspect (Figure 72) in an area of Corazones very gravelly sandy loam, 1 to 30 percent slopes. This photo illustrates the effect of slope exposure on the productivity and species composition of the respective plant communities. The southerly exposure is dominated by short grass (false grama), creosotebush, leatherstem, and ocotillo. The igneous hills in the background are mapped Studybutte-Rock outcrop complex, 10 to 30 percent slopes.

Topography affects the micro-climatic factors of soils in areas of deeply entrenched canyons. The phenomenon of nighttime cold air drainage into lower-lying landforms effectively lengthens the frost-free period of soils on adjacent airsheds, while shortening the period for the soils on the depression floors. The nearly 10 degrees F difference in mean annual air temperature between Boquillas (70 degrees F) and Chisos Basin (62 degrees F) is a reflection of the difference in elevation. The average length of the freeze-free period at Boquillas (Rio Grande Village) and Chisos Basin is the same (245 days), despite the fact that Boquillas is 3,420 feet lower in elevation than Chisos Basin.

Parent Material

Parent material is the unconsolidated organic and mineral matter in which soil forms. Parent material influences or wholly determines the color, texture, mineralogy, structure, consistency, reaction, erodibility, and natural fertility of soil.

Most mineral matter is ultimately derived from rocks. Big Bend National Park has large areas that are dominated by bedrock, igneous and sedimentary. These rock layers are grouped by geologists into mapable units called formations. Physical and chemical weathering of rocks, accompanied by natural erosion, provides an abundant source of mineral material that serves as the parent materials for soils.

Because the parent materials derived from a particular geologic formation have specific characteristics, the soils that form in them tend to have specific characteristics that are related to or inherited from these materials. Soil properties such as soil texture and mineralogy are strongly influenced by the initial parent material. Inheritance is especially evident in dry climates where the rate of chemical alteration of most minerals is slowed by the lack of moisture.

The soils in Big Bend National Park are formed in parent materials that accumulated by several modes of origin. The parent materials present are residuum, colluvium, alluvium, and pedisediment. Residual parent materials exist at the original place of weathering, whereas transported parent materials have been moved from the location of weathering by gravity, water, or wind. Some soils have formed in only one type of material, while many others have formed in a combination of several types. Each of these materials is discussed in the following paragraphs.

Residuum is material formed in place by the physical and chemical weathering of bedrock. Common landform positions in this survey where residuum contributes to the soil material are crests and summits of hills, mountains, mesas, and plateaus. Altuda, Bissett, Blackgap, Brewster, Studybutte, and Terlingua soils formed in parent materials that are at least partially residual in origin.

Colluvium is material that has moved down steep slopes by mass wasting processes. It is composed of material that has rolled, slid, or fallen down slope under the influence of gravity. Included with colluvium are landslide deposits and rock fall deposits. The particle size distribution of most colluvial deposits is large and the material is unsorted. The rock fragments in colluvium are usually angular, except where the fragments are derived from conglomerates that have preexisting, rounded fragments. Liv and Madrone soils formed in colluvial parent material on long, steep mountainsides in the Chisos Mountains.

Alluvium is sediment that has been transported by running water. It may have been moved many miles or only a few feet. In Big Bend National Park, alluvium is derived from bedrock such as limestone, rhyolite, tuff, basalt, mudstone, or sandstone, but it may also be derived from existing soils which are undergoing accelerated erosion. Strawhouse and Stillwell soils formed in gravelly alluvium derived from limestone bedrock, whereas Corazones formed in gravelly alluvium derived from igneous rocks.

Common landforms in Big Bend National Park where alluvium is a dominant parent material are flood plains, stream terraces, pediments, and alluvial fan remnants. Vicente, Lomapelona, and Castolon soils are forming in young, relatively unaltered Holocene alluvium along the Rio Grande and therefore have minimally developed subsurface horizons. Chillon soils are on terraces of tributary arroyos. These soils have cambic subsurface diagnostic horizons. Chilicotal and Paisano soils, that have calcic and petrocalcic horizons, respectively, occur on pediment and fan remnants adjacent to the Chisos Mountains. These distinctive features suggest much greater geomorphic age.

Alluvial deposits are typically stratified because of the fluctuating nature of the processes involving erosion, transportation, and deposition of sediments. This inherent stratification is clearly evident in very young alluvial deposits, but is less evident where pedogenesis has altered the deposits. Differences in particle or grain sizes because of stratification play an important role in the diagnostic horizons that may form in a soil. For example, calcic horizons in soils commonly form over or within layers having distinct differences in grain size. This effect is because of the change in the size of the pores from one strata or layer to the next, which affects water flow. These different layers slow the movement of soil water and allow suspended materials such as clay and dissolved materials such as calcium carbonate to be withdrawn into large soil pores where they accumulate over time.

Eolian parent materials were deposited by wind. Within Big Bend National Park, low coppice mounds occur beneath shrubs within several soil map units composed of loamy soils. Small, unmapped areas of soils formed from eolian parent material occur along Ninepoint Draw and upriver of Rio Grande Village.

Processes of Horizon Differentiation

This section describes the processes of soil formation, and relates the processes to the soils of Big Bend National Park.

Soils are derived from the decomposition of the mineral particles they contain and from the plant and animal remains added to them. Silicate clays, mineral particles, humus, living organisms, and water have a major influence in determining the character of the soil. Soil layers, or horizons, are formed by additions, removals, transfers, and transformations within the soil profile. (Simonson, 1959) These processes include additions or losses of organic, mineral, and gaseous materials to the soil, transfers of material from one location within the soil to another, and physical and chemical alteration of mineral and organic materials within the soil. In most soils, more than one of these processes have been active in the development of horizons and many processes occur simultaneously.

Soil profiles are made up of a series of horizons that extend from the surface downward to the parent material. The parent material has been influenced little by the processes of soil formation. The horizons that make up a soil profile differ in one or more properties, such as color, texture, structure, consistence, porosity, and reaction.

Soil profiles in Big Bend National Park have five major horizons or layers. These are the A, E, B, C, or R horizons. Some soils do not have B or C horizons. In Big Bend National Park, the main processes are leaching of calcium carbonate and bases, accumulation of organic matter and formation, eluviation, and illuviation of silicate clay minerals, and accumulation of sodium. In most soils, more than one of these processes has been active in the development of the horizons.

The A horizon is the surface layer. It is the horizon that has the maximum accumulation of organic matter. The soils of Big Bend National Park range from low to medium in organic matter content. Organic matter has accumulated, partially decomposed, and been incorporated into the soil. The accumulation of organic matter in soils is greatest in and above the surface layer. Many of the more stable products of organic matter decomposition remain as finely divided materials that result in darker colors, increased water-holding and cation-exchange capacities, and granulation of the soil. Very shallow soils, such as Altuda, Bissett, and Blackgap can have relatively high organic matter content even in quite dry environments because the organic material is confined to a comparatively small volume of mineral material. Organic matter accumulation is related to amount of plant growth (followed by death and decomposition) supported by the soil. The type of vegetation affects the amount of organic matter accumulation.

E horizons in Big Bend National Park are mineral horizons in which the main processes are the loss of silicate clay, organic matter, and iron pigments, leaving a concentration of sand and silt particles. They represent the zone of maximum eluviation, or leaching. E horizons in the Puerta and Madrone soils have higher color value, lower color chroma, and coarser texture than the underlying clayey Bt horizons. These “bleached” horizons formed under the influence of acidic pine litter in the cool, moist environment of the high Chisos Mountains.

The A and Bt1 horizons of the Puerta soil have colors dark enough to qualify as mollic epipedons. These horizons are separated by an E horizon that is too light in color to qualify as mollic. *Soil Taxonomy* allows colors to be “mixed’ for the purpose of classifying the epipedon. Because the combined thickness of dark colors is more than one-third of the total soil depth, the epipedon of the shallow Puerta soil is mollic and the Puerta series is classified as a Mollisol. The subgroup class, Alfic Lithic Argiustoll recognizes the presence of the E horizon. (Soil Survey Staff, 1999)

Soils of Madrone series are moderately deep to bedrock. Only the A horizon has colors dark enough to qualify as mollic. Since the thickness of the A horizon is not one-third of soil depth, it is too thin to qualify for mollic epipedon and is therefore recognized as an ochric epipedon. Madrone is classified as a Typic Paleustalf. It is one of only two soil series in Trans-Pecos Texas that are classified as Alfisols.

The presence of soils with E horizons in the Chisos Mountains is a reflection of the relatively high precipitation received by the area during the Pleistocene. The annual precipitation of the present climate (about 25 inches) is probably not enough to create E horizons, but it is sufficient to maintain E horizons formed in the past. Elsewhere in Texas, E horizons are common only in the Pineywoods where they occupy about 90 percent of the landscape, and Coastal Plain. Annual precipitation in these areas is greater than 40 inches. The climate is considered humid.

The B horizon is the subsoil. It is usually directly below the A horizon. It is the horizon that has the maximum accumulation of dissolved or suspended materials, such as clay and iron. It may also be an altered horizon that has a distinctly different structure than that of the A horizon but shows little evidence of clay translocation or accumulation.

A B horizon that has a significant amount of clay accumulation is called a Bt horizon. Clay accumulates in horizons largely because of translocation from upper to lower horizons. As water moves downward, it can carry small amounts of clay in suspension. This clay accumulates at depths penetrated by water. It accumulates in fine pores in the soil and as clay films on surfaces of peds. Over long periods of time, at least a few thousand years, such processes can result in distinct horizons. Process of clay translocation requires wetter climate or long periods of geologic time. Bt horizons occur mainly in the Chisos Mountains where precipitation is relatively high. The Liv, Mainstay, Puerta, and Madrone soils have strongly expressed Bt horizons.

A B horizon that has distinct structure or color development with little significant evidence of clay, lime, or sodium accumulation is called a Bw horizon. Plant roots and other organisms contribute to the rearrangement of soil materials into secondary aggregates. Organic residues and secretions of organisms serve as cementing agents that help stabilize structural aggregates. Soils that have appreciable amounts of clay develop structural aggregates because of drying and wetting and because of shrinking and swelling. Ninepoint, Tornillo, and Chillon soils have Bw horizons.

Processes that result in development of soil structure have occurred in most of the mineral soils. Plant roots and other organisms contribute to the rearrangement of soil material into secondary aggregates. The decomposition products of organic residue and the secretions of organisms serve to help stabilize structural aggregates. Alternate wetting and drying as well as shrinking and swelling contribute to the development of structural aggregates and are particularly effective in soils that have appreciable amounts of clay. Consequently, soil structure is typically most pronounced in the surface horizon, which contains the most organic matter, and in clayey horizons that alternately undergo wetting and drying.

Another important process in soil formation is the loss of components from the soil. Water can leach many soluble components, such as calcium carbonate, to the lower horizons in the profile. A horizon that has a significant accumulation of calcium carbonate is designated by the addition of the symbol "k." Corazones, Chilicotal, Altuda, Bissett, and Blackgap soils are examples of soils that have accumulations of calcium carbonate in the lower horizons.

Some soils have a cemented layer of calcium carbonate, known locally as caliche. The same process that formed the Bk horizons also formed the Bkkm horizon. In Big Bend National Park, Bkkm horizons of the Paisano soils that occur on high, stable geomorphic surfaces have resulted from exposure to soil-forming processes over extended periods of geologic time.

Bn horizons sodium. Typical morphology of sodium affected soils is not evident in Big Bend National Park. Laboratory data demonstrating dominance of sodium is available for soils from Brewster County outside the National Park.

The C horizon is relatively unchanged by soil-forming processes, although in some places it is modified by weathering. It is generally below the B horizon. In some alluvial sediments near streams, rivers, and bays, the C horizon is directly below the A horizon. Castolon soils have C horizons directly below the A horizons.

BC and CB horizons have properties of both B horizons and C horizons. BC are dominated characteristics of the B horizon, but exhibit some properties of the C horizon, whereas CB horizons are mostly unaffected by soil forming processes, but show some evidence of alteration.

Geologic Summary

Dr. Dennis O. Nelson, Former Head of Geology Department, Sul Ross State University, prepared this section.

Introduction

The Big Bend area of western Texas is a geologically diverse region characterized by marine sedimentary rocks of Cretaceous age (65 to 140 million years ago) that have been intruded and locally covered by volcanic rocks of Tertiary Age (20 to 45 million years ago). Subsequent erosion, controlled by the relative resistance of the rock and by the imposed structure created by faults and folds, has deeply dissected the region, transforming it into the combined mountainous and lowland terrain seen today.

The igneous rocks, because of their dense crystalline character, are quite resistant to erosion. Consequently, as erosion proceeds, these rocks tend to be left as residual high areas. In Big Bend National Park, the igneous rocks are commonly either massive, irregularly shaped intrusive rocks or thin but extensive extrusive rocks.

An intrusive rock is formed by molten rock, or magma, crystallizing below the surface. Examples of intrusive igneous masses are Ward Mountains and Pulliam Peak. Such rocks tend to be rather uniform in character. They weather and erode into rounded mountain masses. The exposure of intrusive igneous rocks at the surface is indicative of the significant amount of erosion that has taken place in the Big Bend area. The eroded material, fragments of the igneous and sedimentary rocks that once covered the intrusive rocks, is now stream-deposited alluvium in the lower areas of the park.

An extrusive igneous rock is formed when magma is erupted onto the surface, becoming lava which crystallizes upon cooling. In the park area, extrusive rocks take the form of lava flows, ash deposits, and volcanic breccias. The lava flows, when crystallized, tend to be highly resistant to erosion and form a protective cap over the underlying rocks.

The softer underlying rocks are slowly eroded away, undercutting the overlying lava cap and causing it to collapse downslope. This process has produced Burro Mesa and other flat-topped, steep-sided mesas.

The sedimentary rocks in the region, with the possible exception of some of the massive limestone, are much less resistant to weathering and erosion than are the igneous rocks. Thus, over time, stream drainage has established itself in these softer rocks, eroding them considerably.

Deep dissection as a result of erosion may at first glance appear paradoxical in a region where annual rainfall is low and streams do not continuously flow. The explanation of this seeming contradiction is twofold. First, although annual rainfall is low, it is characterized by intense showers. This intensity causes disruption of the surface layer of the soil and packing of the immediate subsurface layer by raindrop impact. Disruption of the surface loosens materials so that they can readily be transported, and packing inhibits infiltration of the water, increasing runoff. The second cause of extensive erosion in this desert area is the lack of vegetative cover, particularly a lack of dense ground cover. There is no vegetative mat to protect the soil from raindrop damage and to hold the water long enough to allow infiltration and no extensive root system to help keep the soil in place. The result can easily be seen after any heavy rainstorm. The runoff rate is high; the water is muddy and heavily laden with soil debris.

Geologic History

Deposition of marine sedimentary rocks dominates the early geologic history of the Big Bend National Park area. The oldest rocks are exposed in the northern part of the park near Persimmon Gap. They are marine sedimentary rocks of Paleozoic age and belong to the Maravillas (black chert), Caballos (interbedded black chert and novaculite or white chert), and the Tesnus (interbedded sandstone and shale sequence) Formations. Prior to the deposition of younger Cretaceous rocks, the Paleozoic rocks were strongly deformed, folded and faulted, then uplifted and eroded. This erosion resulted in the younger sandstone and conglomerate, whose mineral and rock fragment components were derived from highlands consisting of the Paleozoic formations.

During the Cretaceous Period the seas began to advance, and thick deposits of limestone accumulated on the ocean floor. Fluctuations in sea level and sedimentation rate are reflected in the interbedding of limestone, such as that of the Glen Rose, Del Carmen, Telephone Canyon, Santa Elena, Buda, and Boquillas Formations, with shale, such as that of the Sue Peaks Formation and the Del Rio Clay. Local unconformities separate some of the formations, indicating a loss of the sedimentary record by either erosion or nondeposition, a result of the changing sea level.

The close of the Cretaceous period in the survey area was marked by a change in sedimentary environment. The retreat of the seas resulted in the deposition of primary clastic units, shales and sandstones, such as the Pen, Aguja, and Javelina Formations. The oldest Tertiary unit, the Black Peaks Formation, lies unconformably on the eroded surface of the Javelina Formation. The Black Peaks Formation and overlying Hannold Hill Formation have more sandstone than the upper Cretaceous sedimentary units, suggesting a shoreline depositional environment, consistent with continuous retreat of the seas.

The first record of Tertiary volcanic activity in the survey area is in the Canoe Formation, which unconformably overlies the Hannold Hill Formation. Pebbles of volcanic rock, derived from the erosion of an igneous source, are evident within the Canoe Formation. The amount of tuff, or volcanic ash, in the formation increases as the depth decreases, and isolated, local flows have been reported. Mammal remains in the Canoe Formation indicate that it is from the Middle Eocene Age (45 to 50 million years ago).

The rocks extending from the Canoe Formation into the overlying Chisos and South Rim Formations reveal a dramatic change from the marine sedimentary rocks of the Upper Cretaceous-Lower Tertiary period to the dominantly volcanic rocks of the Middle Tertiary period. Both the Chisos and South Rim Formations record a very active period of volcanic activity, consisting of eruptions of ash, breccias and lava flows, and the emplacement of intrusions ranging from dikes and sills 1 meter thick to stocklike masses, such as Pulliam Peak. These formations include volcaniclastic rocks, which are sedimentary rocks derived from rapid and local erosion of volcanic highlands. Evidence of this rapid erosion can also be seen in the relationship between younger and older volcanic units. For example, several of the extrusive lava flows of the South Rim Formation have filled canyons that were cut in the older, underlying Chisos Formation. Many of these filled canyons are as much as a hundred meters deep, which implies that the process of erosion did not stop during the active volcanic phase of the park's history.

The volcanic rocks of the Big Bend area are part of a large igneous province, called the Trans-Pecos Magmatic Belt that extends from New Mexico through western Texas into Mexico. Radiometric age determinations of rocks of the Chisos Formation suggest that the volcanic phase may have begun as early as 40 to 45 million years ago and continued until 20 to 23 million years ago.

After the emplacement of the Chisos and South Rim Formations, the Big Bend National Park area was subjected to regional block faulting on a northwestern trend. These normal faults are seen to offset many of the units, including the younger dikes associated with the larger intrusive masses, like Dominguez Mountain. Other faults and warping of the units may be related to the forceful emplacement of the larger stocks. (See the section on Surficial Deposits.)

Recent alluvial sediments are throughout the Big Bend area. They consist of older valley fill, sediment gravel, and high-level terrace deposits. Many of these alluvial deposits, particularly the older ones, have been weakly to moderately cemented by caliche. Caliche forms in arid regions where high rates of evaporation lead to concentration of dissolved salts in the alluvium. Eventually, the concentrations reach a saturation point, and mineral salts precipitate. Calcium carbonate is the most common; however, gypsum is with the carbonate in some places.

The alluvial deposits in the park are evidence of the continuous destruction, through erosion, of the older igneous and sedimentary rocks. Also, the terrace deposits record several periods of uplift and the consequent rejuvenation of the erosion process. These terrace deposits represent earlier valley fills much like those that are presently accumulating in the lower elevations. Subsequent to deposition, an uplift occurred that steepened stream gradients and initiated rapid downcutting of the stream channel. Because lateral erosion by the stream was minimal during this phase of erosion, portions of the valley fill were left as remnants on the walls of the deepening valleys.

Relationships Between Surficial Deposits and Soils of Big Bend National Park

Surficial deposits are surface materials that accumulated or formed during the past 2+ million years, and include alluvial, colluvial, eolian, lacustrine and glacial deposits. Surface materials form a mantle of fragmented and generally unconsolidated material that overlies the bedrock foundation of a continent. A framework was devised to map and classify the surficial deposits of Big Bend National Park, and delineate the deposits on a 1:100,000 scale map. Eight units of alluvial, colluvial, and eolian origin are recognized in Figure 74. (Berry and Williams, 2008)

A good relationship exists between the relative age of alluvial deposits that serve as soil parent material and the degree of development of soil diagnostic horizons. Generally speaking, the geomorphic units highest above the drainage network are the oldest; the soils on them exhibit the greatest morphological development. Figure 74 shows the relationships between some of the more extensive surficial deposit units and the soil series that formed in them.

Symbol	Name	Age	Soil Map Unit Components	Diagnostic Subsurface Horizons	Proposed Geomorphic Surface(s)	Comment
Qyw	Young axial river deposits	Holocene to late Pleistocene	Vicente, Lomapelona, Castolon	none		Rio Grande flood plain
Qaw	Active tributary wash and river deposits	latest Holocene	Riverwash	none	La Noria	
Qya	Young alluvial deposits, undivided	Holocene to late Pleistocene	Chillon, Ninepoint, Tornillo, Equipaje, Agust	cambic, weak calcic	Dugout Wells	Alluvial terrace, fan remnants
Qia Qiw	Intermediate alluvial deposits, undivided Intermediate axial river deposits	late and middle Pleistocene	Altar, Hurds, Chilicotal, Corazones, Stillwell	argillic, calcic	Government Spring	Low pediment remnants
Qoa Qow	Old alluvial deposits, undivided Old axial river deposits	middle to early? Pleistocene	Paisano, Strawhouse	petrocalcic	Panther Junction	High pediment remnants
QTa	Very old alluvium	early Pleistocene and Pliocene	Chilicotal, Corazones		Todd Ranch = Ballenas south of Todd Hill Blue Creek Ranch = high gravel hills	Piedmont slope deposits Fingers and Estufa Canyon formations of Stevens (1969, 1977), Stevens and Stevens (1989, 1990, 1993), Stevens et al. (1969) Basin deposits: Delaho, and Banta Shut-In formations

Figure 74.—Relationships between surficial deposits of Berry and Williams (2008), soil map unit components, subsurface diagnostic horizons, and proposed geomorphic surfaces at Big Bend National Park.

Holocene age alluvium on the Rio Grande and flood plains serves as parent material for fluvents. Soils that formed in stratified alluvium on the La Noria geomorphic surface do not have subsurface diagnostic horizons. The Lomapelona, Vicente, Castolon soils formed in the loamy, upper Holocene portion of the Rio Grande flood plain deposits (fig. 75). The sandy late Pleistocene age flood plain deposits are typically below the control section of flood plain soils. Pantera soils are on flood plains.

Alluvial terraces situated 3 to 6 feet (1 to 2 meters) above flood plain channels are high enough to no longer receive regular deposits of sediment. Soils on the Dugout Wells geomorphic surface have soils with weakly developed Bw horizons. Development of soil structure and obliteration of fluvial stratification are sufficient to result in cambic diagnostic subsurface horizons. The Altar, Chillon, and Ninepoint soils are on Holocene or late-Pleistocene alluvial terraces. These soils are classified as Haplocambids.

Soils on late Pleistocene age alluvial fan remnants, pediment remnants, and alluvial terraces of the Rio Grande are old enough to have developed argillic horizons or calcic horizons. The Hurds, Chilicotal, and Corazones soils exist on the Government Spring geomorphic surface.

Dissected alluvial fan remnants have the greatest degree of soil development recognized in Big Bend National Park. Soils of the Chilicotal and Paisano series occur on Todd Ranch geomorphic surface, which dates to middle to early Pleistocene.

The Fingers and Estufa Canyon Formations are very dissected remnants of piedmont slope gravels deposited during the early Pleistocene or Pliocene epochs. Slope gradients on these remnants range from 10 to more than 30 percent. Despite the great age of the sediments, the Blue Creek Ranch geomorphic surface dates only to the late to middle Pleistocene. Corazones and Chilicotal soils that formed on these gravel hills have calcic

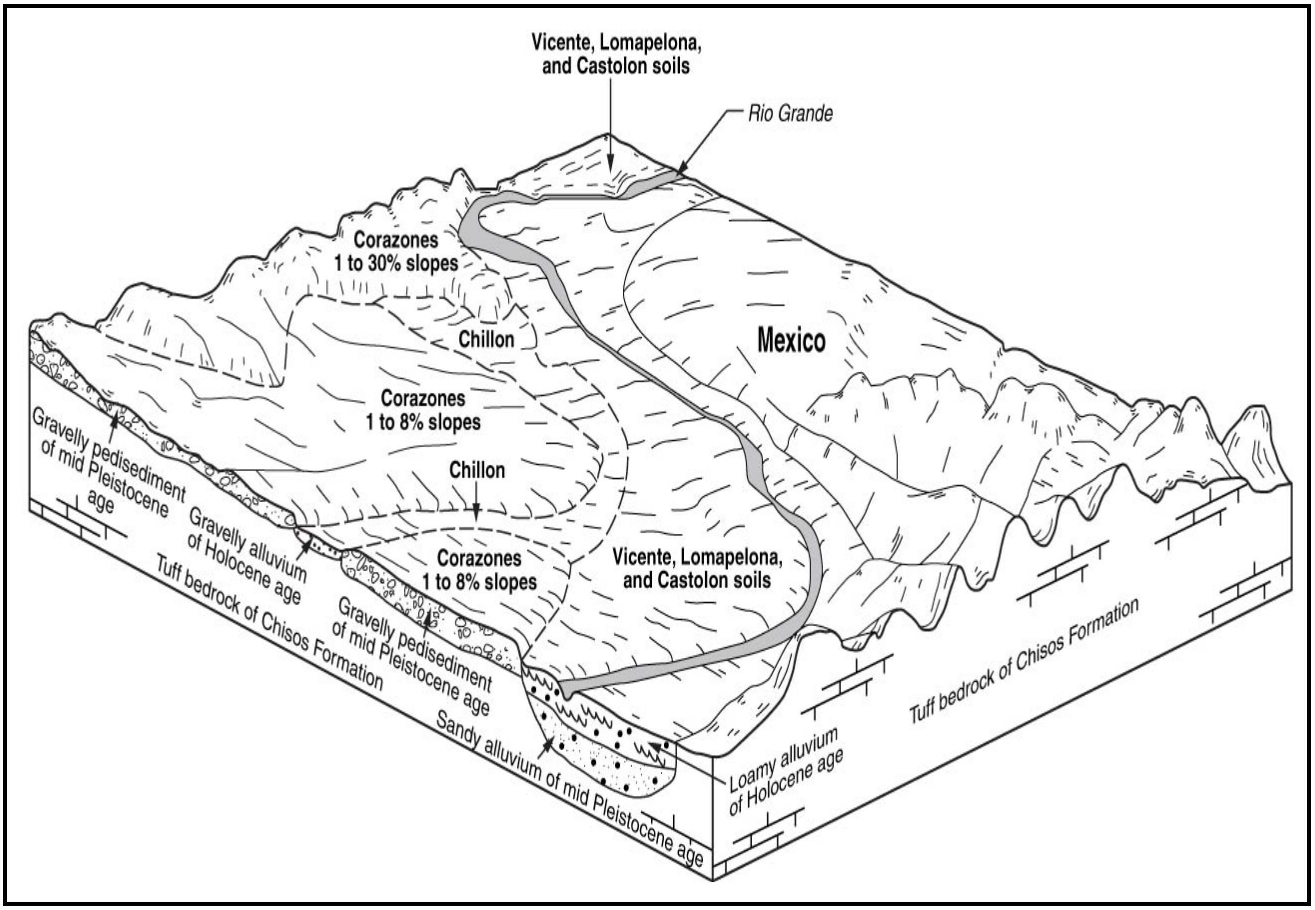

Figure 75.—Relationship of detailed soil map units and Holocene age sediments.

horizons. Petrocalcic horizons generally do not develop on slopes with gradients greater than about 10 percent. (Stevens, 1969, 1977; Stevens and Stevens, 2003)

Areas of colluvium occur at the base of long steep mountain slopes in the Chisos Mountains. Colluvium is the primary parent material for the Liv and Puerta soils.

Small areas of eolian sediment exist in Big Bend National Park. Wind has removed sediment from flood plains and deposited large 3 feet (1 meter) high coppice dunes (fig. 76) along Ninepoint Draw south of Persimmon Gap Ranger Station and west of Rio Grande Village. Because of their limited extent, the soils that formed in eolian parent materials were not mapped separately from the adjacent areas of soils that formed in alluvial or residual parent materials.

Relationships Between Soil Series and Bedrock Lithology

A general relationship exists between the characteristics of the general soil map units and the lithology of rocks upon which they developed. It is apparent, however, that factors other than rock chemistry, such as elevation and rainfall, are important in controlling the nature of the developed soil. For example, soils on hills and mountains are generally on igneous rocks. However, in some areas folding or faulting has brought the sedimentary rocks to a higher elevation; for example in the Sierra del Carmen Mountains, Mariscal Mountain, and Mesa De Anguilla areas. Soils on valleys, plains, and basins formed from the less resistant sedimentary rocks.

Rock Unit Descriptions

The rocks of the Big Bend National Park area can be divided into seven general intervals based on age, lithology, and physical characteristics: the Paleozoic formations, the lower massive limestones, the upper flaggy limestones, the dominantly shale interval, the dominantly sandstone interval, the volcanic interval, and the alluvial deposits.

Figure 76.—An area of Ninepoint clay loam, 0 to 3 percent slopes. The eolian deposits associated with shrubs, are known as coppice dunes.

Paleozoic Interval. The Paleozoic rocks are exposed near Persimmon Gap and consist of intensely folded and faulted rocks of the Maravillas, Caballos, and Tesnus Formations. The Maravillas Formation is about 300 feet (90 meters) thick. It consists primarily of black chert and includes some minor shale beds. The overlying Caballos Formation is 410 to 620 feet (125 to 190 meters) thick. It varies from dark chert at its base to white chert in the middle, then grades through an upper green chert into the silicified sands and shales of the Tesnus Formation, which is several thousand feet thick. This interval is not extensive and no soil series is specifically related to rocks within the Paleozoic interval.

Lower Massive Limestone Interval. This interval of Lower Cretaceous rocks consists of the Glen Rose, Del Carmen, and Santa Elena Formations (fig. 77). These formations vary in thickness and consist of thick massive bedded limestones interbedded with calcareous shale, minor chert, and sandstone. The Glen Rose Formation is about 600 feet (180 meters) thick, Del Carmen Formation is 350 to 450 feet (110 to 140 meters) thick, and the Santa Elena Formation is 750 to 850 feet (230 to 260 meters) thick. Also included in this interval are the Telephone Canyon Formation, a thin marly limestone about 40 to 130 feet (12 to 40 meters) thick, and the Sue Peaks Formation, a thin interbedded shale and marly limestone about 75 feet (23 meters) thick. The Altuda, Bissett, and Blackgap series formed in residuum and colluvium derived from this interval.

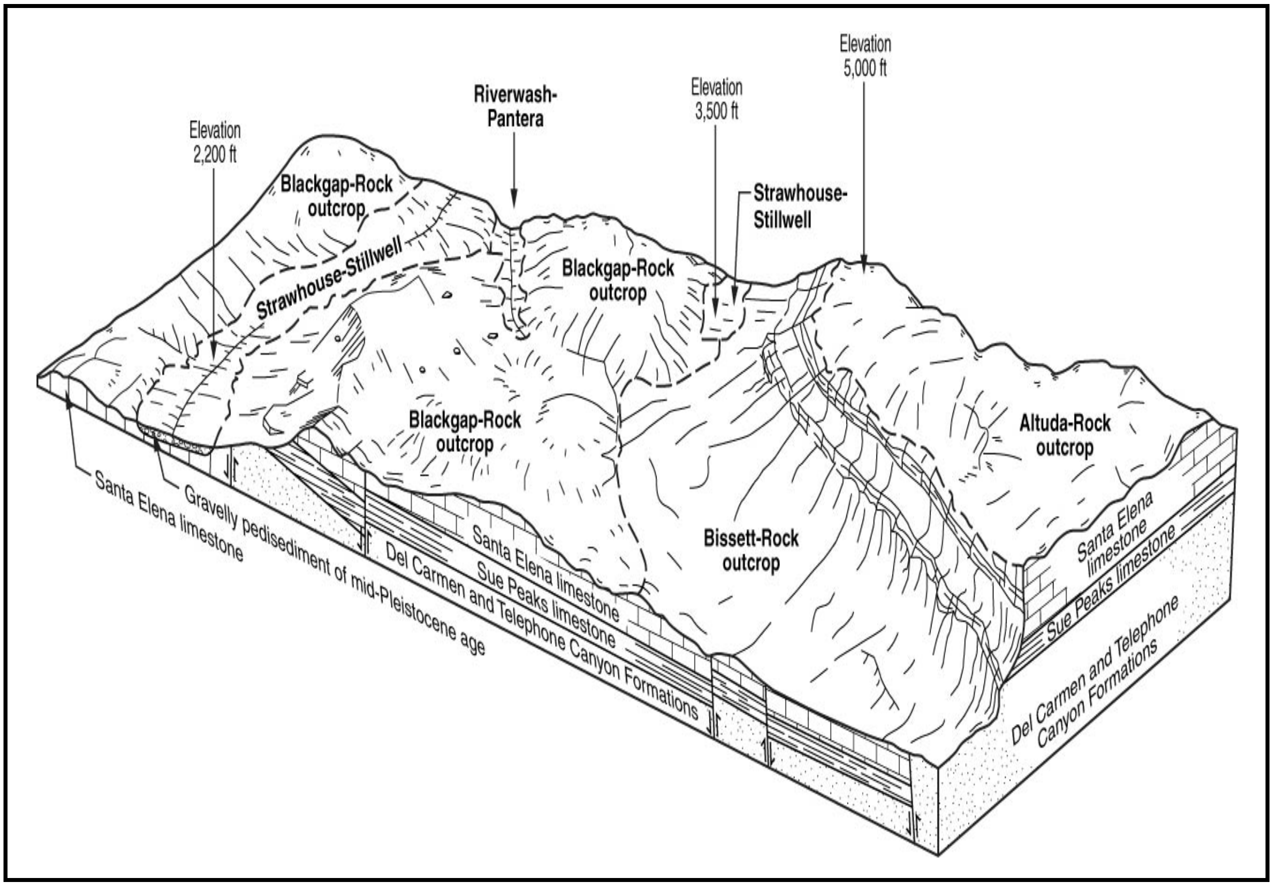

Figure 77.—Relationship of soil mapping units to elevation, geology, and landscape positions. Altuda soils are at elevations around 5,000 feet, and formed from the Santa Elena limestone. Blackgap and Bissett soils formed in residuum and colluvium.

Upper Flaggy Limestone Interval. These Upper Cretaceous rocks are dominated by thin-bedded flaggy limestones of the Del Rio Clay, Buda Limestone, and Boquillas Formations (fig. 78). The lower Del Rio Clay material varies in thickness from 1 to 125 feet (0.3 to 38 meters) and has some shale. The massive Buda Limestone, which is about 100 feet (30 meters) thick, is overlain by Boquillas material, which contains a significant amount of marl interbedded with thin lenses of massive limestone that are less than 3 feet (1 meter) thick. The Boquillas Formation is 800 to 870 feet (245 to 265 meters) thick. Soils of the Geefour series formed in residuum derived from Del Rio Clay. The Boquillas Formation gives rise to residuum in which Mariscal soils form.

Shale-Dominated Interval. The Upper Cretaceous rocks in this interval are of the Pen, Aguja, and Javelina Formations (fig. 79). They are marine and nonmarine shales. Minor amounts of interbedded limestone and calcareous sandstone are in the lower part of the interval in the Pen Formation, and some interbedded thin sandstone beds are in the Aguja and Javelina Formations. Fossil wood and dinosaur bones have been found in the Aguja and Javelina Formations.

The Pen Formation is 220 to 600 feet (65 to 180 meters) thick, the Aguja Formation is 800 to 1,300 feet (245 to 400 meters) thick, and the Javelina Formation 350 to 850 feet (105 to 260 meters) thick. These formations make up a significant portion of the sedimentary materials in the park. Geefour soils formed in residuum derived from the Pen Clay, and Solis soils overly sandstone of the Aguja formation.

Sandstone-Dominated Interval. The sandstone-dominated interval consists of Lower Tertiary rocks of the Black Peaks and Hannold Hill Formations. The Black Peaks Formation is more than 850 feet (260 meters) thick, and the Hannold Hill Formation is

Figure 78.—An exposure of the Boquillas limestone. This formation consists of limestone and marl, and develops into the Mariscal Series.

356 to 770 feet (109 to 235 meters) thick. Both formations consist of clay which is interbedded with sandstone, locally crossbedded, and conglomerates. In outcrops, the clay, which makes up the major part of these formations, is difficult to distinguish from the clays of the underlying shale-dominated interval. Solis soils formed in residuum derived from sandstone formations.

Volcanic Interval. This interval is of Lower to Middle Tertiary rocks and consists of thick accumulations of the Canoe, Chisos, and South Rim Formations. The Canoe Formation is about 1,200 feet (365 meters) thick. The Chisos Formation is 1,500 to 2,600 feet (460 to 795 meters) thick. The South Rim Formation is 1,000 to 1,500 feet (305 to 460 meters) thick. Although these formations contain considerable sedimentary as well as igneous material, they are classified as volcanic because most of the sediment was derived from an igneous, or volcanic source. Volcaniclastic rocks dominate the Canoe Formation. True volcanic rocks, tuffs, flows, and breccias dominate the Chisos (fig. 80) and South Rim Formations. The volcanic interval has been intruded by numerous dikes and sills and a few larger stocklike plutons. The lithology of the flows varies from basalt to rhyolite; rhyolite is the most common. Spectacularly coarse conglomerate can be found in the Chisos Formation, and some stones as much as 1 foot (0.3 meter) in diameter can be found locally. The entire volcanic interval, consisting of sandstone, conglomerate, ash, and flows, can be characterized as having a very complex stratigraphy, typical of an area near an eruptive center. Musgrave soils formed in residuum derived from noncemented tuffaceous mudstones within the Chisos Formation. The Brewster, Leyva, Mainstay, Puerta, and Studybutte series formed in residual materials derived from rhyolitic igneous bedrock and Terlingua formed in residuum weathered from basalt.

Alluvial Deposits Interval. This interval is of alluvial Quaternary material and consists of eroded debris from the volcanic and sedimentary highlands which has been deposited in the lowlands. The alluvium, consisting of silt, sand, and gravel, is locally cemented by caliche.

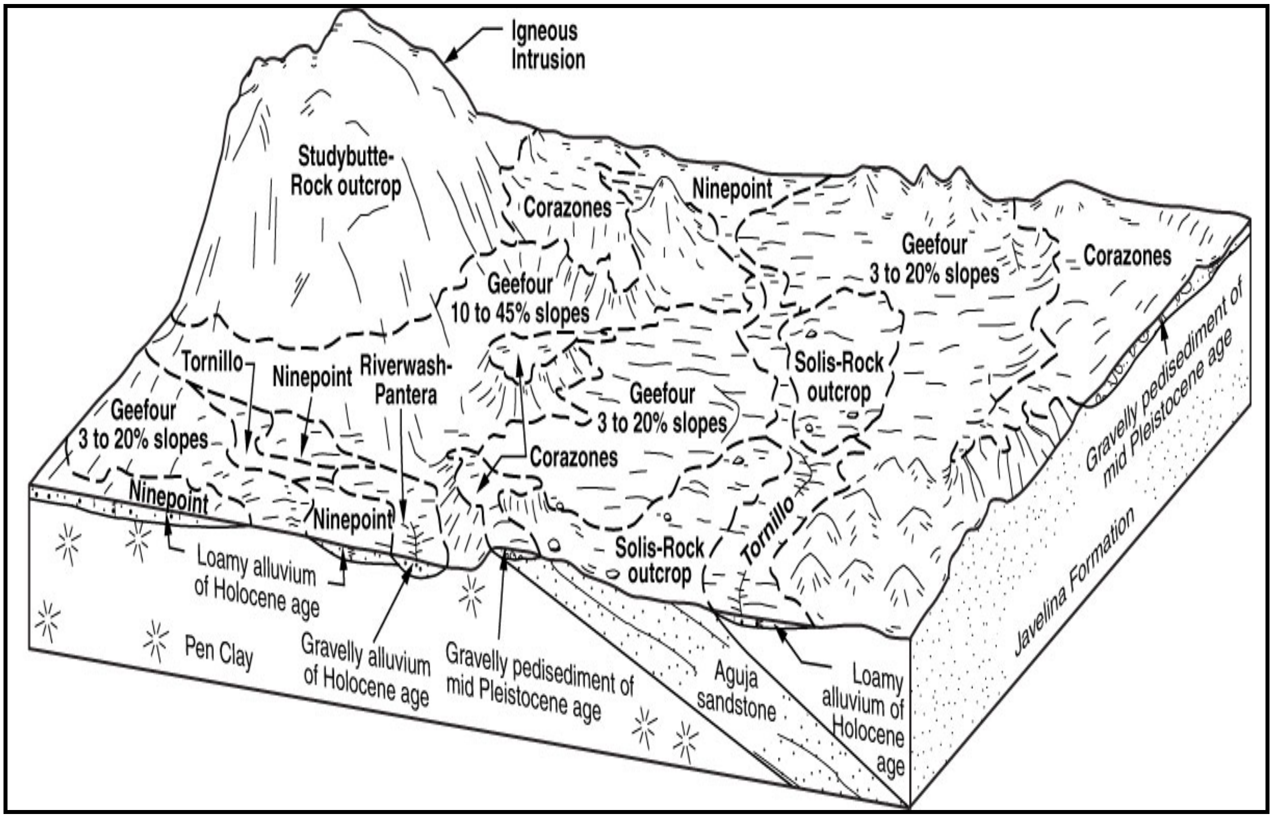

Figure 79.—Relationship of soil mapping units, geologic formations, and landscape positions of the Pen Clay, Aguja sandstone, loamy alluvium, and Javelina Formations.

Landforms of Big Bend National Park

The western three-fourths of Big Bend National Park is within the Mexican Highland section of Basin and Range Physiographic Province. This province is characterized by mountain ranges that are surrounded by piedmont slopes. Closed basins (bolsons) that existed during the geological past are now externally drained by the Rio Grande (semi-bolsons).

The eastern part of the national park is within the Edwards Plateau section of the Interior Plains physiographic province. Basin and Range extensional faulting is present in the area.

In many places, the boundary between adjoining landforms is quite clear. The transition between Riverwash and Pantera soils on flood plains, and Corazones very gravelly sandy loam on fan remnants is usually rather abrupt. However, not all landforms are clearly distinguished. For example, the boundary between Chillon soils on Holocene stream terraces and Vicente, Lomapelona, and Castolon soils on the Rio Grande flood plain can be gradual.

The following paragraphs describe the major landforms recognized in the survey area and some of the soils associated with these landforms.

The Basin and Range Physiographic Province which includes Chisos Mountains, Rosillos Mountains, McKinney Hills, Maverick Mountain, hills and mountains are characterized by soil development that is highly dependent on the nature of the bedrock, such as its chemical composition, grain size, and hardness. The soils on hills and mountains vary greatly in soil development in relation to time and the slope gradient of the bedrock. Some soils show little evidence of development, and others have well developed argillic and calcic horizons. The soils that show little or no evidence of horizon development generally are on the steeper slopes, where erosional activity is greatest.

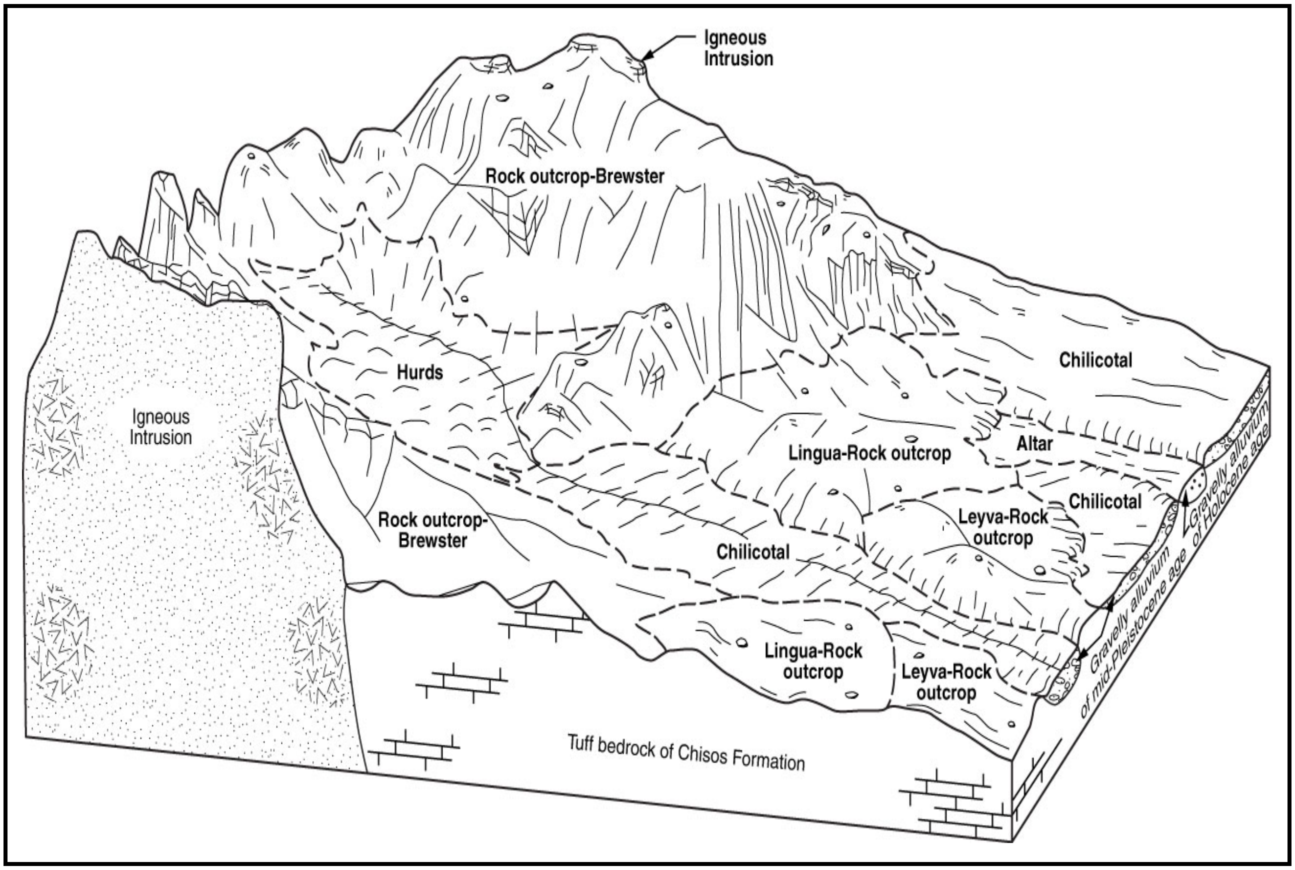

Figure 80.—Relationship of soil mapping units, geologic formations, and landscapes of the Chisos Formation, igneous intrusions, and gravelly alluvium of both mid-Pleistocene and Holocene ages.

Brewster, Studybutte, and Terlingua soils formed in residuum derived from rhyolite, trachyte, or basalt. They show little evidence of profile development. Liv, Mainstay, Puerta, and Madrone have well developed argillic horizons. These soils formed in residuum and colluvium derived from rhyolite or trachyte. Altuda, Bissett, and Blackgap soils formed in residuum derived from limestone bedrock and have calcic horizons.

Alluvial fans formed from material eroded from mountains and deposited where stream gradients decrease at lower landscape segment. Over long periods of geologic time, fans formed by wide distribution of material on the surface. Fan remnants formed by alluvial processes during the Pleistocene and early Holocene eras. However, they are no longer sites of active sediment deposition.

Soils on fan remnants vary greatly in their makeup. The soils on fan remnants exhibit different stages of soil development, which is characterized by well developed calcic horizons and petrocalcic horizons. Older fan remnants have been strongly dissected to the point where they are not subject to flooding. They range from nearly level to steep.

Typical soils on the fan remnants and pediments within Big Bend National Park are in the Chilicotal, Corazones, and Paisano series.

Pediments developed during the middle Pleistocene and late Pleistocene eras. They are broad, undulating, erosion surfaces of low relief at the base of abrupt and receding mountains. They are underlain by bedrock that is mantled with a veneer of alluvium derived from the mountain masses. Pediments tend to have a undulating or rolling landscape. The depth to underlying bedrock is normally greater than 80 inches.

Stream terraces are the erosional remnants of late Pleistocene to middle Holocene flood plains. The slopes are in the same general direction as those of the current flood plains. The soils on the terraces are underlain by stratified sand, gravel, or loamy or clayey sediments or, in some areas, by buried paleosols. The soils on stream terraces have been stable long enough for the formation of cambic horizons. They are not subject to flooding or sediment deposition. Soils that occur on stream terraces in Big Bend National Park include the Chillon and Ninepoint series.

Flood plains are being formed from Holocene and present-day stream alluvium. Floodwater in Big Bend National Park flows at low or very low slope gradients along the Rio Grande and tributaries. The soils on flood plains receive periodic deposits of fresh alluvium, resulting in an irregular decrease in content of organic carbon and weak or no soil profile development. The sediment load of the floodwater tends to be loamy. Typical soils on the flood plains of the Rio Grande are within the Castolon, Lomapelona, and Vicente series. Flood plains of tributaries host the Pantera soils.

Eight of the soils, Blackgap, Chillon, Geefour, Leyva, Ninepoint, Strawhouse, Terlingua, and Tornillo, in this soil survey, were established in the park. Two of these soils, Terlingua and Tornillo, were established in the initial Big Bend National Park Soil Survey published in 1985. The two soils occur in similar settings in adjoining soil surveys. It is possible that the six recently discovered soils in the park occur in similar settings in other portions of West Texas, however, the six soils have not been mapped elsewhere and are therefore currently unique to Big Bend National Park.

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the "National Soil Survey Handbook" (available in local offices of the Natural Resources Conservation Service or on the Internet).

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

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 low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvial flat. A nearly level, graded, alluvial surface in bolsons and semi-bolsons which commonly does not manifest traceable channels, terraces, or flood plain levels.

Alluvium. Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo. The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect. The direction toward which a slope faces. Also called slope aspect.

Association, soil. A group of soils or miscellaneous areas 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:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hill slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Ballena. A fan having a distinctively-rounded surface of fan alluvium. The ballena's broadly-rounded shoulders meet from either side to form a narrow summit and merge smoothly with concave side slopes and then concave, short pediments which form smoothly-rounded drainageways between adjacent ballenas.

Basalt. A general term for dark-colored mafic igneous rocks, commonly extrusive but locally intrusive (e.g. as dikes), composed chiefly of calcic plagioclase and clinopyroxene; the fine-grained equivalent of gabbro. (Neuendorf, et al, 2005)

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology). A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane. A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle-size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bolson. A landscape term for an internally drained (closed) intermontane basin into which drainages from surrounding mountains converge inward toward a central depression. Bolsons are often tectonically depressed areas and, according to Peterson, include alluvial flat, alluvial plain, beach plain, barrier beach, lake plain, sand sheets, dunes, and playa.

Bottom land. An informal term loosely applied to various portions of a flood plain.

Boulders. Rock fragments larger than 2 feet (600 mm) in diameter.

Breaks. A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breccia. A coarse-grained, clastic rock composed of angular rock fragments (larger than 2 mm) commonly bonded by a mineral cement in a finer-grained cement matrix of varying composition and origin. The consolidated equivalent of rubble. (Soil Science Society of America, 1997)

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte. An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

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

Caldera. A large, more or less circular depression, formed by explosion and/or collapse, which surrounds a volcanic vent or vents, and whose diameter is many times greater than that of the included vent, or vents. Jackson, 1997

Caliche. A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canyon. A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

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.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

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.

Cement rock. Clayey limestone used in the manufacture of cement.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chert. A hard, extremely dense or compact, dull to semivitreous, microcrystalline or cryptocrystalline, sedimentary rock, consisting dominantly of interlocking crystals of quartz less than about 30 μm in diameter; it may contain amorphous silica (opal). It sometimes contains impurities such as calcite, iron oxide, and the remains of siliceous and other organisms. It has a tough, splintery to conchoidal fracture, and may be white, or variously colored gray, green, blue, pink, red, yellow, brown, and black. Chert occurs principally as nodular or concretionary segregations (chert nodules) in limestones and dolomites, and less commonly in as areally extensive layered deposits (bedded chert); it may be an original organic or inorganic precipitate or a replacement product. (Jackson, 1997)

Clay. As a soil separate, the mineral soil particles less than 0.002 mm 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 depletions. See Redoximorphic features.

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.

Climax plant community. 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. Rock or mineral fragments having a diameter of 2 mm or more; for example, pebbles, cobbles, stones, and boulders.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (76 to 250 mm) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility). See Linear extensibility.

Colluvium. Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are compounds making up concretions. See Redoximorphic features.

Conglomerate. A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 mm in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

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.

Corrosion (geomorphology). A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations). Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cretaceous. The upper system of the *Meszoic* Erathem of the Standard Global Chronostatrigraphy Scale; above the *Jurassic* and below the *Tertiary* System of Cenzoic Erathem. Also the time during which these rocks were formed, the Cretaceous Period, covering the time span between about 145 and 65 Ma. It is named after the Latin word for chalk ("creta") because of the English chalk beds of this age. (Jackson, 1997)

Cuesta. An asymmetric, homoclinal ridge capped by resistant bedrock layers of slight to moderate dip (commonly less than 15 percent); produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope), that roughly parallels the inclined beds, and on the other side has a relatively short and steep cliff-like slope (scarp) that cuts through the tilted rocks.

Cutbanks cave (in tables)**.** The walls of excavations tend to cave in or slough.

Dense layer (in tables)**.** A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement. A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments, mantling a desert surface. It is formed where wind action and sheetwash have removed all smaller particles or where coarse fragments have migrated upward through sediments to the surface. It usually protects underlying, finer-grained material from further deflation. The coarse fragments commonly are cemented by mineral matter. (Soil Science Society of America, 1997; Jackson, 1997)

Dikes [intrusive rocks]. A tabular igneous intrusion that cuts across the bedding or foliation of country rocks. (Jackson, 1997)

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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained*, and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw. A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Earthy fill. See Mine spoil.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological 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 ecological sites in kind and/or proportion of species or in total production.

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.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit. Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

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 pavement. A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface. A land surface shaped by the action of erosion, especially by running water.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: Scarp.

Extrusive. Said of igneous rocks and sediments derived from deep-seated molten matter (magmas), deposited and cooled on the earth's surface (e.g. including lava flows and tephra deposits). (Hawley and Parsons, 1980)

Fan remnant. A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fan terrace. Refer to fan remnant.

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.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine-earth fraction. All soil material less than 2 mm, or would pass a 2 mm sieve, or soil material that excludes coarse fragments greater than 2 mm.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (150 to 380 mm) longitude

Flood plain. The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms. A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain step. An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial. Of or pertaining to rivers or streams; produced by stream or river action.

Foothills. A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope. The concave surface at the base of a hill slope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

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.

Gilgai. Commonly, a succession of microlows (microbasins) and microhighs (microknolls) in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 mm to 76 mm) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (76 mm) in diameter.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. 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.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim (in tables)**.** Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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.

Head slope (geomorphology). A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hill. A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hill slope. A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Holocene. The epoch of the Quaternary Period of geologic time following the Pliestocene Epoch (from the present to about 10 to 12 thousand years ago); also corresponding (time-stratigraphic) "series" of earth materials. (Schoenberger and Wysocki, 2010)

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." 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.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some 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.

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 overlying soil material. 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, an Arabic numeral, commonly a 2, precedes the letter C.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state; major varieties include plutonic and volcanic rocks. Examples: Andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology). A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream. A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Intermontane basins. A generic term for wide structural depressions between mountain ranges that are partly filled with alluvium and called "valleys" in the vernacular. Intermontane basins may be drained internally (bolsons) or externally (semi-bolsons).

Intrusive. Denoting igneous rocks derived from molten matter (magmas) that invaded pre-existing rocks and cooled below the surface of the earth. (Hawley and Parsons, 1980)

Iron depletions. See Redoximorphic features.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Ksat. Saturated hydraulic conductivity. (See Permeability.)

Landslide. A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables)**.** Rock fragments 3 inches (76 mm) 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.

Limestone. A sedimentary rock consisting chiefly (more than 50 percent) of calcium carbonate, primarily in the form of calcite. Limestones are usually formed by a combination of organic and inorganic processes and include chemical and clastic (soluble and insoluble) constituents; many contain fossils. (Hawley and Parsons, 1980)

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

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.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Mass movement. A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. See Redoximorphic features.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. A kind of map unit that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

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.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: Abundance—*few, common*, and *many; size—fine, medium*, and *coarse*; and *contrast—faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 mm (about 0.2 inch)*; medium,* from 5 to 15 mm (about 0.2 to 0.6 inch)*;* and *coarse,* more than 15 mm (about 0.6 inch).

Mountain. A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Mudstone. (a) A blocky or massive, fine-grained sedimentary rock in which the proportions of clay and silt are approximately equal; (b) A general term that includes clay, silt, claystone, siltstone, shale, and argillite, and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified. (Jackson, 1997)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. See Redoximorphic features.

Nose slope (geomorphology). A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Palezoic. The lowest erathem of the *Phanerozoic* Eonothem of the Standard Global Chronostratigraphic Scale, above the *Precambrian* and below the *Mesozoic*. Also the time during which these rocks were formed, the Palezoic Era, covering the time span between 540 and 250 Ma. (Jackson, 1997)

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.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pediment. A gently sloping erosional surface developed at the foot of a receeding hill or mountain slope. The surface may be essentially bare, exposing earth material that extends beneath adjacent uplands; or it may be thinly mantled with alluvium and colluvium, ultimately in transit from upland front basin or valley lowland. In hill-foot slope terrain the mantle is designated "pedisediment". The term has been used in several geomorphic contexts; Pediments may be classed with respect to (a) landscape positions, for example, Intermontane-basin-piedmont or valley-border footslope surfaces (respectively, apron and terrace pediments (Cooke and Warren, 1973)); (b) type of material eroded, bedrock or regolith; or (c) combinations of the above. (Hawley and Parsons, 1980)

Pedisediment. A layer of sediment, eroded from the shoulder and back slope of an erosional slope, that lies on and is, or was, being transported across a pediment. (Peterson, 1981)

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.

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Impermeable	less than 00.0015 inch
Very slow	00.0015 to 00.06 inch
Slow	00.06 to 0.2 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.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piedmont. Lying or formed at the base of a mountain or mountain range; e.g. a piedmont terrace or a piedmont pediment. (Jackson, 1997)

Piedmont slope. The dominant gentle slope at the foot of a mountain; generally used in terms of Intermontane-basin terrain in arid to subhumid regions. Main components include; (a) An erosional surface on bedrock adjacent to the receeding mountain front (pediment, rock pediment); (b) A constructional surface comprising individual alluvial fans and interfan valleys, also near the mountain front; and (c) A distal complex of coalescent fans (bajada), and alluvial slopes without fan form. Piedmont slopes grade to basin-floor depressions with alluvial and temporary lake plains or to surfaces associated with through drainage (e.g. axial streams) (Hawley and Parsons, 1980)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitted (i.e., land manipulation). The creation of small basins or pits to catch and hold precipitation on the site has been used since the dust bowl days of the 1930s. Known as pitting, it is often used in conjunction with reseeding to enhance seedling establishment by concentrating nutrients and water. Tools used for pitting vary widely. Almost any equipment capable of gouging, digging or in some way creating pits in the soil surface can be used. The most commonly used implements are: (1) modifications of diskplows, and (2) spike-toothed pitters. Modified disk-plows gouge out long shallow pits while the spike type pitter creates small basins. Modifications of spike-tooth pitters are called aerators. Aerators use spikes or cleats to create pits and aerate the soil increasing water and air movement (Fig. 81). Pitting has been effective in increasing forage production by as much as 100 percent, primarily due to enhanced water relations. The disturbance and better water relations increase productivity of the remaining vegetation and, through plant succession, make better plant communities. The value of pits in water retention depends on their density, size, depth and soil permeability. The pit effectively serves as a basin to collect water and allow soil penetration. Pitting is best suited to medium textured soils with less than 8 percent slope. Its value is limited on sandy, rocky or brush covered soils.

Pitting (in tables)**.** Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology). A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Pleistocene. The epoch of the Quaternary Period of geologic time (from about 10 to 12 thousand to 1.6 million years ago), following the Pliocene Epoch and preceeding the Holocene also the corresponding (time-stratigraphic) "series" of earth materials. (Schoenberger and Wysocki, 2010; Hawley and Parsons, 1980)

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings. See Redoximorphic features.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Figure 81.—**Creating pits in the soil, either by roller chopping, aerating or with a specially designed pitter increases water availability and forage yields on deteriorated range.**

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

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.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed as 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 degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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

Redoximorphic concentrations. See Redoximorphic features.

Redoximorphic depletions. See Redoximorphic features.

Redoximorphic features. Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   a. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; and
   b. Masses, which are noncemented concentrations of substances within the soil matrix; and
   c. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   a. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; and
   b. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix. See Redoximorphic features.

Regolith. All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief. The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rhyolite. A group of igneous rocks, typically porphyritic and commonly exhibiting flow texture, with phenocrysts of quartz and alkali feldspar in a glassy to cryptocrystalline groundmass; the fine-grained equivalent of granite. (Neuendorf, et al, 2005)

Rill. A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser. The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 mm or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rubble. An accumulation of loose angular rock fragments, commonly overlying outcropping rock; the unconsolidated equivalent of a breccia.

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 mm to 2.0 mm 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.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saturated hydraulic conductivity (Ksat). See Permeability.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarp. An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or structural bench. A scarp may be of any height.

Sedimentary rock. A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Semi-bolson. Externally drained (open) bolson.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The convex, erosional surface near the top of a hill slope. A shoulder is a transition from summit to backslope.

Shrink-swell (in tables)**.** 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.

Side slope (geomorphology). A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very fine sand (0.05 mm). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides (pedogenic). Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

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. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 1 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 5 percent
Moderately sloping	5 to 8 percent
Strongly sloping	8 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

Slope alluvium. Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill (in tables)**.** The slow filling of ponds, resulting from restricted permeability in the soil.

Sodic (alkali) 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.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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 and by the passage of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes, in mm, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

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, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (251 to 600 mm) in diameter if rounded or 15 to 24 inches (380 to 600 mm) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Strath terrace. A type of stream terrace, formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium). (Schoenberger and Wysocki, 2010; and Jackson, 1997)

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

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).

Substratum. See Underlying material.

Subsurface layer. Any surface soil horizon (A, E, A2, A3, A4) below the surface layer.

Summit. The topographically highest position of a hill slope. It has a nearly level (planar or only slightly convex) surface.

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."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace (geomorphology). A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Tertiary. The lower system of the *Cenzoic* Erathem of the Standard Global Chronostratigraphy Scale, above the *Cretaceous* System and below the *Quaternary*. Also the time during which these rocks were formed, the Tertiary Period, covering the time span between 65 and 1.75Ma. (Jackson, 1997)

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables)**.** Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The gently inclined surface at the base of a hill slope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hill slope continuum that grades to valley or closed-depression floors.

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.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trachyte. A group of fine-grained, generally porphyritic, extrusive rocks having alkali feldspar and minor mafic minerals (biotite, amphibole, or pyroxene) as the main components, and possibly a small amount of sodic plagioclase. (Neuendorf, et al, 2005)

Tread. The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff. A generic term for any consolidated or cemented deposit that is $\geq$ 50 percent volcanic ash (<2 mm); various types of tuff can be recognized based on composition; acidic tuff is predominantly composed of acidic particles; basic tuff is predominantly composed of basic particles. (Schoenberger and Wysocki, 2010)

Upland. An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hill slope continuum.

Underlying material. The part of the soil below the solum.

Valley fill. The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Volcaniclastic. Pertaining to all clastic volcanic materials formed by any process of fragmentation, dispersed by any kind of transporting agent, deposited in any environment, or mixed in any significant portion with nonvolcanic fragments. (Jackson, 1997)

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Boquillas Ranger Station, Texas)

Month	Temperature (Degrees F): Average daily maximum	Average daily minimum	Average	2 years in 10 will have: Maximum temperature higher than	2 years in 10 will have: Minimum temperature less than	Average number of growing degree days*	Precipitation (Inches): Average	2 years in 10 will have: less than	2 years in 10 will have: more than	Average number of days w/0.1 or more
	°F	°F	°F	°F	°F	Units	In	In	In	In
January---	69.6	31.1	50.4	88	16	93	0.35	0.01	0.63	1
February--	75.2	36.0	55.6	95	21	189	0.41	0.03	0.70	1
March-----	83.0	43.6	63.3	100	26	418	0.20	0.00	0.34	0
April-----	91.0	51.4	71.2	106	33	633	0.45	0.03	0.71	1
May-------	99.0	63.3	81.2	112	47	937	1.38	0.38	2.34	2
June------	102.9	70.8	86.9	114	60	1,095	1.39	0.48	2.28	2
July------	103.3	72.1	87.7	113	64	1,156	1.23	0.32	2.13	2
August----	101.4	70.9	86.2	110	64	1,119	1.26	0.47	1.89	3
September-	97.1	65.5	81.3	108	47	932	1.14	0.18	2.02	2
October---	88.8	53.6	71.2	103	33	658	1.22	0.04	2.00	2
November--	77.7	40.4	59.0	95	22	294	0.52	0.02	0.99	1
December--	68.8	32.4	50.6	88	15	103	0.40	0.00	0.71	1
Yearly:										
Average--	88.1	52.6	70.4	---	---	---	---	---	---	---
Extreme--	117	4	---	116	11	---	---	---	---	---
Total---	---	---	---	---	---	7,626	9.93	7.41	12.04	18

* 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 (50 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Boquillas Ranger Station, Texas)

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 13	March 28
2 years in 10 later than--	February 15	March 4	March 23
5 years in 10 later than--	January 12	February 17	March 13
First freezing temperature in fall:			
1 year in 10 earlier than--	November 17	November 11	October 24
2 years in 10 earlier than--	November 25	November 16	October 30
5 years in 10 earlier than--	December 10	November 27	November 11

Table 3.--Growing Season

(Recorded in the period 1971-2000 at Boquillas Ranger Station, Texas)

Probability	Daily Minimum Temperature		
	Number of days higher than 24˚F	Number of days higher than 28˚F	Number of days higher than 32˚F
	Days	Days	Days
9 years in 10	281	260	223
8 years in 10	295	269	230
5 years in 10	321	285	245
2 years in 10	347	301	259
1 year in 10	361	309	267

Table 4.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Chisos Basin, Texas)

Month	Temperature (Degrees F): Average daily maximum	Average daily minimum	Average	2 years in 10 will have: Maximum temperature higher than	2 years in 10 will have: Minimum temperature less than	Average number of growing degree days*	Precipitation (Inches): Average	2 years in 10 will have: less than	2 years in 10 will have: more than	Average number of days w/0.1 or more
	°F	°F	°F	°F	°F	Units	In	In	In	In
January---	57.6	36.1	46.9	73	15	58	0.55	0.04	1.02	1
February---	61.5	39.1	50.3	79	19	95	0.69	0.07	1.18	1
March------	68.2	44.0	56.1	85	23	224	0.37	0.00	0.64	0
April------	74.9	50.3	62.6	89	31	388	0.61	0.03	1.02	1
May--------	81.9	58.5	70.2	95	43	624	1.60	0.44	2.80	3
June-------	85.5	63.0	74.3	97	52	728	2.38	0.69	3.89	4
July-------	84.2	63.9	74.0	94	57	742	3.55	1.40	5.38	5
August-----	82.5	62.6	72.5	93	55	691	3.80	1.48	5.82	5
September--	78.8	58.8	68.8	91	43	563	2.71	0.76	4.41	4
October----	72.8	51.7	62.3	87	30	382	1.72	0.19	2.98	3
November---	64.8	43.4	54.1	79	23	178	0.66	0.09	1.10	1
December---	58.8	37.6	48.2	75	16	74	0.59	0.00	1.07	1
Yearly:										
Average--	72.6	50.8	61.7	---	---	---	---	---	---	---
Extreme--	103	-3	---	98	12	---	---	---	---	---
Total----	---	---	---	---	---	4,748	19.22	13.83	23.71	29

* 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 (50 degrees F).

Table 5.--Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Chisos Basin, Texas)

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--	March 11	April 4	April 10
2 years in 10 later than--	March 1	March 23	April 1
5 years in 10 later than--	February 6	February 28	March 14
First freezing temperature in fall:			
1 year in 10 earlier than--	November 13	October 30	October 25
2 years in 10 earlier than--	November 25	November 9	November 2
5 years in 10 earlier than--	December 16	November 28	November 17

Table 6.--Growing Season

(Recorded in the period 1971-2000 at Chisos Basin, Texas)

Probability	Daily Minimum Temperature		
	Number of days higher than 24°F	Number of days higher than 28°F	Number of days higher than 32°F
	Days	Days	Days
9 years in 10	258	230	213
8 years in 10	277	244	224
5 years in 10	315	272	245
2 years in 10	> 365	299	267
1 year in 10	> 365	313	278

Table 7.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Panther Junction, Texas)

Month	Temperature (Degrees F): Average daily maximum	Average daily minimum	Average	2 years in 10 will have: Maximum temperature higher than	2 years in 10 will have: Minimum temperature less than	Average number of growing degree days*	Precipitation (Inches): Average	2 years in 10 will have: less than	2 years in 10 will have: more than	Average number of days w/0.1 or more
	°F	°F	°F	°F	°F	Units	In	In	In	In
January---	61.3	35.1	48.2	80	16	86	0.43	0.04	0.76	1
February--	66.4	39.0	52.7	85	19	147	0.51	0.07	0.84	1
March-----	74.4	45.5	60.0	91	24	327	0.32	0.00	0.59	0
April-----	81.9	52.4	67.1	96	34	519	0.55	0.02	0.93	1
May-------	89.3	60.8	75.0	102	46	775	1.46	0.37	2.50	2
June------	93.5	66.1	79.8	104	55	893	1.82	0.77	2.83	4
July------	92.4	68.3	80.4	103	59	941	2.26	0.71	3.80	4
August----	90.7	67.0	78.9	101	60	889	2.34	0.89	3.55	4
September-	86.6	62.0	74.3	99	46	728	1.86	0.35	3.33	3
October---	79.1	53.0	66.0	94	35	500	1.53	0.08	2.91	2
November--	69.5	43.6	56.6	86	24	240	0.57	0.05	1.05	1
December--	61.9	36.6	49.3	80	17	97	0.51	0.00	0.85	1
Yearly:										
Average--	78.9	52.5	65.7	---	---	---	---	---	---	---
Extreme--	109	4	---	105	12	---	---	---	---	---
Total----	---	---	---	---	---	6,140	14.17	9.71	18.42	24

* 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 (50 degrees F).

Table 8.--Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Panther Junction, Texas)

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--	March 6	March 23	April 5
2 years in 10 later than--	February 24	March 12	March 27
5 years in 10 later than--	February 3	February 20	March 10
First freezing temperature in fall:			
1 year in 10 earlier than--	November 19	November 7	October 30
2 years in 10 earlier than--	November 28	November 15	November 6
5 years in 10 earlier than--	December 17	December 2	November 18

Table 9.--Growing Season

(Recorded in the period 1971-2000 at Panther Junction, Texas)

Probability	Daily Minimum Temperature Number of days higher than 24°F	Number of days higher than 28°F	Number of days higher than 32°F
	Days	Days	Days
9 years in 10	267	244	219
8 years in 10	285	258	230
5 years in 10	318	284	252
2 years in 10	362	310	274
1 year in 10	> 365	324	285

Table 10.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Area	Extent
		Acres	Pct
AAC	Altar gravelly sandy loam, 1 to 8 percent slopes	2,628	0.3
ADE	Altuda very cobbly silt loam, 10 to 30 percent slopes	3,230	0.4
ADG	Altuda-Rock outcrop complex, 20 to 70 percent slopes	1,066	0.1
BIE	Bissett-Rock outcrop complex, 5 to 30 percent slopes	15,547	1.9
BIG	Bissett-Rock outcrop complex, 20 to 70 percent slopes	19,831	2.4
BLD	Blackgap-Rock outcrop complex, 1 to 16 percent slopes	19,818	2.4
BLE	Blackgap-Rock outcrop complex, 10 to 30 percent slopes	27,382	3.4
BLG	Blackgap-Rock outcrop complex, 20 to 70 percent slopes	41,443	5.1
CIC	Chilicotal very gravelly fine sandy loam, 1 to 8 percent slopes	37,727	4.6
CLE	Chilicotal-Paisano association, 5 to 30 percent slopes	18,575	2.3
CNB	Chillon very gravelly fine sandy loam, 1 to 3 percent slopes, rarely flooded	17,877	2.2
COC	Corazones very gravelly sandy loam, 1 to 8 percent slopes	91,787	11.3
COE	Corazones very gravelly sandy loam, 1 to 30 percent slopes	48,085	5.9
EUB	Equipaje-Agust complex, 1 to 3 percent slopes	14,419	1.8
GEE	Geefour silty clay, 3 to 20 percent slopes	28,260	3.5
GEF	Geefour silty clay, 10 to 45 percent slopes	21,476	2.6
HRE	Hurds very cobbly loam, 10 to 30 percent slopes	2,326	0.3
LEE	Leyva-Rock outcrop complex, 10 to 30 percent slopes	36,786	4.5
LGG	Lingua-Rock outcrop complex, 20 to 60 percent slopes	75,776	9.3
LMF	Liv-Mainstay-Rock outcrop complex, 20 to 45 percent slopes	2,004	0.2
MCC	Mariscal very channery loam, 1 to 8 percent slopes	5,932	0.7
MDE	Mariscal-Rock outcrop complex, 5 to 30 percent slopes	18,015	2.2
MNE	Mariscal-Terlingua complex, 10 to 30 percent slopes	21,398	2.6
MSE	Musgrave silty clay, 1 to 20 percent slopes	8,989	1.1
NNB	Ninepoint clay loam, 0 to 3 percent slopes	31,912	3.9
NPB	Ninepoint complex, 1 to 3 percent slopes, pitted	579	*
PUF	Puerta-Madrone-Lazarus complex, 20 to 45 percent slopes	2,361	0.3
RIA	Riverwash and Pantera soils, 0 to 2 percent slopes, frequently flooded	10,606	1.3
RKG	Rock outcrop-Brewster complex, 20 to 70 percent slopes	11,069	1.4
RTE	Rock outcrop-Terlingua complex, 10 to 30 percent slopes	12,071	1.5
RTG	Rock outcrop-Terlingua complex, 20 to 70 percent slopes	6,506	0.8
SKE	Solis-Rock outcrop complex, 1 to 20 percent slopes	53,136	6.5
SKG	Solis-Rock outcrop complex, 20 to 60 percent slopes	16,980	2.1
STC	Strawhouse-Stillwell complex, 1 to 8 percent slopes	44,595	5.5
STE	Strawhouse-Stillwell complex, 1 to 30 percent slopes	5,151	0.6
SUE	Studybutte-Rock outcrop complex, 10 to 30 percent slopes	9,125	1.1
SUG	Studybutte-Rock outcrop complex, 20 to 60 percent slopes	12,004	1.5
TOA	Tornillo loam, 0 to 2 percent slopes, occasionally flooded	7,944	1.0
VCA	Vicente, Lomapelona, and Castolon soils, 0 to 1 percent slopes, flooded	8,317	1.0
	Total	812,733	100.0

* Less than 0.1 percent.

Table 11.--Land Capability Classification

Land capability is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time.

Map symbol and soil name	Land Capability	
	N	I
AAC:		
Altar	7s	---
ADE:		
Altuda	7s	---
ADG:		
Altuda	7s	---
Rock Outcrop	---	---
BIE:		
Bissett	7s	---
Rock Outcrop	---	---
BIG:		
Bissett	7s	---
Rock Outcrop	---	---
BLD:		
Blackgap	7s	---
Rock Outcrop	---	---
BLE:		
Blackgap	7s	---
Rock Outcrop	---	---
BLG:		
Blackgap	7s	---
Rock Outcrop	---	---
CIC:		
Chilicotal	7s	---
CLE:		
Chilicotal	7s	---
Paisano	7s	---
CNB:		
Chillon	---	---
COC:		
Corazones	7s	---
COE:		
Corazones	7s	---
EUB:		
Equipaje	7c	3e
Agust	7e	---

Table 11.--Land Capability Classification--Continued

Map symbol and soil name	Land Capability N	Land Capability I
GEE:		
Geefour	7s	---
GEF:		
Geefour	7s	---
HRE:		
Hurds	6s	---
LEE:		
Leyva	7s	---
Rock Outcrop	---	---
LGG:		
Lingua	7s	---
Rock Outcrop	---	---
LMF:		
Liv	7s	---
Mainstay	7s	---
Rock Outcrop	---	---
MCC:		
Mariscal	7s	---
MDE:		
Mariscal	7s	---
Rock Outcrop	---	---
MNE:		
Mariscal	7s	---
Terlingua	7s	---
MSE:		
Musgrave	6s	---
NNB:		
Ninepoint	7c	3e
NPB:		
Ninepoint, flat	6e	---
Ninepoint, pit	6e	---
Ninepoint, mound	6e	---
PUF:		
Puerta	6s	---
Madrone	6s	---
Lazarus	3c	---
RIA:		
Riverwash	8w	---
Pantera	7w	---
RKG:		
Rock Outcrop	---	---
Brewster	7s	---

Table 11.--Land Capability Classification--Continued

Map symbol and soil name	Land Capability N	Land Capability I
RTE:		
Rock Outcrop	---	---
Terlingua	7s	---
RTG:		
Rock Outcrop	---	---
Terlingua	7s	---
SKE:		
Solis	7s	---
Rock Outcrop	---	---
SKG:		
Solis	7s	---
Rock Outcrop	---	---
STC:		
Strawhouse	7s	---
Stillwell	7s	---
STE:		
Strawhouse	7e	---
Stillwell	7s	---
SUE:		
Studybutte	7s	---
Rock Outcrop	---	---
SUG:		
Studybutte	7s	---
Rock Outcrop	---	---
TOA:		
Tornillo	6e	---
VCA:		
Vicente	7w	2w
Lomapelona	7w	2w
Castolon	7w	2w

Table 12.--Land Management--Planting

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting with equipment use	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AAC:							
Altar----------------	83	Moderately suited		Poorly suited		Moderate	
		Sandiness	0.50	Rock fragments	0.75	Low strength	0.50
		Rock fragments	0.50	Sandiness	0.50		
ADE:							
Altuda---------------	75	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Rock fragments	1.00	Strength	0.10
		Rock fragments	0.50	Restrictive layer	1.00		
				Slope	0.75		
ADG:							
Altuda---------------	60	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Slope	1.00	Strength	0.10
		Rock fragments	0.50	Rock fragments	1.00		
		Slope	0.50	Restrictive layer	1.00		
Rock outcrop---------	30	Not rated		Not rated		Not rated	
BIE:							
Bissett--------------	50	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Restrictive layer	1.00	Strength	0.10
		Rock fragments	0.50	Slope	0.75		
				Rock fragments	0.50		
Rock outcrop---------	30	Not rated		Not rated		Not rated	
BIG:							
Bissett--------------	55	Moderately suited		Unsuited		Slight	
		Slope	0.50	Slope	1.00	Strength	0.10
		Rock fragments	0.50	Rock fragments	0.75		
Rock outcrop---------	30	Not rated		Not rated		Not rated	
BLD:							
Blackgap-------------	85	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Rock fragments	1.00	Strength	0.10
		Rock fragments	0.50	Restrictive layer	1.00		
				Slope	0.50		
Rock outcrop---------	10	Not rated		Not rated		Not rated	
BLE:							
Blackgap-------------	50	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Rock fragments	1.00	Strength	0.10
		Rock fragments	0.50	Restrictive layer	1.00		
				Slope	0.75		
Rock outcrop---------	40	Not rated		Not rated		Not rated	

Table 12.--Land Management--Planting--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting with equipment use: Rating class and limiting features	Value
BLG:							
Blackgap	50	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Rock fragments	1.00	Strength	0.10
		Rock fragments	0.50	Slope	1.00		
		Slope	0.50	Restrictive layer	1.00		
Rock outcrop	40	Not rated		Not rated		Not rated	
CIC:							
Chilicotal	70	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
CLE:							
Chilicotal	60	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
				Slope	0.50		
Paisano	25	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
				Slope	0.50		
CNB:							
Chillon	81	Unsuited		Unsuited		Slight	
		Rock fragments	1.00	Rock fragments	1.00	Strength	0.10
COC:							
Corazones	85	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
COE:							
Corazones	70	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
				Slope	0.50		
EUB:							
Equipaje	45	Well suited		Well suited		Moderate	
						Low strength	0.50
Agust	40	Well suited		Moderately suited		Moderate	
				Rock fragments	0.50	Low strength	0.50
GEE:							
Geefour	60	Moderately suited		Moderately suited		Severe	
		Stickiness; high plasticity index	0.50	Stickiness; high plasticity index	0.50	Low strength	1.00
				Slope	0.50		
GEF:							
Geefour	70	Poorly suited		Poorly suited		Severe	
		Stickiness; high plasticity index	0.75	Slope	0.75	Low strength	1.00
				Stickiness; high plasticity index	0.75		

Table 12.--Land Management--Planting--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting with equipment use: Rating class and limiting features	Value
HRE:							
Hurds	70	Moderately suited		Poorly suited		Slight	
		Rock fragments	0.50	Rock fragments	0.75	Strength	0.10
				Slope	0.50		
LEE:							
Leyva	75	Moderately suited		Poorly suited		Moderate	
		Stickiness; high plasticity index	0.50	Slope	0.75	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Stickiness; high plasticity index	0.50		
Rock outcrop	15	Not rated		Not rated		Not rated	
LGG:							
Lingua	41	Moderately suited		Unsuited		Moderate	
		Sandiness	0.50	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	1.00		
		Slope	0.50	Sandiness	0.50		
Rock outcrop	36	Not rated		Not rated		Not rated	
LMF:							
Liv	30	Poorly suited		Unsuited		Moderate	
		Stickiness; high plasticity index	0.75	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Stickiness; high plasticity index	0.75		
Mainstay	30	Poorly suited		Unsuited		Moderate	
		Stickiness; high plasticity index	0.75	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Stickiness; high plasticity index	0.75		
Rock outcrop	15	Not rated		Not rated		Not rated	
MCC:							
Mariscal	70	Unsuited		Poorly suited		Moderate	
		Restrictive layer	1.00	Rock fragments	0.75	Low strength	0.50
		Rock fragments	0.50	Restrictive layer	0.50		
MDE:							
Mariscal	45	Unsuited		Poorly suited		Moderate	
		Restrictive layer	1.00	Slope	0.75	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Restrictive layer	0.50		
Rock outcrop	40	Not rated		Not rated		Not rated	

Table 12.--Land Management--Planting--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting with equipment use	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
MNE:							
Mariscal	45	Unsuited		Poorly suited		Moderate	
		Restrictive layer	1.00	Slope	0.75	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Restrictive layer	0.50		
Terlingua	40	Moderately suited		Poorly suited		Slight	
		Restrictive layer	0.50	Slope	0.75	Strength	0.10
		Rock fragments	0.50	Rock fragments	0.75		
MSE:							
Musgrave	92	Poorly suited		Poorly suited		Severe	
		Stickiness; high plasticity index	0.75	Stickiness; high plasticity index	0.75	Low strength	1.00
				Slope	0.50		
NNB:							
Ninepoint	85	Well suited		Well suited		Severe	
						Low strength	1.00
NPB:							
Ninepoint, flat	35	Moderately suited		Moderately suited		Severe	
		Stickiness; high plasticity index	0.50	Stickiness; high plasticity index	0.50	Low strength	1.00
Ninepoint, pit	30	Moderately suited		Moderately suited		Severe	
		Stickiness; high plasticity index	0.50	Stickiness; high plasticity index	0.50	Low strength	1.00
Ninepoint, mound	20	Moderately suited		Moderately suited		Severe	
		Stickiness; high plasticity index	0.50	Stickiness; high plasticity index	0.50	Low strength	1.00
PUF:							
Puerta	50	Poorly suited		Unsuited		Moderate	
		Stickiness; high plasticity index	0.75	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Stickiness; high plasticity index	0.75		
				Rock fragments	0.75		
Madrone	35	Poorly suited		Unsuited		Moderate	
		Stickiness; high plasticity index	0.75	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Stickiness; high plasticity index	0.75		
		Slope	0.50	Rock fragments	0.75		
Lazarus	3	Well suited		Well suited		Severe	
						Low strength	1.00
RIA:							
Riverwash	60	Not rated		Not rated		Not rated	
Pantera	30	Moderately suited		Poorly suited		Moderate	
		Sandiness	0.50	Rock fragments	0.75	Low strength	0.50
		Rock fragments	0.50	Sandiness	0.50		

Table 12.--Land Management--Planting--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting with equipment use: Rating class and limiting features	Value
RKG:							
Rock outcrop	60	Not rated		Not rated		Not rated	
Brewster	30	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Restrictive layer	1.00		
				Rock fragments	0.75		
RTE:							
Rock outcrop	50	Not rated		Not rated		Not rated	
Terlingua	40	Moderately suited		Poorly suited		Slight	
		Restrictive layer	0.50	Slope	0.75	Strength	0.10
		Rock fragments	0.50	Rock fragments	0.75		
RTG:							
Rock outcrop	65	Not rated		Not rated		Not rated	
Terlingua	25	Moderately suited		Unsuited		Slight	
		Restrictive layer	0.50	Slope	1.00	Strength	0.10
		Rock fragments	0.50	Rock fragments	0.75		
		Slope	0.50				
SKE:							
Solis	45	Poorly suited		Moderately suited		Moderate	
		Restrictive layer	0.75	Slope	0.50	Low strength	0.50
Rock outcrop	35	Not rated		Not rated		Not rated	
SKG:							
Solis	50	Poorly suited		Unsuited		Moderate	
		Restrictive layer	0.75	Slope	1.00	Low strength	0.50
Rock outcrop	40	Not rated		Not rated		Not rated	
STC:							
Strawhouse	60	Moderately suited		Poorly suited		Slight	
		Rock fragments	0.50	Rock fragments	0.75	Strength	0.10
Stillwell	25	Moderately suited		Poorly suited		Slight	
		Rock fragments	0.50	Rock fragments	0.75	Strength	0.10
				Slope	0.50		
STE:							
Strawhouse	45	Moderately suited		Poorly suited		Slight	
		Rock fragments	0.50	Rock fragments	0.75	Strength	0.10
				Slope	0.50		
Stillwell	40	Moderately suited		Poorly suited		Slight	
		Rock fragments	0.50	Slope	0.50	Strength	0.10
				Rock fragments	0.75		

Table 12.--Land Management--Planting--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting with equipment use	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
SUE:							
Studybutte----------	60	Unsuited		Poorly suited		Moderate	
		Restrictive layer	1.00	Slope	0.75	Low strength	0.50
		Sandiness	0.50	Rock fragments	0.75		
		Rock fragments	0.50	Sandiness	0.50		
				Restrictive layer	0.50		
Rock outcrop--------	20	Not rated		Not rated		Not rated	
SUG:							
Studybutte----------	55	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Slope	1.00	Low strength	0.50
		Sandiness	0.50	Rock fragments	0.75		
		Rock fragments	0.50	Sandiness	0.50		
				Restrictive layer	0.50		
Rock outcrop--------	30	Not rated		Not rated		Not rated	
TOA:							
Tornillo------------	80	Well suited		Well suited		Severe	
						Low strength	1.00
VCA:							
Vicente-------------	40	Moderately suited		Moderately suited		Severe	
		Stickiness; high plasticity index	0.50	Stickiness; high plasticity index	0.50	Low strength	1.00
Lomapelona----------	30	Well suited		Well suited		Severe	
						Low strength	1.00
Castolon------------	25	Moderately suited		Moderately suited		Severe	
		Stickiness; high plasticity index	0.50	Stickiness; high plasticity index	0.50	Low strength	1.00

Table 13.--Land Management--Hazard of Erosion and Suitability for Roads

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Hazard of erosion: Value	Hazard of erosion on roads and trails: Rating class and limiting features	Hazard of erosion on roads and trails: Value	Suitability for roads (natural surface): Rating class and limiting features	Suitability for roads (natural surface): Value
AAC:							
Altar	83	Slight		Slight		Moderately suited	
						Sandiness	0.50
ADE:							
Altuda	75	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
ADG:							
Altuda	60	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BIE:							
Bissett	50	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BIG:							
Bissett	55	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BLD:							
Blackgap	85	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
Rock outcrop	10	Not rated		Not rated		Not rated	
BLE:							
Blackgap	50	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
BLG:							
Blackgap	50	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
CIC:							
Chilicotal	70	Slight		Slight		Well suited	
CLE:							
Chilicotal	60	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
Paisano	25	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50

Table 13.--Land Management--Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
CNB:							
Chillon	81	Slight		Slight		Well suited	
COC:							
Corazones	85	Slight		Slight		Well suited	
COE:							
Corazones	70	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
EUB:							
Equipaje	45	Slight		Slight		Well suited	
Agust	40	Slight		Slight		Well suited	
GEE:							
Geefour	60	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
						Low strength	0.50
GEF:							
Geefour	70	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
						Stickiness; high plasticity index	0.50
HRE:							
Hurds	70	Moderate		Moderate		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.50	Slope	1.00
LEE:							
Leyva	75	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	15	Not rated		Not rated		Not rated	
LGG:							
Lingua	41	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	36	Not rated		Not rated		Not rated	
LMF:							
Liv	30	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Mainstay	30	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	15	Not rated		Not rated		Not rated	
MCC:							
Mariscal	70	Slight		Slight		Well suited	

Table 13.--Land Management--Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
MDE:							
Mariscal	45	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
MNE:							
Mariscal	45	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Terlingua	40	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
MSE:							
Musgrave	92	Moderate		Severe		Moderately suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Stickiness; high plasticity index	0.50
NNB:							
Ninepoint	85	Slight		Slight		Moderately suited	
						Low strength	0.50
NPB:							
Ninepoint, flat	35	Slight		Slight		Moderately suited	
						Low strength	0.50
Ninepoint, pit	30	Slight		Slight		Moderately suited	
						Low strength	0.50
Ninepoint, mound	20	Slight		Slight		Moderately suited	
						Low strength	0.50
PUF:							
Puerta	50	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Madrone	35	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
Lazarus	3	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
RIA:							
Riverwash	60	Not rated		Not rated		Not rated	
Pantera	30	Slight		Slight		Poorly suited	
						Flooding	1.00
						Sandiness	0.50
RKG:							
Rock outcrop	60	Not rated		Not rated		Not rated	
Brewster	30	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00

Table 13.--Land Management--Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
RTE:							
Rock outcrop	50	Not rated		Not rated		Not rated	
Terlingua	40	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
RTG:							
Rock outcrop	65	Not rated		Not rated		Not rated	
Terlingua	25	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
SKE:							
Solis	45	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
Rock outcrop	35	Not rated		Not rated		Not rated	
SKG:							
Solis	50	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
STC:							
Strawhouse	60	Slight		Slight		Well suited	
Stillwell	25	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
STE:							
Strawhouse	45	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
Stillwell	40	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
SUE:							
Studybutte	60	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Sandiness	0.50
Rock outcrop	20	Not rated		Not rated		Not rated	
SUG:							
Studybutte	55	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Sandiness	0.50
Rock outcrop	30	Not rated		Not rated		Not rated	
TOA:							
Tornillo	80	Slight		Slight		Moderately suited	
						Low strength	0.50
						Flooding	0.50

Table 13.--Land Management--Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Hazard of erosion: Value	Hazard of erosion on roads and trails: Rating class and limiting features	Hazard of erosion on roads and trails: Value	Suitability for roads (natural surface): Rating class and limiting features	Suitability for roads (natural surface): Value
VCA:							
Vicente	40	Slight		Slight		Moderately suited	
						Low strength	0.50
						Flooding	0.50
Lomapelona	30	Slight		Slight		Poorly suited	
						Flooding	1.00
						Low strength	0.50
Castolon	25	Slight		Slight		Moderately suited	
						Low strength	0.50
						Flooding	0.50

Table 14.--Land Management--Site Preparation and Site Restoration

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation (Deep)		Mechanical Site Preparation (Surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AAC:					
Altar	83	Well suited		Poorly suited	
				Rock fragments	0.50
ADE:					
Altuda	75	Unsuited		Poorly suited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Slope	0.50	Rock fragments	0.50
		Rock fragments	0.50	Slope	0.50
ADG:					
Altuda	60	Unsuited		Poorly suited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Slope	0.50	Slope	0.50
		Rock fragments	0.50	Rock fragments	0.50
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Unsuited		Poorly suited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Slope	0.50	Slope	0.50
				Rock fragments	0.50
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Rock fragments	0.50
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Unsuited		Poorly suited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50	Rock fragments	0.50
Rock outcrop	10	Not rated		Not rated	
BLE:					
Blackgap	50	Unsuited		Poorly suited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50	Rock fragments	0.50
		Slope	0.50	Slope	0.50
Rock outcrop	40	Not rated		Not rated	

Table 14.--Land Management--Site Preparation and Site Restoration--Continued

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation (Deep): Rating class and limiting features	Value	Mechanical Site Preparation (Surface): Rating class and limiting features	Value
BLG:					
Blackgap	50	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50	Rock fragments	0.50
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	Well suited		Poorly suited	
				Rock fragments	0.50
CLE:					
Chilicotal	60	Well suited		Poorly suited	
				Rock fragments	0.50
Paisano	25	Well suited		Poorly suited	
				Rock fragments	0.50
CNB:					
Chillon	81	Unsuited		Poorly suited	
		Rock fragments	1.00	Rock fragments	1.00
COC:					
Corazones	85	Well suited		Poorly suited	
				Rock fragments	0.50
COE:					
Corazones	70	Well suited		Poorly suited	
				Rock fragments	0.50
EUB:					
Equipaje	45	Well suited		Well suited	
Agust	40	Well suited		Well suited	
GEE:					
Geefour	60	Well suited		Poorly suited	
				Stickiness; high plasticity index	0.50
GEF:					
Geefour	70	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
				Stickiness; high plasticity index	0.50
HRE:					
Hurds	70	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
				Rock fragments	0.50

Table 14.--Land Management--Site Preparation and Site Restoration--Continued

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation (Deep)		Mechanical Site Preparation (Surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
LEE:					
Leyva	75	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
		Slope	0.50	Slope	0.50
Rock outcrop	15	Not rated		Not rated	
LGG:					
Lingua	41	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	0.50
		Slope	0.50	Rock fragments	0.50
Rock outcrop	36	Not rated		Not rated	
LMF:					
Liv	30	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
		Rock fragments	0.50	Stickiness; high plasticity index	0.50
				Rock fragments	0.50
Mainstay	30	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	0.50
		Slope	0.50	Stickiness; high plasticity index	0.50
				Rock fragments	0.50
Rock outcrop	15	Not rated		Not rated	
MCC:					
Mariscal	70	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
				Restrictive layer	0.50
MDE:					
Mariscal	45	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
		Slope	0.50	Slope	0.50
				Restrictive layer	0.50
Rock outcrop	40	Not rated		Not rated	
MNE:					
Mariscal	45	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
		Slope	0.50	Slope	0.50
				Restrictive layer	0.50
Terlingua	40	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
		Slope	0.50	Slope	0.50
MSE:					
Musgrave	92	Well suited		Poorly suited	
				Stickiness; high plasticity index	0.50

Table 14.--Land Management--Site Preparation and Site Restoration--Continued

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation (Deep): Rating class and limiting features	Value	Mechanical Site Preparation (Surface): Rating class and limiting features	Value
NNB:					
Ninepoint	85	Well suited		Well suited	
NPB:					
Ninepoint, flat	35	Well suited		Well suited	
Ninepoint, pit	30	Well suited		Well suited	
Ninepoint, mound	20	Well suited		Well suited	
PUF:					
Puerta	50	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	0.50
		Slope	0.50	Stickiness; high plasticity index	0.50
				Rock fragments	0.50
Madrone	35	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	0.50	Stickiness; high plasticity index	0.50
				Rock fragments	0.50
Lazarus	3	Well suited		Well suited	
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	Well suited		Poorly suited	
				Rock fragments	0.50
RKG:					
Rock outcrop	60	Not rated		Not rated	
Brewster	30	Unsuited		Poorly suited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Slope	0.50	Slope	0.50
				Rock fragments	0.50
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
		Slope	0.50	Slope	0.50
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Rock fragments	0.50
SKE:					
Solis	45	Well suited		Well suited	
Rock outcrop	35	Not rated		Not rated	

Table 14.--Land Management--Site Preparation and Site Restoration--Continued

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation (Deep)		Mechanical Site Preparation (Surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
SKG:					
Solis	50	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
Rock outcrop	40	Not rated		Not rated	
STC:					
Strawhouse	60	Well suited		Poorly suited	
				Rock fragments	0.50
Stillwell	25	Well suited		Poorly suited	
				Rock fragments	0.50
STE:					
Strawhouse	45	Well suited		Poorly suited	
				Rock fragments	0.50
Stillwell	40	Well suited		Poorly suited	
				Rock fragments	0.50
SUE:					
Studybutte	60	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
		Slope	0.50	Slope	0.50
				Restrictive layer	0.50
Rock outcrop	20	Not rated		Not rated	
SUG:					
Studybutte	55	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	0.50
		Slope	0.50	Restrictive layer	0.50
				Rock fragments	0.50
Rock outcrop	30	Not rated		Not rated	
TOA:					
Tornillo	80	Well suited		Well suited	
VCA:					
Vicente	40	Well suited		Well suited	
Lomapelona	30	Well suited		Well suited	
Castolon	25	Well suited		Well suited	

Table 15.--Damage by Fire and Seedling Mortality

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Potential for damage to soil by fire: Value	Potential for seedling mortality: Rating class and limiting features	Potential for seedling mortality: Value
AAC:					
Altar	83	Moderate		Low	
		Texture/rock fragments	0.50		
ADE:					
Altuda	75	Moderate		High	
		Texture/rock fragments	0.50	Carbonate content	1.00
				Available water	1.00
				Soil reaction	0.50
ADG:					
Altuda	60	Moderate		High	
		Texture/slope/rock fragments	0.50	Carbonate content	1.00
				Available water	1.00
				Soil reaction	0.50
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Carbonate content	1.00
				Soil reaction	0.50
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	High		High	
		Texture/slope/surface depth/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Moderate		High	
		Texture/rock fragments	0.50	Carbonate content	1.00
				Soil reaction	0.50
Rock outcrop	10	Not rated		Not rated	

Table 15.--Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
BLE:					
Blackgap	50	Moderate		High	
		Texture/rock fragments	0.50	Carbonate content	1.00
				Soil reaction	0.50
Rock outcrop	40	Not rated		Not rated	
BLG:					
Blackgap	50	Moderate		High	
		Texture/slope/rock fragments	0.50	Carbonate content	1.00
				Soil reaction	0.50
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Carbonate content	0.50
				Soil reaction	0.50
CLE:					
Chilicotal	60	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Carbonate content	0.50
				Soil reaction	0.50
Paisano	25	High		High	
		Texture/surface depth/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50
CNB:					
Chillon	81	High		Moderate	
		Texture/rock fragments	1.00	Soil reaction	0.50
		Texture/rock fragments	1.00	Salinity	0.50
		Texture/rock fragments	0.50		
COC:					
Corazones	85	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Carbonate content	0.50
				Soil reaction	0.50
COE:					
Corazones	70	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Carbonate content	0.50
				Soil reaction	0.50

Table 15.--Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
EUB:					
Equipaje	45	High		Low	
		Texture/surface depth/rock fragments	1.00		
Agust	40	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Soil reaction	0.50
GEE:					
Geefour	60	High		Moderate	
		Texture/rock fragments	1.00	Salinity	0.50
GEF:					
Geefour	70	High		High	
		Texture/rock fragments	1.00	Salinity	1.00
				Soil reaction	0.50
HRE:					
Hurds	70	High		High	
		Texture/rock fragments	1.00	Available water	1.00
LEE:					
Leyva	75	High		Low	
		Texture/surface depth/rock fragments	1.00		
Rock outcrop	15	Not rated		Not rated	
LGG:					
Lingua	41	High		Low	
		Texture/slope/rock fragments	1.00		
Rock outcrop	36	Not rated		Not rated	
LMF:					
Liv	30	Low		High	
				Available water	1.00
Mainstay	30	Moderate		High	
		Texture/slope/rock fragments	0.50	Available water	1.00
Rock outcrop	15	Not rated		Not rated	
MCC:					
Mariscal	70	High		High	
		Texture/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50

Table 15.--Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
MDE:					
Mariscal	45	High		High	
		Texture/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50
Rock outcrop	40	Not rated		Not rated	
MNE:					
Mariscal	45	High		High	
		Texture/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50
Terlingua	40	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Soil reaction	0.50
MSE:					
Musgrave	92	High		Moderate	
		Texture/rock fragments	1.00	Salinity	0.50
				Soil reaction	0.50
NNB:					
Ninepoint	85	Low		Moderate	
				Carbonate content	0.50
NPB:					
Ninepoint, flat	35	Low		Moderate	
				Carbonate content	0.50
				Soil reaction	0.50
Ninepoint, pit	30	Low		Moderate	
				Carbonate content	0.50
				Soil reaction	0.50
Ninepoint, mound	20	Low		Moderate	
				Carbonate content	0.50
				Soil reaction	0.50
PUF:					
Puerta	50	High		High	
		Texture/slope/surface depth/rock fragments	1.00	Available water	1.00
Madrone	35	High		High	
		Texture/slope/surface depth/rock fragments	1.00	Available water	1.00
Lazarus	3	Low		Low	
		Texture/rock fragments	0.10		

Table 15.--Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	High		High	
		Texture/rock fragments	1.00	Soil reaction	1.00
				Wetness	1.00
RKG:					
Rock outcrop	60	Not rated		Not rated	
Brewster	30	High		High	
		Texture/slope/surface depth/rock fragments	1.00	Available water	1.00
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Soil reaction	0.50
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	High		Moderate	
		Texture/slope/surface depth/rock fragments	1.00	Soil reaction	0.50
SKE:					
Solis	45	Moderate		Moderate	
		Texture/rock fragments	0.50	Soil reaction	0.50
Rock outcrop	35	Not rated		Not rated	
SKG:					
Solis	50	Moderate		Moderate	
		Texture/slope/rock fragments	0.50	Soil reaction	0.50
Rock outcrop	40	Not rated		Not rated	
STC:					
Strawhouse	60	High		High	
		Texture/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50
Stillwell	25	High		High	
		Texture/surface depth/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50

Table 15.--Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
STE:					
Strawhouse	45	High		High	
		Texture/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50
Stillwell	40	High		High	
		Texture/surface depth/rock fragments	1.00	Carbonate content	1.00
				Soil reaction	0.50
SUE:					
Studybutte	60	High		Low	
		Texture/rock fragments	1.00		
Rock outcrop	20	Not rated		Not rated	
SUG:					
Studybutte	55	High		Low	
		Texture/slope/rock fragments	1.00		
Rock outcrop	30	Not rated		Not rated	
TOA:					
Tornillo	80	Moderate		High	
		Texture/rock fragments	0.50	Wetness	1.00
				Soil reaction	0.50
VCA:					
Vicente	40	High		High	
		Texture/surface depth/rock fragments	1.00	Wetness	1.00
				Soil reaction	0.50
Lomapelona	30	Moderate		High	
		Texture/rock fragments	0.50	Wetness	1.00
				Soil reaction	0.50
Castolon	25	Moderate		High	
		Texture/rock fragments	0.50	Wetness	1.00
				Soil reaction	0.50

Table 16.--Rangeland Productivity

(Only the soils that support rangeland vegetation suitable for grazing are rated.)

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
AAC:				
Altar	Gravelly, Desert Grassland	800	600	400
ADE:				
Altuda	Limestone Hill and Mountain, Mixed Prairie	1,000	800	600
ADG:				
Altuda	Limestone Hill and Mountain, Mixed Prairie	1,000	800	600
BIE:				
Bissett	Limestone Hill and Mountain, Desert Grassland	800	600	400
BIG:				
Bissett	Limestone Hill and Mountain, Desert Grassland	800	600	400
BLD:				
Blackgap	Limestone Hill and Mountain 8-14" PZ	550	450	350
BLE:				
Blackgap	Limestone Hill and Mountain 8-14" PZ	550	450	350
BLG:				
Blackgap	Limestone Hill and Mountain 8-14" PZ	550	450	350
CIC:				
Chilicotal	Gravelly, Desert Grassland	800	600	400
CLE:				
Chilicotal	Gravelly, Desert Grassland	800	600	400
Paisano	Gravelly, Desert Grassland	600	450	300
CNB:				
Chillon	Arroyo, Hot Desert Shrub	1,200	900	600
COC:				
Corazones	Gravelly, Hot Desert Shrub	500	400	300
COE:				
Corazones	Gravelly, Hot Desert Shrub	500	400	300
EUB:				
Equipaje	Gravelly, Hot Desert Shrub	500	400	300
Agust	Gravelly, Hot Desert Shrub	500	400	300
GEE:				
Geefour	Salty Clay Hill, Hot Desert Shrub	350	250	150
GEF:				
Geefour	Salty Clay Hill, Hot Desert Shrub	350	250	150

Table 16.--Rangeland Productivity--Continued

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
HRE:				
Hurds	Foothill Slope, Mixed Prairie	1,400	1,100	900
LEE:				
Leyva	Igneous Hill and Mountain, Desert Grassland	1,200	975	750
LGG:				
Lingua	Igneous Hill and Mountain, Desert Grassland	1,200	975	750
LMF:				
Liv	Igneous Hill and Mountain, Mountain Savannah	2,500	2,100	1,700
Mainstay	Igneous Hill and Mountain, Mountain Savannah	2,500	2,100	1,700
MCC:				
Mariscal	Flagstone Hill 8-14" PZ	700	300	250
MDE:				
Mariscal	Flagstone Hill 8-14" PZ	400	300	200
MNE:				
Mariscal	Flagstone Hill 8-14" PZ	400	300	200
Terlingua	Basalt Hill, Hot Desert Shrub	350	250	150
MSE:				
Musgrave	Clay Hill, Hot Desert Shrub	500	350	200
NNB:				
Ninepoint	Loamy, Hot Desert Shrub	500	350	200
NPB:				
Ninepoint, flat	Loamy, Hot Desert Shrub	600	400	200
Ninepoint, pit	Loamy, Hot Desert Shrub	600	400	200
Ninepoint, mound	Loamy, Hot Desert Shrub	300	200	100
PUF:				
Puerta	Igneous Hill and Mountain, Mountain Savannah	2,500	2,100	1,700
Madrone	Igneous Hill and Mountain, Mountain Savannah	2,500	2,100	1,700
Lazarus	Loamy, Mountain Savannah	2,500	2,100	1,700
RIA:				
Pantera	Arroyo, Hot Desert Shrub	1,200	900	600
RKG:				
Brewster	Igneous Hill and Mountain, Mixed Prairie	1,400	1,100	700
RTE:				
Terlingua	Basalt Hill, Hot Desert Shrub	350	250	150
RTG:				
Terlingua	Igneous Hill and Mountain, Hot Desert Shrub	500	400	300

Table 16.--Rangeland Productivity--Continued

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
SKE:				
Solis	Sandstone Hill and Mountain, Hot Desert Shrub	450	300	200
SKG:				
Solis	Sandstone Hill and Mountain, Hot Desert Shrub	300	225	150
STC:				
Strawhouse	Gravelly 8-14" PZ	400	250	150
Stillwell	Gravelly 8-14" PZ	500	350	200
STE:				
Strawhouse	Gravelly 8-14" PZ	400	250	150
Stillwell	Gravelly 8-14" PZ	500	350	200
SUE:				
Studybutte	Igneous Hill and Mountain, Hot Desert Shrub	550	450	350
SUG:				
Studybutte	Igneous Hill and Mountain, Hot Desert Shrub	550	450	350
TOA:				
Tornillo	Loamy, Hot Desert Shrub	600	450	300
VCA:				
Vicente	Loamy Bottomland, Hot Desert Shrub	2,500	2,000	1,500
Lomapelona	Loamy Bottomland, Hot Desert Shrub	2,500	2,000	1,500
Castolon	Loamy Bottomland, Hot Desert Shrub	2,500	2,000	1,500

Table 17.--Ecological Site—Soil Correlation

(Only soils and miscellaneous land types with correlated ecological sites are shown)

Map unit symbol soil percentage and soil name	Ecological site name	Ecological site type	Ecological site ID
AAC:			
83%-Altar	Gravelly, Desert Grassland	Rangeland	R042XC244TX
ADE:			
75%-Altuda	Limestone Hill and Mountain, Mixed Prairie	Rangeland	R042XE278TX
ADG:			
60%-Altuda	Limestone Hill and Mountain, Mixed Prairie	Rangeland	R042XE278TX
BIE:			
50%-Bissett	Limestone Hill and Mountain, Desert Grassland	Rangeland	R042XC249TX
BIG:			
55%-Bissett	Limestone Hill and Mountain, Desert Grassland	Rangeland	R042XC249TX
BLD:			
85%-Blackgap	Limestone Hill and Mountain 8-14" PZ	Rangeland	R081DY592TX
BLE:			
50%-Blackgap	Limestone Hill and Mountain 8-14" PZ	Rangeland	R081DY592TX
BLG:			
50%-Blackgap	Limestone Hill and Mountain 8-14" PZ	Rangeland	R081DY592TX
CIC:			
70%-Chilicotal	Gravelly, Desert Grassland	Rangeland	R042XC244TX
CLE:			
60%-Chilicotal	Gravelly, Desert Grassland	Rangeland	R042XC244TX
25%-Paisano	Gravelly, Desert Grassland	Rangeland	R042XC244TX
CNB:			
81%-Chillon	Arroyo, Hot Desert Shrub	Rangeland	R042XG736TX
COC:			
85%-Corazones	Gravelly, Hot Desert Shrub	Rangeland	R042XG735TX
COE:			
70%-Corazones	Gravelly, Hot Desert Shrub	Rangeland	R042XG735TX
EUB:			
45%-Equipaje	Gravelly, Hot Desert Shrub	Rangeland	R042XG735TX
40%-Agust	Gravelly, Hot Desert Shrub	Rangeland	R042XG735TX
GEE:			
60%-Geefour	Salty Clay Hill, Hot Desert Shrub	Rangeland	R042XG734TX
GEF:			
70%-Geefour	Salty Clay Hill, Hot Desert Shrub	Rangeland	R042XG734TX

Table 17.--Ecological Site–Soil Correlation--Continued

Map unit symbol soil percentage and soil name	Ecological site name	Ecological site type	Ecological site ID
HRE:			
70%-Hurds	Foothill Slope, Mixed Prairie	Rangeland	R042XE274TX
LEE:			
75%-Leyva	Igneous Hill and Mountain, Desert Grassland	Rangeland	R042XC247TX
LGG:			
41%-Lingua	Igneous Hill and Mountain, Desert Grassland	Rangeland	R042XC247TX
LMF:			
30%-Liv	Igneous Hill and Mountain, Mountain Savannah	Rangeland	R042XF286TX
30%-Mainstay	Igneous Hill and Mountain, Mountain Savannah	Rangeland	R042XF286TX
MCC:			
70%-Mariscal	Flagstone Hill 8-14" PZ	Rangeland	R081DY295TX
MDE:			
45%-Mariscal	Flagstone Hill 8-14" PZ	Rangeland	R081DY295TX
MNE:			
45%-Mariscal	Flagstone Hill 8-14" PZ	Rangeland	R081DY295TX
40%-Terlingua	Basalt Hill, Hot Desert Shrub	Rangeland	R042XG263TX
MSE:			
92%-Musgrave	Clay Hill, Hot Desert Shrub	Rangeland	R042XG739TX
NNB:			
85%-Ninepoint	Loamy, Hot Desert Shrub	Rangeland	R042XG738TX
NPB:			
35%-Ninepoint, flat	Loamy, Hot Desert Shrub	Rangeland	R042XG738TX
30%-Ninepoint, pit	Loamy, Hot Desert Shrub	Rangeland	R042XG738TX
20%-Ninepoint, mound	Loamy, Hot Desert Shrub	Rangeland	R042XG738TX
PUF:			
50%-Puerta	Igneous Hill and Mountain, Mountain Savannah	Rangeland	R042XF286TX
35%-Madrone	Igneous Hill and Mountain, Mountain Savannah	Rangeland	R042XF286TX
3%-Lazarus	Loamy	Rangeland	R070CY109NM
RIA:			
30%-Pantera	Arroyo, Hot Desert Shrub	Rangeland	R042XG736TX
RKG:			
30%-Brewster	Igneous Hill and Mountain, Mixed Prairie	Rangeland	R042XE277TX
RTE:			
40%-Terlingua	Basalt Hill, Hot Desert Shrub	Rangeland	R042XG263TX
RTG:			
25%-Terlingua	Igneous Hill and Mountain, Hot Desert Shrub	Rangeland	R042XG264TX

Table 17.--Ecological Site—Soil Correlation--Continued

Map unit symbol soil percentage and soil name	Ecological site name	Ecological site type	Ecological site ID
SKE:			
45%-Solis	Sandstone Hill and Mountain, Hot Desert Shrub	Rangeland	R042XG586TX
SKG:			
50%-Solis	Sandstone Hill and Mountain, Hot Desert Shrub	Rangeland	R042XG586TX
STC:			
60%-Strawhouse	Gravelly 8-14" PZ	Rangeland	R081DY297TX
25%-Stillwell	Gravelly 8-14" PZ	Rangeland	R081DY297TX
STE:			
45%-Strawhouse	Gravelly 8-14" PZ	Rangeland	R081DY297TX
40%-Stillwell	Gravelly 8-14" PZ	Rangeland	R081DY297TX
SUE:			
60%-Studybutte	Igneous Hill and Mountain, Hot Desert Shrub	Rangeland	R042XG264TX
SUG:			
55%-Studybutte	Igneous Hill and Mountain, Hot Desert Shrub	Rangeland	R042XG264TX
TOA:			
80%-Tornillo	Loamy, Hot Desert Shrub	Rangeland	R042XG738TX
VCA:			
40%-Vicente	Loamy Bottomland, Hot Desert Shrub	Rangeland	R042XG733TX
30%-Lomapelona	Loamy Bottomland, Hot Desert Shrub	Rangeland	R042XG733TX
25%-Castolon	Loamy Bottomland, Hot Desert Shrub	Rangeland	R042XG733TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification

(Miscellaneous non-soil components are not displayed in this report. Component percents may not add up to 100 percent.)

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
AAC:								
Altar	83	1-8	2,684-4,898	12-15	Piedmont slope	Fan terrace	Gravelly alluvium derived from igneous and sedimentary rock	Gravelly, Desert Grassland, R042XC244TX
ADE:								
Altuda	75	10-30	4,026-6,942	14-20	Mountains	Mountain slope Ridge	Gravelly residuum weathered from limestone and/or gravelly colluvium derived from limestone	Limestone Hill and Mountain, Mixed Prairie, R042XE278TX
ADG:								
Altuda	60	20-70	4,646-5,837	14-20	Mountains	Mountain slope Ridge	Gravelly residuum weathered from limestone and/or gravelly colluvium derived from limestone	Limestone Hill and Mountain, Mixed Prairie, R042XE278TX
BIE:								
Bissett	50	5-30	2,697-5,463	12-15	Hills	Hill	Gravelly residuum weathered from limestone	Limestone Hill and Mountain, Desert Grassland, R042XC249TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
BIG:								
Bissett------------	55	20-60	2,818-5,817	12-15	Hills	Ridge	Gravelly residuum weathered from limestone and/or gravelly colluvium derived from limestone	Limestone Hill and Mountain, Desert Grassland, R042XC249TX
BLD:								
Blackgap-----------	85	1-16	1,929-3,914	10-13	Dissected plateau	Hill	Gravelly residuum weathered from limestone and/or gravelly colluvium derived from limestone	Limestone Hill and Mountain 8-14" PZ, R081DY592TX
						Ridge		
BLE:								
Blackgap-----------	50	10-30	1,808-4,173	10-13	Dissected plateau	Hill	Gravelly residuum weathered from limestone and/or gravelly colluvium derived from limestone	Limestone Hill and Mountain 8-14" PZ, R081DY592TX
						Ridge		
BLG:								
Blackgap-----------	50	20-60	1,726-4,636	10-13	Dissected plateau	Hill	Gravelly residuum weathered from limestone and/or gravelly colluvium derived from limestone	Limestone Hill and Mountain 8-14" PZ, R081DY592TX
						Ridge		

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
CIC:								
Chilicotal----------	70	1-8	2,513-4,865	12-15	Piedmont slope	Fan remnant	Gravelly alluvium derived from igneous rock	Gravelly, Desert Grassland, R042XC244TX
CLE:								
Chilicotal----------	60	5-30	2,598-4,856	12-15	Piedmont slope	Fan remnant	Gravelly pedisediment derived from igneous and sedimentary rock and/or gravelly alluvium derived from igneous and sedimentary rock	Gravelly, Desert Grassland, R042XC244TX
Paisano------------	25	5-8	2,598-4,856	12-15	Piedmont slope	Fan remnant	Gravelly alluvium derived from igneous and sedimentary rock	Gravelly, Desert Grassland, R042XC244TX
CNB:								
Chillon------------	81	1-3	1,850-4,298	10-13	Semi-bolson	Flood-plain step Low terrace	Gravelly alluvium derived from igneous and sedimentary rock	Arroyo, Hot Desert Shrub, R042XG736TX
COC:								
Corazones----------	85	1-8	1,863-4,298	10-13	Piedmont slope	Pediment	Gravelly alluvium derived from igneous and sedimentary rock	Gravelly, Hot Desert Shrub, R042XG735TX
COE:								
Corazones----------	70	1-30	1,939-3,553	10-13	Piedmont slope	Dissected pediment	Gravelly alluvium derived from igneous and sedimentary rock	Gravelly, Hot Desert Shrub, R042XG735TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
EUB:								
Equipaje-----------	45	1-3	2,634-3,333	10-13	Piedmont slope	Alluvial fan	Loamy alluvium derived from igneous and sedimentary rock	Gravelly, Hot Desert Shrub, R042XG735TX
Agust--------------	40	1-3	2,634-3,333	10-13	Piedmont slope	Alluvial fan	Loamy alluvium derived from igneous and sedimentary rock	Gravelly, Hot Desert Shrub, R042XG735TX
GEE:								
Geefour------------	60	3-20	1,814-3,858	10-13	Intermontane basin	Hillslope	Clayey residuum weathered from mudstone	Salty Clay Hill, Hot Desert Shrub, R042XG734TX
GEF:								
Geefour------------	70	10-45	1,841-4,564	10-13	Intermontane basin	Hillslope	Clayey residuum weathered from mudstone	Salty Clay Hill, Hot Desert Shrub, R042XG734TX
HRE:								
Hurds--------------	70	10-30	4,022-6,526	14-20	Mountain valleys or canyons	Alluvial fan	Gravelly colluvium derived from igneous rock and/or gravelly alluvium derived from igneous rock	Foothill Slope, Mixed Prairie, R042XE274TX
LEE:								
Leyva--------------	75	10-30	2,464-5,440	12-15	Hills	Hillslope	Colluvium and/or residuum weathered from rhyolite and/or igneous rock	Igneous Hill and Mountain, Desert Grassland, R042XC247TX
					Mountains	Mountain slope		
LGG:								
Lingua-------------	41	20-60	2,385-7,365	12-15	Hills	Hillslope	Gravelly residuum weathered from trachyte and/or gravelly colluvium derived from trachyte	Igneous Hill and Mountain, Desert Grassland,R042XC247TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
LMF:								
Liv-----------------	30	20-45	4,619-7,185	18-26	Mountains	Mountain slope	Gravelly colluvium derived from trachyte	Igneous Hill and Mountain, Mountain Savannah, R042XF286TX
Mainstay------------	30	20-45	4,619-7,185	18-26	Mountains	Mountain slope	Gravelly colluvium derived from trachyte	Igneous Hill and Mountain, Mountain Savannah, R042XF286TX
MCC:								
Mariscal------------	70	1-8	1,893-3,602	10-13	Dissected plateau	Plateau	Residuum weathered from limestone and shale	Flagstone (Desert Shrub), R042XY584TX
MDE:								
Mariscal------------	45	5-30	1,824-3,589	10-13	Dissected plateau	Hill	Residuum weathered from limestone and shale and/or colluvium derived from limestone and shale	Flagstone Hill 8-14" PZ, R081DY295TX
MNE:								
Mariscal------------	45	10-30	1,890-3,930	10-13	Dissected plateau	Hill	Residuum weathered from limestone and shale and/or colluvium derived from limestone and shale	Flagstone Hill 8-14" PZ, R081DY295TX
Terlingua-----------	40	10-30	1,890-3,930	10-13	Dissected plateau	Hillslope Ridge	Residuum weathered from basalt	Basalt Hill, Hot Desert Shrub, R042XG263TX
MSE:								
Musgrave------------	92	1-20	2,024-3,576	10-13	Basin	Low hill	Residuum weathered from tuff	Clay Hill, Hot Desert Shrub, R042XG739TX
NNB:								
Ninepoint-----------	85	0-3	1,837-3,435	10-13	Basin	Alluvial flat	Loamy alluvium derived from limestone and shale	Loamy, Hot Desert Shrub, R042XG738TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
NPB:								
Ninepoint, flat----	35	1-2	2,795-2,946	10-13	Basin	Alluvial flat	Loamy alluvium derived from sandstone and siltstone	Loamy, Hot Desert Shrub, R042XG738TX
Ninepoint, pit-----	30	1-1	2,795-2,946	10-13	Basin	Alluvial flat	Loamy alluvium derived from sandstone and siltstone	Loamy, Hot Desert Shrub, R042XG738TX
Ninepoint, mound---	20	1-3	2,795-2,946	10-13	Basin	Alluvial flat	Loamy alluvium derived from sandstone and siltstone	Loamy, Hot Desert Shrub, R042XG738TX
PUF:								
Puerta-------------	50	20-45	5,577-7,782	18-26	Mountains	Mountain slope	Gravelly residuum weathered from trachyte	Igneous Hill and Mountain, Mountain Savannah, R042XF286TX
Madrone------------	35	20-45	5,577-7,782	18-26	Mountains	Mountain slope	Gravelly residuum weathered from trachyte and/or gravelly colluvium derived from trachyte	Igneous Hill and Mountain, Mountain Savannah,R042XF286TX
Lazarus------------	3	0-10	5,577-7,782	18-26	Mountains	Valley floor	Alluvium derived from limestone and dolomite	Loamy, R070CY109NM
RIA:								
Pantera------------	30	0-2	1,739-4,140	10-13	Intermontane basin	Arroyo	Sandy and gravelly alluvium derived from igneous and sedimentary rock	Arroyo, Hot Desert Shrub, R042XG736TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
RKG:								
Brewster	30	20-45	4,121-7,480	14-20	Mountains	Mountain slope	Residuum weathered from trachyte	Igneous Hill and Mountain, Mixed Prairie, R042XE277TX
RTE:								
Terlingua	40	10-30	1,965-3,487	10-13	Hills	Hillslope	Gravelly residuum weathered from basalt	Basalt Hill, Hot Desert Shrub, R042XG263TX
						Ridge		
RTG:								
Terlingua	25	20-60	2,087-3,346	10-13	Hills	Hillslope	Residuum weathered from basalt	Igneous Hill and Mountain, Hot Desert Shrub,R042XG264TX
						Ridge		
SKE:								
Solis	45	1-16	1,854-3,757	10-13	Hills	Erosion remnant	Loamy residuum weathered from sandstone	Sandstone Hill and Mountain, Hot Desert Shrub, R042XG586TX
SKG:								
Solis	50	20-45	1,860-4,055	10-13	Hills	Scarp	Loamy residuum weathered from sandstone	Sandstone Hill and Mountain, Hot Desert Shrub, R042XG586TX
STC:								
Strawhouse	60	1-3	1,726-3,730	10-13	Piedmont slope	Fan remnant	Gravelly pedisediment derived from limestone	Gravelly 8-14" PZ, R081DY297TX
Stillwell	25	1-8	1,726-3,730	10-13	Piedmont slope	Fan remnant	Gravelly alluvium derived from limestone	Gravelly 8-14" PZ, R081DY297TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
STE:								
Strawhouse---------	45	1-8	1,709-3,337	10-13	Piedmont slope	Fan remnant	Gravelly pedisediment derived from limestone and/or gravelly alluvium derived from limestone	Gravelly 8-14" PZ, R081DY297TX
Stillwell----------	40	1-30	1,709-3,337	10-13	Piedmont slope	Inset fan on low pediment	Gravelly alluvium derived from limestone	Gravelly 8-14" PZ, R081DY297TX
SUE:								
Studybutte---------	60	10-30	2,260-3,914	10-13	Hills	Hillslope	Gravelly residuum weathered from trachyte and/or gravelly residuum weathered from rhyolite	Igneous Hill and Mountain, Hot Desert Shrub, R042XG264TX
SUG:								
Studybutte---------	55	20-45	2,270-4,819	10-13	Hills	Hillslope	Gravelly residuum weathered from trachyte and/or gravelly residuum weathered from rhyolite	Igneous Hill and Mountain, Hot Desert Shrub, R042XG264TX
TOA:								
Tornillo-----------	80	0-2	1,909-3,199	10-13	Basin	Alluvial flat	Loamy alluvium derived from igneous and sedimentary rock	Loamy, Hot Desert Shrub, R042XG738TX

Table 18.--Elevation, Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	Mean Annual Precipitation	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Feet	In				
VCA:								
Vicente------------	40	0-1	1,713-2,316	10-13	River valley	Proximal to channel flood plain	Loamy alluvium derived from igneous and sedimentary rock	Loamy Bottomland, Hot Desert Shrub, R042XG733TX
Lomapelona---------	30	0-1	1,713-2,316	10-13	River valley	Proximal to channel flood plain	Loamy alluvium derived from igneous and sedimentary rock	Loamy Bottomland, Hot Desert Shrub, R042XG733TX
Castolon-----------	25	0-1	1,713-2,316	10-13	River valley	Distal to channel on flood plain	Loamy alluvium derived from igneous and sedimentary rock	Loamy Bottomland, Hot Desert Shrub, R042XG733TX

Table 19.--Camp and Picnic Areas

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AAC:					
Altar	83	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
ADE:					
Altuda	75	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Gravel	0.01	Gravel	0.01
		Dusty	0.50	Dusty	0.50
		Large stones content	0.18	Large stones content	0.18
ADG:					
Altuda	60	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.01	Gravel	0.01
		Dusty	0.50	Dusty	0.50
		Large stones content	0.18	Large stones content	0.18
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Gravel	0.76	Gravel	0.76
		Dusty	0.50	Dusty	0.50
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Gravel	1.00	Gravel	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	10	Not rated		Not rated	

Table 19.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
BLE:					
Blackgap	50	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	40	Not rated		Not rated	
BLG:					
Blackgap	50	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Gravel	1.00	Gravel	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
CLE:					
Chilicotal	60	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
		Sodium content	1.00	Sodium content	1.00
		Slope	0.16	Slope	0.16
Paisano	25	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Gravel	0.99	Gravel	0.99
CNB:					
Chillon	81	Not rated		Not rated	
COC:					
Corazones	85	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
COE:					
Corazones	70	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
		Slope	0.16	Slope	0.16
EUB:					
Equipaje	45	Not limited		Not limited	
Agust	40	Not limited		Not limited	
GEE:					
Geefour	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slow water movement	0.39	Slow water movement	0.39

Table 19.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Value	Picnic areas: Rating class and limiting features	Value
GEF:					
Geefour	70	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.39	Slow water movement	0.39
HRE:					
Hurds	70	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.05	Large stones content	0.05
		Dusty	0.50	Dusty	0.50
LEE:					
Leyva	75	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.97	Gravel	0.97
		Slow water movement	0.85	Slow water movement	0.85
		Dusty	0.50	Dusty	0.50
Rock outcrop	15	Not rated		Not rated	
LGG:					
Lingua	41	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
Rock outcrop	36	Not rated		Not rated	
LMF:					
Liv	30	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Gravel	1.00	Gravel	1.00
Mainstay	30	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.01	Gravel	0.01
		Dusty	0.50	Dusty	0.50
		Large stones content	0.12	Large stones content	0.12
Rock outcrop	15	Not rated		Not rated	
MCC:					
Mariscal	70	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.27	Gravel	0.27
		Large stones content	0.18	Large stones content	0.18
		Dusty	0.50	Dusty	0.50

Table 19.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
MDE:					
Mariscal	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Gravel	0.27	Gravel	0.27
		Large stones content	0.18	Large stones content	0.18
		Dusty	0.50	Dusty	0.50
Rock outcrop	40	Not rated		Not rated	
MNE:					
Mariscal	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Gravel	0.27	Gravel	0.27
		Large stones content	0.18	Large stones content	0.18
		Dusty	0.50	Dusty	0.50
Terlingua	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Too steep	1.00	Too steep	1.00
MSE:					
Musgrave	92	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.16	Slope	0.16
		Salinity	0.10	Salinity	0.10
		Too clayey	0.50	Too clayey	0.50
NNB:					
Ninepoint	85	Not limited		Not limited	
NPB:					
Ninepoint, flat	35	Not limited		Not limited	
Ninepoint, pit	30	Not limited		Not limited	
Ninepoint, mound	20	Very limited		Very limited	
		Sodium content	1.00	Sodium content	1.00
PUF:					
Puerta	50	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Gravel	1.00	Gravel	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
Madrone	35	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Gravel	0.99	Gravel	0.99
Lazarus	3	Not limited		Not limited	

Table 19.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	Very limited		Very limited	
		Flooding	1.00	Too sandy	1.00
		Too sandy	1.00	Gravel	0.89
		Gravel	0.89	Flooding	0.40
RKG:					
Rock outcrop	60	Not rated		Not rated	
Brewster	30	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Gravel	1.00	Gravel	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Too steep	1.00	Too steep	1.00
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
SKE:					
Solis	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.37	Slope	0.37
Rock outcrop	35	Not rated		Not rated	
SKG:					
Solis	50	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
Rock outcrop	40	Not rated		Not rated	
STC:					
Strawhouse	60	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Gravel	1.00	Gravel	1.00
		Dusty	0.50	Dusty	0.50
Stillwell	25	Very limited		Very limited	
		Sodium content	1.00	Sodium content	1.00
		Gravel	1.00	Gravel	1.00
		Too sandy	0.08	Too sandy	0.08

Table 19.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
STE:					
Strawhouse----------	45	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Gravel	1.00	Gravel	1.00
		Dusty	0.50	Dusty	0.50
Stillwell-----------	40	Very limited		Very limited	
		Sodium content	1.00	Sodium content	1.00
		Gravel	1.00	Gravel	1.00
		Slope	0.16	Slope	0.16
		Too sandy	0.08	Too sandy	0.08
SUE:					
Studybutte----------	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Too steep	1.00	Too steep	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop--------	20	Not rated		Not rated	
SUG:					
Studybutte----------	55	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop--------	30	Not rated		Not rated	
TOA:					
Tornillo------------	80	Very limited		Very limited	
		Flooding	1.00	Sodium content	1.00
		Sodium content	1.00	Dusty	0.50
		Dusty	0.50		
VCA:					
Vicente-------------	40	Very limited		Not limited	
		Flooding	1.00		
Lomapelona----------	30	Very limited		Somewhat limited	
		Flooding	1.00	Flooding	0.40
Castolon------------	25	Very limited		Not limited	
		Flooding	1.00		

Table 20.--Trail Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Foot traffic and equestrian trails: Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Mountain bike and off-road vehicle trails: Value
AAC:					
Altar	83	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
ADE:					
Altuda	75	Somewhat limited		Somewhat limited	
		Slope	0.18	Dusty	0.50
		Dusty	0.50	Large stones content	0.18
		Large stones content	0.18		
ADG:					
Altuda	60	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.78
		Dusty	0.50	Dusty	0.50
		Large stones content	0.18	Large stones content	0.18
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Somewhat limited		Somewhat limited	
		Slope	0.50	Dusty	0.50
		Dusty	0.50		
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Rock outcrop	10	Not rated		Not rated	
BLE:					
Blackgap	50	Somewhat limited		Somewhat limited	
		Slope	0.18	Dusty	0.50
		Dusty	0.50		
Rock outcrop	40	Not rated		Not rated	

Table 20.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
BLG:					
Blackgap	50	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	Not limited		Not limited	
CLE:					
Chilicotal	60	Not limited		Not limited	
Paisano	25	Not limited		Not limited	
CNB:					
Chillon	81	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
COC:					
Corazones	85	Not limited		Not limited	
COE:					
Corazones	70	Not limited		Not limited	
EUB:					
Equipaje	45	Not limited		Not limited	
Agust	40	Not limited		Not limited	
GEE:					
Geefour	60	Not limited		Not limited	
GEF:					
Geefour	70	Very limited		Somewhat limited	
		Slope	1.00	Too clayey	0.50
		Too clayey	0.50		
HRE:					
Hurds	70	Somewhat limited		Somewhat limited	
		Large stones content	0.05	Large stones content	0.05
		Dusty	0.50	Dusty	0.50
LEE:					
Leyva	75	Somewhat limited		Somewhat limited	
		Slope	0.92	Dusty	0.50
		Dusty	0.50		
Rock outcrop	15	Not rated		Not rated	
LGG:					
Lingua	41	Very limited		Very limited	
		Slope	1.00	Gravel	1.00
		Gravel	1.00	Slope	0.78
Rock outcrop	36	Not rated		Not rated	

Table 20.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
LMF:					
Liv	30	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.56
Mainstay	30	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.56
		Dusty	0.50	Dusty	0.50
		Large stones content	0.12	Large stones content	0.12
Rock outcrop	15	Not rated		Not rated	
MCC:					
Mariscal	70	Somewhat limited		Somewhat limited	
		Large stones content	0.18	Large stones content	0.18
		Dusty	0.50	Dusty	0.50
MDE:					
Mariscal	45	Somewhat limited		Somewhat limited	
		Slope	0.50	Large stones content	0.18
		Large stones content	0.18	Dusty	0.50
		Dusty	0.50		
Rock outcrop	40	Not rated		Not rated	
MNE:					
Mariscal	45	Somewhat limited		Somewhat limited	
		Slope	0.50	Large stones content	0.18
		Large stones content	0.18	Dusty	0.50
		Dusty	0.50		
Terlingua	40	Somewhat limited		Not limited	
		Slope	0.02		
MSE:					
Musgrave	92	Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00
		Too clayey	0.50	Too clayey	0.50
NNB:					
Ninepoint	85	Not limited		Not limited	
NPB:					
Ninepoint, flat	35	Not limited		Not limited	
Ninepoint, pit	30	Not limited		Not limited	
Ninepoint, mound	20	Not limited		Not limited	

Table 20.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
PUF:					
Puerta	50	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.56
Madrone	35	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Lazarus	3	Not limited		Not limited	
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Flooding	0.40	Flooding	0.40
RKG:					
Rock outcrop	60	Not rated		Not rated	
Brewster	30	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.56
		Dusty	0.50	Dusty	0.50
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	Somewhat limited		Not limited	
		Slope	0.02		
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
SKE:					
Solis	45	Not limited		Not limited	
Rock outcrop	35	Not rated		Not rated	
SKG:					
Solis	50	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.22
Rock outcrop	40	Not rated		Not rated	
STC:					
Strawhouse	60	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Stillwell	25	Somewhat limited		Somewhat limited	
		Too sandy	0.08	Too sandy	0.08

Table 20.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
STE:					
Strawhouse	45	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Stillwell	40	Somewhat limited		Somewhat limited	
		Too sandy	0.08	Too sandy	0.08
SUE:					
Studybutte	60	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
		Slope	0.18	Dusty	0.50
		Dusty	0.50		
Rock outcrop	20	Not rated		Not rated	
SUG:					
Studybutte	55	Very limited		Very limited	
		Slope	1.00	Gravel	1.00
		Gravel	1.00	Slope	0.22
		Dusty	0.50	Dusty	0.50
Rock outcrop	30	Not rated		Not rated	
TOA:					
Tornillo	80	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
VCA:					
Vicente	40	Not limited		Not limited	
Lomapelona	30	Somewhat limited		Somewhat limited	
		Flooding	0.40	Flooding	0.40
Castolon	25	Not limited		Not limited	

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants		Habitat for Burrowing Mammals and Reptiles	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AAC:					
Altar	83	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.29	Too gravelly	0.88
ADE:					
Altuda	75	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.22	Content of large stones	1.00
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
ADG:					
Altuda	60	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.22	Content of large stones	1.00
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Somewhat limited		Very limited	
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
				Too gravelly	1.00
				Too clayey	0.05
				Content of large stones	0.68
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	Somewhat limited		Somewhat limited	
		Droughty	0.50	Too gravelly	0.68
		Too gravelly, cobbly, or stony	0.18	Content of large stones	0.86
				Too clayey	0.05
				10-20" to Bedrock (Hard or Soft)	0.12
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.24	Content of large stones	1.00
		Droughty	0.50	Too gravelly	0.09
		Extreme soil temperatures	0.50	10-20" to Bedrock (Hard or Soft)	0.97

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles--Continued

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants		Habitat for Burrowing Mammals and Reptiles	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Rock outcrop	10	Not rated		Not rated	
BLE:					
Blackgap	50	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.24	Content of large stones	1.00
		Droughty	0.50	Too gravelly	0.09
		Extreme soil temperatures	0.50	10-20" to Bedrock (Hard or Soft)	0.97
Rock outcrop	40	Not rated		Not rated	
BLG:					
Blackgap	50	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.24	Content of large stones	1.00
		Droughty	0.50	Too gravelly	0.09
		Extreme soil temperatures	0.50	10-20" to Bedrock (Hard or Soft)	0.97
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.03	Too gravelly	0.59
CLE:					
Chilicotal	60	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.03	Too gravelly	0.59
Paisano	25	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.01	Cemented pan	0.92
		Droughty	0.50	Too gravelly	0.54
CNB:					
Chillon	81	Somewhat limited		Somewhat limited	
		Excess Sodium	0.44	Content of large stones	0.96
		Too gravelly, cobbly, or stony	0.29	Too gravelly	0.88
		Extreme soil temperatures	0.50	Flooding	0.50
		Droughty	0.50		
		Excess salt	0.01		

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles--Continued

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants: Rating class and limiting features	Value	Habitat for Burrowing Mammals and Reptiles: Rating class and limiting features	Value
COC:					
Corazones	85	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.14	Content of large stones	0.99
		Extreme soil temperatures	0.50	Too gravelly	0.83
COE:					
Corazones	70	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.14	Content of large stones	0.99
		Extreme soil temperatures	0.50	Too gravelly	0.83
EUB:					
Equipaje	45	Somewhat limited		Not limited	
		Extreme soil temperatures	0.50		
Agust	40	Somewhat limited		Not limited	
		Extreme soil temperatures	0.50		
GEE:					
Geefour	60	Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	1.00
		Droughty	0.50	10-20" to Bedrock (Hard or Soft)	0.46
		Extreme soil temperatures	0.50		
		Excess salt	0.06		
GEF:					
Geefour	70	Somewhat limited		Very limited	
		Too alkaline	0.92	Too clayey	1.00
		Excess salt	0.88	10-20" to Bedrock (Hard or Soft)	0.92
		Too clayey	0.50		
		Extreme soil temperatures	0.50		
		Droughty	0.50		
HRE:					
Hurds	70	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.06	Content of large stones	0.99
				Too clayey	0.11

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles--Continued

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants: Rating class and limiting features	Value	Habitat for Burrowing Mammals and Reptiles: Rating class and limiting features	Value
LEE:					
Leyva	75	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.08	Too clayey	0.95
		Droughty	0.50	Too gravelly	0.17
				10-20" to Bedrock (Hard or Soft)	0.46
				Content of large stones	0.04
Rock outcrop	15	Not rated		Not rated	
LGG:					
Lingua	41	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.34	Too gravelly	0.99
		Droughty	0.50	10-20" to Bedrock (Hard or Soft)	0.80
Rock outcrop	36	Not rated		Not rated	
LMF:					
Liv	30	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.27	Too clayey	1.00
				Content of large stones	1.00
				Too gravelly	0.13
Mainstay	30	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.14	Too clayey	1.00
		Droughty	0.50	Content of large stones	1.00
				10-20" to Bedrock (Hard or Soft)	0.05
Rock outcrop	15	Not rated		Not rated	
MCC:					
Mariscal	70	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.47	Content of large stones	1.00
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
		Extreme soil temperatures	0.50		

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles--Continued

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants		Habitat for Burrowing Mammals and Reptiles	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MDE:					
Mariscal------------	45	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.47	Content of large stones	1.00
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
		Extreme soil temperatures	0.50		
Rock outcrop--------	40	Not rated		Not rated	
MNE:					
Mariscal------------	45	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.47	Content of large stones	1.00
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
		Extreme soil temperatures	0.50		
Terlingua-----------	40	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.16	< 10" to Bedrock (Hard or Soft)	1.00
		Droughty	0.50	Too gravelly	0.22
		Extreme soil temperatures	0.50		
MSE:					
Musgrave------------	92	Somewhat limited		Very limited	
		Too alkaline	0.92	Too clayey	1.00
		Excess salt	0.17	10-20" to Bedrock (Hard or Soft)	0.01
		Too clayey	0.50		
		Extreme soil temperatures	0.50		
NNB:					
Ninepoint-----------	85	Somewhat limited		Somewhat limited	
		Extreme soil temperatures	0.50	Too clayey	0.11
NPB:					
Ninepoint, flat-----	35	Somewhat limited		Not limited	
		Extreme soil temperatures	0.50		
Ninepoint, pit------	30	Somewhat limited		Somewhat limited	
		Extreme soil temperatures	0.50	Too clayey	0.43
Ninepoint, mound----	20	Somewhat limited		Not limited	
		Extreme soil temperatures	0.50		

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles--Continued

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants: Rating class and limiting features	Value	Habitat for Burrowing Mammals and Reptiles: Rating class and limiting features	Value
PUF:					
Puerta	50	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.10	Too clayey	1.00
		Droughty	0.50	Too gravelly	0.05
Madrone	35	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.02	Too clayey	1.00
				Too gravelly	0.45
Lazarus	3	Not limited		Somewhat limited	
				Too clayey	0.01
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	Somewhat limited		Very limited	
		Too alkaline	0.32	Flooding	1.00
		Sandy surface	0.50	Too gravelly	0.33
		Extreme soil temperatures	0.50		
RKG:					
Rock outcrop	60	Not rated			
Brewster	30	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.18	< 10" to Bedrock (Hard or Soft)	1.00
		Droughty	0.50	Content of large stones	0.08
				Too gravelly	0.02
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.16	< 10" to Bedrock (Hard or Soft)	1.00
		Droughty	0.50	Excess humus	1.00
		Extreme soil temperatures	0.50	Too gravelly	0.46
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.16	< 10" to Bedrock (Hard or Soft)	1.00
		Droughty	0.50	Excess humus	1.00
		Extreme soil temperatures	0.50	Too gravelly	0.46

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles--Continued

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants: Rating class and limiting features	Value	Habitat for Burrowing Mammals and Reptiles: Rating class and limiting features	Value
SKE:					
Solis	45	Somewhat limited		Very limited	
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
		Extreme soil temperatures	0.50		
Rock outcrop	35	Not rated		Not rated	
SKG:					
Solis	50	Somewhat limited		Very limited	
		Droughty	0.50	< 10" to Bedrock (Hard or Soft)	1.00
		Extreme soil temperatures	0.50		
Rock outcrop	40	Not rated		Not rated	
STC:					
Strawhouse	60	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.05	Cemented pan	0.46
		Extreme soil temperatures	0.50	Too gravelly	0.09
		Droughty	0.50		
		Excess salt	0.01		
Stillwell	25	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.02	Too gravelly	0.04
		Extreme soil temperatures	0.50		
		Droughty	0.50		
STE:					
Strawhouse	45	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.05	Cemented pan	0.46
		Extreme soil temperatures	0.50	Too gravelly	0.09
		Droughty	0.50		
		Excess salt	0.01		
Stillwell	40	Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.02	Too gravelly	0.04
		Extreme soil temperatures	0.50		
		Droughty	0.50		

Table 21.--Desertic Herbaceous Plants and Habitat for Burrowing Mammals and Reptiles--Continued

Map symbol and soil name	Pct. of map unit	Desertic Herbaceous Plants: Rating class and limiting features	Value	Habitat for Burrowing Mammals and Reptiles: Rating class and limiting features	Value
SUE:					
Studybutte----------	60	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.55	< 10" to Bedrock (Hard or Soft)	1.00
		Droughty	0.50	Too gravelly	0.96
		Extreme soil temperatures	0.50		
Rock outcrop--------	20	Not rated		Not rated	
SUG:					
Studybutte----------	55	Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.55	< 10" to Bedrock (Hard or Soft)	1.00
		Droughty	0.50	Too gravelly	0.96
		Extreme soil temperatures	0.50		
Rock outcrop--------	30	Not rated		Not rated	
TOA:					
Tornillo------------	80	Somewhat limited		Very limited	
		Extreme soil temperatures	0.50	Flooding	1.00
VCA:					
Vicente-------------	40	Somewhat limited		Very limited	
		Extreme soil temperatures	0.50	Flooding	1.00
Lomapelona----------	30	Somewhat limited		Very limited	
		Extreme soil temperatures	0.50	Flooding	1.00
Castolon------------	25	Somewhat limited		Very limited	
		Extreme soil temperatures	0.50	Flooding	1.00

Table 22.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines for Wildlife Habitat

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants		Upland Desertic Shrubs and Trees		Upland Shrubs and Vines	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AAC:							
Altar	83	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.29	Too gravelly, cobbly, or stony	0.29	Too gravelly, cobbly, or stony	0.29
ADE:							
Altuda	75	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.22	Too gravelly, cobbly, or stony	0.22	Too gravelly, cobbly, or stony	0.22
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.06
ADG:							
Altuda	60	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.22	Too gravelly, cobbly, or stony	0.22	Too gravelly, cobbly, or stony	0.22
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.06
Rock outcrop	30	Not rated		Not rated		Not rated	
BIE:							
Bissett	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.05
Rock outcrop	30	Not rated		Not rated		Not rated	
BIG:							
Bissett	55	Somewhat limited		Somewhat limited		Somewhat limited	
		Droughty	0.50	Droughty	0.50	Droughty	0.50
		Too gravelly, cobbly, or stony	0.18	Too gravelly, cobbly, or stony	0.18	Too gravelly, cobbly, or stony	0.18
						Bedrock	0.29
Rock outcrop	30	Not rated		Not rated		Not rated	
BLD:							
Blackgap	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.24	Too gravelly, cobbly, or stony	0.24	Too gravelly, cobbly, or stony	0.24
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.08
Rock outcrop	10	Not rated		Not rated		Not rated	

Table 22.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants: Rating class and limiting features	Value	Upland Desertic Shrubs and Trees: Rating class and limiting features	Value	Upland Shrubs and Vines: Rating class and limiting features	Value
BLE:							
Blackgap	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.24	Too gravelly, cobbly, or stony	0.24	Too gravelly, cobbly, or stony	0.24
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.08
Rock outcrop	40	Not rated		Not rated		Not rated	
BLG:							
Blackgap	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.24	Too gravelly, cobbly, or stony	0.24	Too gravelly, cobbly, or stony	0.24
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.08
Rock outcrop	40	Not rated		Not rated		Not rated	
CIC:							
Chilicotal	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.03	Too gravelly, cobbly, or stony	0.03	Too gravelly, cobbly, or stony	0.03
CLE:							
Chilicotal	60	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.03	Too gravelly, cobbly, or stony	0.03	Too gravelly, cobbly, or stony	0.03
Paisano	25	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.01	Too gravelly, cobbly, or stony	0.01	Cemented pan	0.90
		Droughty	0.50	Droughty	0.50	Too gravelly, cobbly, or stony	0.01
						Droughty	0.50
CNB:							
Chillon	81	Not rated		Not rated		Not rated	
COC:							
Corazones	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.14	Too gravelly, cobbly, or stony	0.14	Too gravelly, cobbly, or stony	0.14
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
COE:							
Corazones	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.14	Too gravelly, cobbly, or stony	0.14	Too gravelly, cobbly, or stony	0.14
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50

Table 22.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants: Rating class and limiting features	Value	Upland Desertic Shrubs and Trees: Rating class and limiting features	Value	Upland Shrubs and Vines: Rating class and limiting features	Value
EUB:							
Equipaje	45	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
Agust	40	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
GEE:							
Geefour	60	Somewhat limited		Somewhat limited		Somewhat limited	
		Too clayey	0.50	Too clayey	0.50	Too clayey	0.50
		Droughty	0.50	Droughty	0.50	Droughty	0.50
		Excess salt	0.06	Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
				Excess salt	0.06	Excess salt	0.06
						Bedrock	0.19
GEF:							
Geefour	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Excess salt	0.88	Too alkaline	0.92	Excess salt	0.88
		Too clayey	0.50	Excess salt	0.88	Too clayey	0.50
		Droughty	0.50	Too clayey	0.50	Extreme soil temperatures	0.50
				Extreme soil temperatures	0.50	Droughty	0.50
				Droughty	0.50	Bedrock	0.10
HRE:							
Hurds	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.06	Too gravelly, cobbly, or stony	0.06	Too gravelly, cobbly, or stony	0.06
LEE:							
Leyva	75	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.08	Too gravelly, cobbly, or stony	0.08	Too gravelly, cobbly, or stony	0.08
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.19
Rock outcrop	15	Not rated		Not rated		Not rated	
LGG:							
Lingua	41	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.34	Too gravelly, cobbly, or stony	0.34	Too gravelly, cobbly, or stony	0.34
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.13
Rock outcrop	36	Not rated		Not rated		Not rated	

Table 22.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants		Upland Desertic Shrubs and Trees		Upland Shrubs and Vines	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LMF:							
Liv	30	Somewhat limited		Somewhat limited		Very limited	
		Too gravelly, cobbly, or stony	0.27	Too gravelly, cobbly, or stony	0.27	Bedrock	1.00
						Too gravelly, cobbly, or stony	0.27
Mainstay	30	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.14	Too gravelly, cobbly, or stony	0.14	Too gravelly, cobbly, or stony	0.14
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.32
Rock outcrop	15	Not rated		Not rated		Not rated	
MCC:							
Mariscal	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.47	Too gravelly, cobbly, or stony	0.47	Too gravelly, cobbly, or stony	0.47
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
MDE:							
Mariscal	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.47	Too gravelly, cobbly, or stony	0.47	Too gravelly, cobbly, or stony	0.47
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
Rock outcrop	40	Not rated		Not rated		Not rated	
MNE:							
Mariscal	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.47	Too gravelly, cobbly, or stony	0.47	Too gravelly, cobbly, or stony	0.47
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
Terlingua	40	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.16	Too gravelly, cobbly, or stony	0.16	Too gravelly, cobbly, or stony	0.16
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.02
MSE:							
Musgrave	92	Somewhat limited		Somewhat limited		Somewhat limited	
		Excess sodium	0.32	Too alkaline	0.92	Excess salt	0.17
		Excess salt	0.17	Excess salt	0.17	Too clayey	0.50
		Too clayey	0.50	Too clayey	0.50	Extreme soil temperatures	0.50
				Extreme soil temperatures	0.50	Bedrock	0.36

Table 22.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants: Rating class and limiting features	Value	Upland Desertic Shrubs and Trees: Rating class and limiting features	Value	Upland Shrubs and Vines: Rating class and limiting features	Value
NNB:							
Ninepoint-----------	85	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
NPB:							
Ninepoint, flat-----	35	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
Ninepoint, pit------	30	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
Ninepoint, mound----	20	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
PUF:							
Puerta--------------	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.10	Too gravelly, cobbly, or stony	0.10	Too gravelly, cobbly, or stony	0.10
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.38
Madrone-------------	35	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.02	Too gravelly, cobbly, or stony	0.02	Too gravelly, cobbly, or stony	0.02
						Bedrock	0.91
Lazarus-------------	3	Not limited		Not limited		Not limited	
RIA:							
Riverwash-----------	60	Not rated		Not rated		Not rated	
Pantera-------------	30	Somewhat limited		Somewhat limited		Somewhat limited	
		Sandy surface	0.40	Too alkaline	0.32	Extreme soil temperatures	0.50
				Extreme soil temperatures	0.50	Sandy surface	0.40
				Sandy surface	0.40		
RKG:							
Rock outcrop--------	60	Not rated		Not rated		Not rated	
Brewster------------	30	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.18	Too gravelly, cobbly, or stony	0.18	Too gravelly, cobbly, or stony	0.18
		Droughty	0.50	Droughty	0.50	Droughty	0.50

Table 22.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants: Rating class and limiting features	Value	Upland Desertic Shrubs and Trees: Rating class and limiting features	Value	Upland Shrubs and Vines: Rating class and limiting features	Value
RTE:							
Rock outcrop	50	Not rated		Not rated		Not rated	
Terlingua	40	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.16	Too gravelly, cobbly, or stony	0.16	Too gravelly, cobbly, or stony	0.16
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.02
RTG:							
Rock outcrop	65	Not rated		Not rated		Not rated	
Terlingua	25	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.16	Too gravelly, cobbly, or stony	0.16	Too gravelly, cobbly, or stony	0.16
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.02
SKE:							
Solis	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.01
Rock outcrop	35	Not rated		Not rated		Not rated	
SKG:							
Solis	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.01
Rock outcrop	40	Not rated		Not rated		Not rated	
STC:							
Strawhouse	60	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.05	Too gravelly, cobbly, or stony	0.05	Cemented pan	0.81
		Droughty	0.50	Extreme soil temperatures	0.50	Too gravelly, cobbly, or stony	0.05
		Excess salt	0.01	Droughty	0.50	Extreme soil temperatures	0.50
				Excess salt	0.01	Droughty	0.50
						Excess salt	0.01
Stillwell	25	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.02	Too gravelly, cobbly, or stony	0.02	Too gravelly, cobbly, or stony	0.02
		Droughty	0.50	Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
				Droughty	0.50	Droughty	0.50

Table 22.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants: Rating class and limiting features	Value	Upland Desertic Shrubs and Trees: Rating class and limiting features	Value	Upland Shrubs and Vines: Rating class and limiting features	Value
STE:							
Strawhouse	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.05	Too gravelly, cobbly, or stony	0.05	Cemented pan	0.81
		Droughty	0.50	Extreme soil temperatures	0.50	Too gravelly, cobbly, or stony	0.05
		Excess salt	0.01	Droughty	0.50	Extreme soil temperatures	0.50
				Excess salt	0.01	Droughty	0.50
						Excess salt	0.01
Stillwell	40	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.02	Too gravelly, cobbly, or stony	0.02	Too gravelly, cobbly, or stony	0.02
		Droughty	0.50	Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
				Droughty	0.50	Droughty	0.50
SUE:							
Studybutte	60	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.55	Too gravelly, cobbly, or stony	0.55	Too gravelly, cobbly, or stony	0.55
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.01
Rock outcrop	20	Not rated		Not rated		Not rated	
SUG:							
Studybutte	55	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.55	Too gravelly, cobbly, or stony	0.55	Too gravelly, cobbly, or stony	0.55
		Droughty	0.50	Droughty	0.50	Droughty	0.50
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
						Bedrock	0.01
Rock outcrop	30	Not rated		Not rated		Not rated	
TOA:							
Tornillo	80	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
VCA:							
Vicente	40	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
Lomapelona	30	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50
Castolon	25	Not limited		Somewhat limited		Somewhat limited	
				Extreme soil temperatures	0.50	Extreme soil temperatures	0.50

Table 23.--Upland Deciduous Trees, Upland Coniferous Trees, and Upland Mixed Deciduous and Coniferous Trees for Wildlife Habitat

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees: Rating class and limiting features	Value	Upland Coniferous Trees: Rating class and limiting features	Value	Upland Mixed Deciduous and Coniferous Trees: Rating class and limiting features	Value
AAC:							
Altar	83	Very limited		Somewhat limited		Very limited	
		Too arid	1.00	Droughty	0.27	Too arid	1.00
		Droughty	0.27			Droughty	0.98
ADE:							
Altuda	75	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	0.50			Too arid	0.50
ADG:							
Altuda	60	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	0.50			Too arid	0.50
Rock outcrop	30	Not rated		Not rated		Not rated	
BIE:							
Bissett	50	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00			Too arid	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BIG:							
Bissett	55	Very limited		Very limited		Very limited	
		Bedrock	1.00	Bedrock	1.00	Droughty	1.00
		Too arid	1.00	Droughty	1.00	Bedrock	1.00
		Droughty	1.00			Too arid	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BLD:							
Blackgap	85	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop	10	Not rated		Not rated		Not rated	

Table 23.--Upland Deciduous Trees, Upland Coniferous Trees, and Upland Mixed Deciduous and Coniferous Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees		Upland Coniferous Trees		Upland Mixed Deciduous and Coniferous Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BLE:							
Blackgap	50	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
BLG:							
Blackgap	50	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
CIC:							
Chilicotal	70	Very limited		Somewhat limited		Very limited	
		Too arid	1.00	Droughty	0.07	Too arid	1.00
		Droughty	0.07			Droughty	0.91
CLE:							
Chilicotal	60	Very limited		Somewhat limited		Very limited	
		Too arid	1.00	Droughty	0.07	Too arid	1.00
		Droughty	0.07			Droughty	0.91
Paisano	25	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Cemented pan	1.00	Cemented pan	1.00	Cemented pan	1.00
CNB:							
Chillon	81	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
COC:							
Corazones	85	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
		Droughty	0.88	Droughty	0.88	Droughty	1.00
COE:							
Corazones	70	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
		Droughty	0.88	Droughty	0.88	Droughty	1.00
EUB:							
Equipaje	45	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
						Droughty	0.04

Table 23.--Upland Deciduous Trees, Upland Coniferous Trees, and Upland Mixed Deciduous and Coniferous Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees: Rating class and limiting features	Value	Upland Coniferous Trees: Rating class and limiting features	Value	Upland Mixed Deciduous and Coniferous Trees: Rating class and limiting features	Value
Agust	40	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
		Droughty	0.23	Droughty	0.23	Droughty	0.98
GEE:							
Geefour	60	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
GEF:							
Geefour	70	Very limited		Very limited		Very limited	
		Bedrock	1.00	Bedrock	1.00	Droughty	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Bedrock	1.00
		Droughty	1.00	Droughty	1.00	Too arid	1.00
HRE:							
Hurds	70	Very limited		Somewhat limited		Very limited	
		Too arid	1.00	Droughty	0.50	Too arid	1.00
		Droughty	0.50	Too arid	0.50	Droughty	1.00
LEE:							
Leyva	75	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00			Too arid	1.00
Rock outcrop	15	Not rated		Not rated		Not rated	
LGG:							
Lingua	41	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00			Too arid	1.00
Rock outcrop	36	Not rated		Not rated		Not rated	
LMF:							
Liv	30	Somewhat limited		Somewhat limited		Very limited	
		Droughty	0.76	Droughty	0.76	Droughty	1.00
		Too arid	0.50	Bedrock	0.01	Too arid	0.50
		Bedrock	0.01			Bedrock	0.01
Mainstay	30	Very limited		Very limited		Very limited	
		Bedrock	1.00	Bedrock	1.00	Droughty	1.00
		Too arid	1.00	Droughty	1.00	Bedrock	1.00
		Droughty	1.00	Too arid	0.50	Too arid	1.00
Rock outcrop	15	Not rated		Not rated		Not rated	

Table 23.--Upland Deciduous Trees, Upland Coniferous Trees, and Upland Mixed Deciduous and Coniferous Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees: Rating class and limiting features	Value	Upland Coniferous Trees: Rating class and limiting features	Value	Upland Mixed Deciduous and Coniferous Trees: Rating class and limiting features	Value
MCC:							
Mariscal------------	70	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
MDE:							
Mariscal------------	45	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop--------	40	Not rated		Not rated		Not rated	
MNE:							
Mariscal------------	45	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Terlingua-----------	40	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
MSE:							
Musgrave------------	92	Very limited		Very limited		Very limited	
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
		Droughty	0.44	Droughty	0.44	Droughty	1.00
NNB:							
Ninepoint-----------	85	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
NPB:							
Ninepoint, flat-----	35	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Ninepoint, pit------	30	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Ninepoint, mound----	20	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00

Table 23.--Upland Deciduous Trees, Upland Coniferous Trees, and Upland Mixed Deciduous and Coniferous Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees: Rating class and limiting features	Value	Upland Coniferous Trees: Rating class and limiting features	Value	Upland Mixed Deciduous and Coniferous Trees: Rating class and limiting features	Value
PUF:							
Puerta	50	Very limited		Very limited		Very limited	
		Bedrock	1.00	Bedrock	1.00	Droughty	1.00
		Droughty	1.00	Droughty	1.00	Bedrock	1.00
		Too arid	0.50			Too arid	0.50
Madrone	35	Somewhat limited		Somewhat limited		Very limited	
		Droughty	0.90	Droughty	0.90	Droughty	1.00
		Too arid	0.50	Bedrock	0.29	Too arid	0.50
		Bedrock	0.29			Bedrock	0.29
Lazarus	3	Somewhat limited		Not limited		Somewhat limited	
		Too arid	0.50			Too arid	0.50
RIA:							
Riverwash	60	Not rated		Not rated		Not rated	
Pantera	30	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
		Droughty	0.92	Droughty	0.92	Droughty	1.00
RKG:							
Rock outcrop	60	Not rated		Not rated		Not rated	
Brewster	30	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Too arid	0.50	Too arid	1.00
RTE:							
Rock outcrop	50	Not rated		Not rated		Not rated	
Terlingua	40	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
RTG:							
Rock outcrop	65	Not rated		Not rated		Not rated	
Terlingua	25	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
SKE:							
Solis	45	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop	35	Not rated		Not rated		Not rated	

Table 23.--Upland Deciduous Trees, Upland Coniferous Trees, and Upland Mixed Deciduous and Coniferous Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees: Rating class and limiting features	Value	Upland Coniferous Trees: Rating class and limiting features	Value	Upland Mixed Deciduous and Coniferous Trees: Rating class and limiting features	Value
SKG:							
Solis	50	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
STC:							
Strawhouse	60	Very limited		Very limited		Very limited	
		Cemented pan	1.00	Cemented pan	1.00	Cemented pan	1.00
		Droughty	1.00	Extreme soil temperatures	1.00	Droughty	1.00
				Droughty	1.00		
Stillwell	25	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Droughty	1.00
		Droughty	1.00	Droughty	1.00	Too arid	1.00
STE:							
Strawhouse	45	Very limited		Very limited		Very limited	
		Cemented pan	1.00	Cemented pan	1.00	Cemented pan	1.00
		Droughty	1.00	Extreme soil temperatures	1.00	Droughty	1.00
				Droughty	1.00		
Stillwell	40	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Droughty	1.00
		Droughty	1.00	Droughty	1.00	Too arid	1.00
SUE:							
Studybutte	60	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop	20	Not rated		Not rated		Not rated	
SUG:							
Studybutte	55	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
TOA:							
Tornillo	80	Not limited		Very limited		Not limited	
				Extreme soil temperatures	1.00		

Table 23.--Upland Deciduous Trees, Upland Coniferous Trees, and Upland Mixed Deciduous and Coniferous Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees		Upland Coniferous Trees		Upland Mixed Deciduous and Coniferous Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
VCA:							
Vicente	40	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Lomapelona	30	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00
Castolon	25	Very limited		Very limited		Very limited	
		Too arid	1.00	Extreme soil temperatures	1.00	Too arid	1.00

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants: Rating class and limiting features	Value	Riparian Shrubs, Vines, and Trees: Rating class and limiting features	Value
AAC:					
Altar	83	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.27
		Too gravelly, cobbly, or stony	0.88		
ADE:					
Altuda	75	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.76		
ADG:					
Altuda	60	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.76		
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
		Too gravelly, cobbly, or stony	0.68		
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.82		
Rock outcrop	10	Not rated		Not rated	

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants: Rating class and limiting features	Value	Riparian Shrubs, Vines, and Trees: Rating class and limiting features	Value
BLE:					
Blackgap	50	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.82		
Rock outcrop	40	Not rated		Not rated	
BLG:					
Blackgap	50	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.82		
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.07
		Too gravelly, cobbly, or stony	0.11		
CLE:					
Chilicotal	60	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.07
		Too gravelly, cobbly, or stony	0.11		
Paisano	25	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.05		
CNB:					
Chillon	81	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.88	Excess sodium	0.11
		Excess sodium	0.05		

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants: Rating class and limiting features	Value	Riparian Shrubs, Vines, and Trees: Rating class and limiting features	Value
COC:					
Corazones	85	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.88
		Too gravelly, cobbly, or stony	0.56		
COE:					
Corazones	70	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.88
		Too gravelly, cobbly, or stony	0.56		
EUB:					
Equipaje	45	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
Agust	40	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.23
GEE:					
Geefour	60	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
GEF:					
Geefour	70	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
HRE:					
Hurds	70	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.50
		Too gravelly, cobbly, or stony	0.23		
LEE:					
Leyva	75	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.32		
Rock outcrop	15	Not rated		Not rated	

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants: Rating class and limiting features	Value	Riparian Shrubs, Vines, and Trees: Rating class and limiting features	Value
LGG:					
Lingua	41	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.94		
Rock outcrop	36	Not rated		Not rated	
LMF:					
Liv	30	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.76
		Too gravelly, cobbly, or stony	0.86		
Mainstay	30	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
		Too gravelly, cobbly, or stony	0.57		
Rock outcrop	15	Not rated		Not rated	
MCC:					
Mariscal	70	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	1.00		
MDE:					
Mariscal	45	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	1.00		
Rock outcrop	40	Not rated		Not rated	
MNE:					
Mariscal	45	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	1.00		

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants: Rating class and limiting features	Value	Riparian Shrubs, Vines, and Trees: Rating class and limiting features	Value
Terlingua-----------	40	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.63		
MSE:					
Musgrave------------	92	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Excess salt	0.12
		Excess salt	0.12	Droughty	0.44
NNB:					
Ninepoint-----------	85	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
NPB:					
Ninepoint, flat-----	35	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
Ninepoint, pit------	30	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
Ninepoint, mound----	20	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
PUF:					
Puerta--------------	50	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
		Too gravelly, cobbly, or stony	0.38		
Madrone-------------	35	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.90
		Too gravelly, cobbly, or stony	0.09		
Lazarus-------------	3	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants: Rating class and limiting features	Value	Riparian Shrubs, Vines, and Trees: Rating class and limiting features	Value
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	Very limited		Very limited	
		Too sandy	1.00	Too dry	1.00
		Too dry	1.00	Droughty	0.92
RKG:					
Rock outcrop	60	Not rated		Not rated	
Brewster	30	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.69		
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.63		
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.63		
SKE:					
Solis	45	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
Rock outcrop	35	Not rated		Not rated	
SKG:					
Solis	50	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
Rock outcrop	40	Not rated		Not rated	

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants: Rating class and limiting features	Value	Riparian Shrubs, Vines, and Trees: Rating class and limiting features	Value
STC:					
Strawhouse	60	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
		Too gravelly, cobbly, or stony	0.22		
Stillwell	25	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
		Too gravelly, cobbly, or stony	0.06		
STE:					
Strawhouse	45	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
		Too gravelly, cobbly, or stony	0.22		
Stillwell	40	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
		Too gravelly, cobbly, or stony	0.06		
SUE:					
Studybutte	60	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	1.00		
Rock outcrop	20	Not rated		Not rated	
SUG:					
Studybutte	55	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	1.00		
Rock outcrop	30	Not rated		Not rated	
TOA:					
Tornillo	80	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		

Table 24.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants		Riparian Shrubs, Vines, and Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
VCA:					
Vicente	40	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Flooding	0.50
		Long flooding	0.50		
Lomapelona	30	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Long flooding	0.50	Flooding	0.50
Castolon	25	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Flooding	0.50
		Long flooding	0.50		

Table 25.--Dwellings and Small Commercial Buildings

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Dwellings without Basements: Rating class and limiting features	Value	Dwellings with Basements: Rating class and limiting features	Value	Small Commercial Buildings: Rating class and limiting features	Value
AAC:							
Altar	83	Not limited		Not limited		Not limited	
ADE:							
Altuda	75	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
		Large stones	0.93	Large stones	0.93	Large stones	0.93
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
ADG:							
Altuda	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.93	Large stones	0.93	Large stones	0.93
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
Rock outcrop	30	Not rated		Not rated		Not rated	
BIE:							
Bissett	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00	Slope	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BIG:							
Bissett	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BLD:							
Blackgap	85	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.29	Large stones	0.29	Slope	1.00
						Large stones	0.29
Rock outcrop	10	Not rated		Not rated		Not rated	

Table 25.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements: Rating class and limiting features	Value	Dwellings with Basements: Rating class and limiting features	Value	Small Commercial Buildings: Rating class and limiting features	Value
BLE:							
Blackgap	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
		Large stones	0.29	Large stones	0.29	Large stones	0.29
Rock outcrop	40	Not rated		Not rated		Not rated	
BLG:							
Blackgap	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.29	Large stones	0.29	Large stones	0.29
Rock outcrop	40	Not rated		Not rated		Not rated	
CIC:							
Chilicotal	70	Not limited		Not limited		Not limited	
CLE:							
Chilicotal	60	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Slope	0.16	Slope	1.00
Paisano	25	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00
				Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00
						Slope	0.50
CNB:							
Chillon	81	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
COC:							
Corazones	85	Not limited		Not limited		Not limited	
COE:							
Corazones	70	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Slope	0.16	Slope	1.00
EUB:							
Equipaje	45	Not limited		Not limited		Not limited	
Agust	40	Not limited		Not limited		Not limited	
GEE:							
Geefour	60	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
						Slope	1.00

Table 25.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements: Rating class and limiting features	Value	Dwellings with Basements: Rating class and limiting features	Value	Small Commercial Buildings: Rating class and limiting features	Value
GEF:							
Geefour	70	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Slope	1.00
		Too steep	1.00	Depth to soft bedrock	1.00	Shrink-swell	1.00
		Depth to soft bedrock	0.50	Too steep	1.00	Depth to soft bedrock	1.00
HRE:							
Hurds	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Large stones	0.01	Large stones	0.01	Large stones	0.01
LEE:							
Leyva	75	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
		Shrink-swell	0.94	Shrink-swell	0.94	Shrink-swell	0.94
Rock outcrop	15	Not rated		Not rated		Not rated	
LGG:							
Lingua	41	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Rock outcrop	36	Not rated		Not rated		Not rated	
LMF:							
Liv	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Large stones	0.53	Depth to hard bedrock	1.00	Large stones	0.53
		Shrink-swell	0.50	Large stones	0.53	Shrink-swell	0.50
		Depth to hard bedrock	0.01	Shrink-swell	0.50	Depth to hard bedrock	0.01
Mainstay	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
		Large stones	0.46	Large stones	0.46	Large stones	0.46
Rock outcrop	15	Not rated		Not rated		Not rated	
MCC:							
Mariscal	70	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.68	Large stones	0.68	Large stones	0.68

Table 25.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements: Rating class and limiting features	Value	Dwellings with Basements: Rating class and limiting features	Value	Small Commercial Buildings: Rating class and limiting features	Value
MDE:							
Mariscal------------	45	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Large stones	0.68	Large stones	0.68	Large stones	0.68
Rock outcrop--------	40	Not rated		Not rated		Not rated	
MNE:							
Mariscal------------	45	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
		Large stones	0.68	Large stones	0.68	Large stones	0.68
Terlingua-----------	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Depth to soft bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Too steep	1.00	Depth to soft bedrock	1.00
MSE:							
Musgrave------------	92	Somewhat limited		Very limited		Very limited	
		Shrink-swell	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.16	Shrink-swell	0.50	Slope	1.00
		Depth to soft bedrock	0.50	Slope	0.16	Shrink-swell	0.50
NNB:							
Ninepoint-----------	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
NPB:							
Ninepoint, flat-----	35	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
Ninepoint, pit------	30	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
Ninepoint, mound----	20	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
PUF:							
Puerta--------------	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00

Table 25.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements: Rating class and limiting features	Value	Dwellings with Basements: Rating class and limiting features	Value	Small Commercial Buildings: Rating class and limiting features	Value
Madrone-------------	35	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Shrink-swell	0.50	Depth to hard bedrock	1.00	Shrink-swell	0.50
		Depth to hard bedrock	0.29	Shrink-swell	0.50	Depth to hard bedrock	0.29
Lazarus-------------	3	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
RIA:							
Riverwash-----------	60	Not rated		Not rated		Not rated	
Pantera-------------	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
RKG:							
Rock outcrop--------	60	Not rated		Not rated		Not rated	
Brewster------------	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
RTE:							
Rock outcrop--------	50	Not rated		Not rated		Not rated	
Terlingua-----------	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Depth to soft bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Too steep	1.00	Depth to soft bedrock	1.00
RTG:							
Rock outcrop--------	65	Not rated		Not rated		Not rated	
Terlingua-----------	25	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
SKE:							
Solis---------------	45	Somewhat limited		Very limited		Very limited	
		Slope	0.37	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	0.50	Slope	0.37	Slope	1.00
Rock outcrop--------	35	Not rated		Not rated		Not rated	

Table 25.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements: Rating class and limiting features	Value	Dwellings with Basements: Rating class and limiting features	Value	Small Commercial Buildings: Rating class and limiting features	Value
SKG:							
Solis----------------	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
Rock outcrop--------	40	Not rated		Not rated		Not rated	
STC:							
Strawhouse----------	60	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00
				Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00
Stillwell-----------	25	Not limited		Not limited		Somewhat limited	
						Slope	0.12
STE:							
Strawhouse----------	45	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00
				Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00
						Slope	0.12
Stillwell-----------	40	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Slope	0.16	Slope	1.00
SUE:							
Studybutte----------	60	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
Rock outcrop--------	20	Not rated		Not rated		Not rated	
SUG:							
Studybutte----------	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Rock outcrop--------	30	Not rated		Not rated		Not rated	
TOA:							
Tornillo------------	80	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50

Table 25.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements		Dwellings with Basements		Small Commercial Buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
VCA:							
Vicente	40	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Lomapelona	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Castolon	25	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AAC:							
Altar	83	Not limited		Very limited		Very limited	
				Unstable excavation walls	1.00	Gravel	1.00
						Droughty	0.29
ADE:							
Altuda	75	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Large stones	1.00
		Large stones	0.93	Large stones	0.93	Droughty	1.00
		Shrink-swell	0.50	Unstable excavation walls	0.10	Too steep	1.00
						Carbonate content	1.00
ADG:							
Altuda	60	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Large stones	0.93	Large stones	0.93	Large stones	1.00
		Shrink-swell	0.50	Unstable excavation walls	0.10	Droughty	1.00
						Carbonate content	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BIE:							
Bissett	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
				Unstable excavation walls	0.50	Too steep	1.00
						Carbonate content	1.00
						Gravel	0.76
Rock outcrop	30	Not rated		Not rated		Not rated	
BIG:							
Bissett	55	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
				Unstable excavation walls	0.10	Droughty	1.00
						Gravel	1.00
						Carbonate content	1.00
Rock outcrop	30	Not rated		Not rated		Not rated	

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
BLD:							
Blackgap	85	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Large stones	0.29	Large stones	0.29	Droughty	1.00
				Unstable excavation walls	0.10	Gravel	1.00
						Carbonate content	1.00
						Large stones	0.16
Rock outcrop	10	Not rated		Not rated		Not rated	
BLE:							
Blackgap	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
		Large stones	0.29	Large stones	0.29	Gravel	1.00
				Unstable excavation walls	0.10	Too steep	1.00
						Carbonate content	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
BLG:							
Blackgap	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Large stones	0.29	Large stones	0.29	Droughty	1.00
				Unstable excavation walls	0.10	Gravel	1.00
						Carbonate content	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
CIC:							
Chilicotal	70	Not limited		Very limited		Very limited	
				Unstable excavation walls	1.00	Gravel	1.00
						Droughty	0.08
CLE:							
Chilicotal	60	Somewhat limited		Very limited		Very limited	
		Slope	0.16	Unstable excavation walls	1.00	Gravel	1.00
				Slope	0.16	Sodium content	1.00
						Slope	0.16
						Droughty	0.08
Paisano	25	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to cemented pan	1.00
		Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00	Droughty	1.00
				Unstable excavation walls	1.00	Carbonate content	1.00
						Gravel	0.99

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
CNB:							
Chillon	81	Somewhat limited		Very limited		Very limited	
		Flooding	0.40	Unstable excavation walls	1.00	Droughty	1.00
						Gravel	1.00
						Sodium content	1.00
COC:							
Corazones	85	Not limited		Very limited		Very limited	
				Unstable excavation walls	1.00	Gravel	1.00
						Droughty	0.89
COE:							
Corazones	70	Somewhat limited		Very limited		Very limited	
		Slope	0.16	Unstable excavation walls	1.00	Gravel	1.00
				Slope	0.16	Droughty	0.89
						Slope	0.16
EUB:							
Equipaje	45	Not limited		Somewhat limited		Not limited	
				Unstable excavation walls	0.10		
Agust	40	Not limited		Very limited		Somewhat limited	
				Unstable excavation walls	1.00	Droughty	0.25
GEE:							
Geefour	60	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Depth to soft bedrock	1.00	Too clayey	0.01	Droughty	1.00
		Low strength	1.00	Unstable excavation walls	0.10		
GEF:							
Geefour	70	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Depth to soft bedrock	1.00	Too steep	1.00	Droughty	1.00
		Low strength	1.00	Too clayey	0.40	Too steep	1.00
		Too steep	1.00	Unstable excavation walls	0.10	Too clayey	1.00
HRE:							
Hurds	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Large stones	1.00
		Large stones	0.01	Large stones	0.01	Too steep	1.00
				Unstable excavation walls	0.10	Droughty	0.52

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
LEE:							
Leyva	75	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
		Shrink-swell	0.94	Unstable excavation walls	0.10	Too steep	1.00
						Gravel	0.97
						Large stones	0.20
Rock outcrop	15	Not rated		Not rated		Not rated	
LGG:							
Lingua	41	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
				Unstable excavation walls	0.10	Droughty	1.00
						Gravel	1.00
Rock outcrop	36	Not rated		Not rated		Not rated	
LMF:							
Liv	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00	Too steep	1.00
		Low strength	1.00	Too steep	1.00	Gravel	1.00
		Large stones	0.53	Unstable excavation walls	1.00	Droughty	0.77
		Shrink-swell	0.50	Too clayey	1.00	Large stones	0.16
		Depth to hard bedrock	0.01	Large stones	0.53	Depth to bedrock	0.01
Mainstay	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Low strength	1.00	Large stones	0.46	Droughty	1.00
		Shrink-swell	0.50	Unstable excavation walls	0.10	Large stones	1.00
						Gravel	0.01
Rock outcrop	15	Not rated		Not rated		Not rated	
MCC:							
Mariscal	70	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Large stones	0.68	Large stones	0.68	Droughty	1.00
				Unstable excavation walls	0.50	Large stones	1.00
						Carbonate content	1.00
						Gravel	0.27

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
MDE:							
Mariscal	45	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
		Large stones	0.68	Large stones	0.68	Large stones	1.00
				Unstable excavation walls	0.50	Too steep	1.00
						Carbonate content	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
MNE:							
Mariscal	45	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
		Large stones	0.68	Large stones	0.68	Large stones	1.00
				Unstable excavation walls	0.50	Too steep	1.00
						Carbonate content	1.00
Terlingua	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Droughty	1.00
		Too steep	1.00	Too steep	1.00	Gravel	1.00
				Unstable excavation walls	0.50	Too steep	1.00
MSE:							
Musgrave	92	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Slope	0.16	Too clayey	1.00
		Shrink-swell	0.50	Too clayey	0.04	Slope	0.16
		Slope	0.16	Unstable excavation walls	0.10	Salinity	0.10
						Droughty	0.46
NNB:							
Ninepoint	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Unstable excavation walls	0.10		
		Shrink-swell	0.50				
NPB:							
Ninepoint, flat	35	Somewhat limited		Somewhat limited		Not limited	
		Shrink-swell	0.50	Unstable excavation walls	0.10		
		Low strength	0.22				
Ninepoint, pit	30	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Unstable excavation walls	0.10		
		Shrink-swell	0.50				

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
Ninepoint, mound----	20	Somewhat limited		Somewhat limited		Very limited	
		Shrink-swell	0.50	Unstable excavation walls	0.10	Sodium content	1.00
		Low strength	0.22				
PUF:							
Puerta--------------	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Shrink-swell	1.00	Unstable excavation walls	0.10	Droughty	1.00
		Low strength	0.78			Gravel	1.00
						Large stones	0.01
Madrone-------------	35	Very limited		Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00	Too steep	1.00
		Shrink-swell	0.50	Too steep	1.00	Gravel	0.99
		Depth to hard bedrock	0.29	Unstable excavation walls	1.00	Droughty	0.90
				Too clayey	0.72	Depth to bedrock	0.29
						Large stones	0.01
Lazarus-------------	3	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Unstable excavation walls	0.10		
		Shrink-swell	0.50				
RIA:							
Riverwash-----------	60	Not rated		Not rated		Not rated	
Pantera-------------	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Unstable excavation walls	1.00	Flooding	1.00
				Flooding	0.80	Droughty	0.92
						Gravel	0.89
						Too sandy	0.50
RKG:							
Rock outcrop--------	60	Not rated		Not rated		Not rated	
Brewster------------	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
				Unstable excavation walls	0.50	Droughty	1.00
						Gravel	1.00
						Large stones	0.20

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
RTE:							
Rock outcrop	50	Not rated		Not rated		Not rated	
Terlingua	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Droughty	1.00
		Too steep	1.00	Too steep	1.00	Gravel	1.00
				Unstable excavation walls	0.50	Too steep	1.00
RTG:							
Rock outcrop	65	Not rated		Not rated		Not rated	
Terlingua	25	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Depth to soft bedrock	1.00	Too steep	1.00
		Depth to soft bedrock	1.00	Too steep	1.00	Droughty	1.00
				Unstable excavation walls	0.50	Gravel	1.00
SKE:							
Solis	45	Somewhat limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Slope	0.37	Slope	0.37	Droughty	1.00
				Unstable excavation walls	0.50	Slope	0.37
Rock outcrop	35	Not rated		Not rated		Not rated	
SKG:							
Solis	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Depth to soft bedrock	1.00	Too steep	1.00	Too steep	1.00
				Unstable excavation walls	0.50	Droughty	1.00
Rock outcrop	40	Not rated		Not rated		Not rated	
STC:							
Strawhouse	60	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to cemented pan	1.00
		Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00	Droughty	1.00
				Unstable excavation walls	1.00	Gravel	1.00
						Carbonate content	1.00

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Stillwell-----------	25	Not limited		Very limited		Very limited	
				Unstable excavation walls	1.00	Sodium content	1.00
						Gravel	1.00
						Droughty	1.00
						Carbonate content	1.00
STE:							
Strawhouse----------	45	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to cemented pan	1.00
		Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00	Droughty	1.00
				Unstable excavation walls	1.00	Gravel	1.00
						Carbonate content	1.00
Stillwell-----------	40	Somewhat limited		Very limited		Very limited	
		Slope	0.16	Unstable excavation walls	1.00	Sodium content	1.00
				Slope	0.16	Gravel	1.00
						Droughty	1.00
						Carbonate content	1.00
						Slope	0.16
SUE:							
Studybutte----------	60	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
				Unstable excavation walls	0.50	Gravel	1.00
						Too steep	1.00
Rock outcrop--------	20	Not rated		Not rated		Not rated	
SUG:							
Studybutte----------	55	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
				Unstable excavation walls	0.50	Droughty	1.00
						Gravel	1.00
Rock outcrop--------	30	Not rated		Not rated		Not rated	
TOA:							
Tornillo------------	80	Very limited		Very limited		Very limited	
		Flooding	1.00	Unstable excavation walls	1.00	Sodium content	1.00
		Low strength	1.00	Flooding	0.60	Flooding	0.60
		Shrink-swell	0.50				
VCA:							
Vicente-------------	40	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Flooding	0.60	Flooding	0.60
		Low strength	0.78	Unstable excavation walls	0.10		

Table 26.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Lomapelona----------	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Unstable excavation walls	1.00	Flooding	1.00
				Flooding	0.80		
Castolon------------	25	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Flooding	0.60	Flooding	0.60
		Low strength	0.78	Unstable excavation walls	0.10		

Table 27.--Sewage Disposal

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields: Rating class and limiting features	Septic Tank Absorption Fields: Value	Sewage Lagoons: Rating class and limiting features	Sewage Lagoons: Value
AAC:					
Altar	83	Not limited		Very limited	
				Seepage	1.00
ADE:					
Altuda	75	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.93	Large stones	1.00
ADG:					
Altuda	60	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.93	Large stones	1.00
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.50
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.29	Large stones	1.00
				Slope	1.00
Rock outcrop	10	Not rated		Not rated	

Table 27.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields: Rating class and limiting features	Value	Sewage Lagoons: Rating class and limiting features	Value
BLE:					
Blackgap	50	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.29	Large stones	1.00
Rock outcrop	40	Not rated		Not rated	
BLG:					
Blackgap	50	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.29	Large stones	1.00
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
CLE:					
Chilicotal	60	Somewhat limited		Very limited	
		Slow water movement	0.50	Slope	1.00
		Slope	0.16	Seepage	0.50
Paisano	25	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
				Slope	0.92
				Seepage	0.50
CNB:					
Chillon	81	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
		Flooding	0.40	Flooding	0.40
COC:					
Corazones	85	Not limited		Very limited	
				Seepage	1.00
				Slope	0.08
COE:					
Corazones	70	Somewhat limited		Very limited	
		Slope	0.16	Seepage	1.00
				Slope	1.00
EUB:					
Equipaje	45	Not limited		Very limited	
				Seepage	1.00
Agust	40	Not limited		Very limited	
				Seepage	1.00

Table 27.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields: Rating class and limiting features	Value	Sewage Lagoons: Rating class and limiting features	Value
GEE:					
Geefour	60	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
GEF:					
Geefour	70	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Too steep	1.00		
HRE:					
Hurds	70	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Large stones	0.01	Seepage	1.00
				Large stones	0.62
LEE:					
Leyva	75	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
Rock outcrop	15	Not rated		Not rated	
LGG:					
Lingua	41	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.50
Rock outcrop	36	Not rated		Not rated	
LMF:					
Liv	30	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Too steep	1.00	Large stones	0.81
		Large stones	0.53		
Mainstay	30	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.46	Large stones	1.00
Rock outcrop	15	Not rated		Not rated	

Table 27.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields		Sewage Lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MCC:					
Mariscal------------	70	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.68	Large stones	1.00
				Slope	0.32
MDE:					
Mariscal------------	45	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.68	Large stones	1.00
Rock outcrop--------	40	Not rated		Not rated	
MNE:					
Mariscal------------	45	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.68	Large stones	1.00
Terlingua-----------	40	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Depth to soft bedrock	1.00
				Slope	1.00
MSE:					
Musgrave------------	92	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	0.16		
NNB:					
Ninepoint-----------	85	Very limited		Not limited	
		Slow water movement	1.00		
NPB:					
Ninepoint, flat-----	35	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Ninepoint, pit------	30	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Ninepoint, mound----	20	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
PUF:					
Puerta--------------	50	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.02

Table 27.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields: Rating class and limiting features	Value	Sewage Lagoons: Rating class and limiting features	Value
Madrone	35	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Too steep	1.00	Seepage	0.02
Lazarus	3	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.08
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	1.00	Seepage	1.00
RKG:					
Rock outcrop	60	Not rated		Not rated	
Brewster	30	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Depth to soft bedrock	1.00
				Slope	1.00
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Depth to soft bedrock	1.00
				Slope	1.00
SKE:					
Solis	45	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.37	Slope	1.00
Rock outcrop	35	Not rated		Not rated	
SKG:					
Solis	50	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Too steep	1.00	Slope	1.00
Rock outcrop	40	Not rated		Not rated	

Table 27.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields: Rating class and limiting features	Value	Sewage Lagoons: Rating class and limiting features	Value
STC:					
Strawhouse	60	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
				Seepage	1.00
Stillwell	25	Not limited		Very limited	
				Seepage	1.00
				Slope	0.68
STE:					
Strawhouse	45	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
				Seepage	1.00
				Slope	0.68
Stillwell	40	Somewhat limited		Very limited	
		Slope	0.16	Seepage	1.00
				Slope	1.00
SUE:					
Studybutte	60	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
Rock outcrop	20	Not rated		Not rated	
SUG:					
Studybutte	55	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
Rock outcrop	30	Not rated		Not rated	
TOA:					
Tornillo	80	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	1.00
VCA:					
Vicente	40	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
Lomapelona	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	1.00		
Castolon	25	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50

Table 28.--Landfills

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
AAC:							
Altar	83	Not limited		Not limited		Very limited	
						Gravel content	1.00
ADE:							
Altuda	75	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Too clayey	1.00			Too sandy	1.00
		Too sandy	1.00			Carbonate content	1.00
		Large stones	0.93			Too clayey	1.00
ADG:							
Altuda	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too sandy	1.00
		Too sandy	1.00			Carbonate content	1.00
		Large stones	0.93			Too clayey	1.00
Rock outcrop	30	Not rated		Very limited		Not rated	
				Too steep	1.00		
BIE:							
Bissett	50	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Too steep	1.00
						Carbonate content	1.00
						Gravel content	0.66
Rock outcrop	30	Not rated		Very limited		Not rated	
				Not rated	1.00		
				Too steep	1.00		
BIG:							
Bissett	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
						Gravel content	1.00
						Carbonate content	1.00
Rock outcrop	30	Not rated		Very limited		Not rated	
				Too steep	1.00		
				Not rated	1.00		
BLD:							
Blackgap	85	Very limited		Not limited		Very limited	
		Depth to bedrock	1.00			Depth to bedrock	1.00
		Large stones	0.29			Carbonate content	1.00
						Large stones	0.29
						Gravel content	0.36

Table 28.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
Rock outcrop	10	Not rated		Very limited		Not rated	
				Not rated	1.00		
				Slope	0.16		
BLE:							
Blackgap	50	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Too steep	1.00
		Large stones	0.29			Carbonate content	1.00
						Large stones	0.29
						Gravel content	0.36
Rock outcrop	40	Not rated		Very limited		Not rated	
				Too steep	1.00		
BLG:							
Blackgap	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
		Large stones	0.29			Carbonate content	1.00
						Large stones	0.29
						Gravel content	0.36
Rock outcrop	40	Not rated		Very limited		Not rated	
				Too steep	1.00		
CIC:							
Chilicotal	70	Not limited		Not limited		Very limited	
						Gravel content	1.00
CLE:							
Chilicotal	60	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Slope	0.16	Gravel content	1.00
						Slope	0.16
Paisano	25	Very limited		Not limited		Very limited	
		Depth to thick cemented pan	1.00			Depth to cemented pan	1.00
						Gravel content	1.00
						Carbonate content	1.00
CNB:							
Chillon	81	Somewhat limited		Somewhat limited		Somewhat limited	
		Flooding	0.40	Flooding	0.40	Gravel content	0.88
COC:							
Corazones	85	Not limited		Not limited		Very limited	
						Gravel content	1.00
						Seepage	0.50
COE:							
Corazones	70	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Slope	0.16	Gravel content	1.00
						Seepage	0.50
						Slope	0.16

Table 28.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
EUB:							
Equipaje	45	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
Agust	40	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
						Gravel content	0.20
GEE:							
Geefour	60	Very limited		Not limited		Very limited	
		Depth to bedrock	1.00			Depth to bedrock	1.00
						Hard to compact	1.00
GEF:							
Geefour	70	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Hard to compact	1.00
						Too steep	1.00
HRE:							
Hurds	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
						Seepage	0.50
						Gravel content	0.36
LEE:							
Leyva	75	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Gravel content	1.00
						Too steep	1.00
Rock outcrop	15	Not rated		Very limited		Not rated	
				Too steep	1.00		
LGG:							
Lingua	41	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
						Gravel content	1.00
Rock outcrop	36	Not rated		Very limited		Not rated	
				Too steep	1.00		
LMF:							
Liv	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too clayey	1.00
		Large stones	0.53			Large stones	0.53
						Gravel content	0.23
Mainstay	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
		Large stones	0.46			Large stones	0.46
						Gravel content	0.09

Table 28.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
Rock outcrop	15	Not rated		Very limited		Not rated	
				Too steep	1.00		
MCC:							
Mariscal	70	Very limited		Not limited		Very limited	
		Depth to bedrock	1.00			Depth to bedrock	1.00
		Large stones	0.68			Carbonate content	1.00
						Large stones	0.68
						Gravel content	0.27
MDE:							
Mariscal	45	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Too steep	1.00
		Large stones	0.68			Carbonate content	1.00
						Large stones	0.68
						Gravel content	0.27
Rock outcrop	40	Not rated		Very limited		Not rated	
				Too steep	1.00		
MNE:							
Mariscal	45	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Too steep	1.00
		Large stones	0.68			Carbonate content	1.00
						Large stones	0.68
						Gravel content	0.27
Terlingua	40	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Gravel content	1.00
		Too sandy	1.00			Too steep	1.00
						Too sandy	1.00
						Seepage	0.50
MSE:							
Musgrave	92	Very limited		Somewhat limited		Very limited	
		Depth to bedrock	1.00	Slope	0.16	Depth to bedrock	1.00
		Slope	0.16			Hard to compact	1.00
						Slope	0.16
NNB:							
Ninepoint	85	Not limited		Not limited		Not limited	
NPB:							
Ninepoint, flat	35	Not limited		Not limited		Not limited	
Ninepoint, pit	30	Not limited		Not limited		Not limited	
Ninepoint, mound	20	Not limited		Not limited		Not limited	

Table 28.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
PUF:							
Puerta	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too clayey	1.00
						Gravel content	1.00
Madrone	35	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too clayey	1.00
						Gravel content	1.00
Lazarus	3	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
RIA:							
Riverwash	60	Not rated		Not rated		Not rated	
Pantera	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Seepage	1.00
		Too sandy	0.50			Gravel content	1.00
						Too sandy	0.50
RKG:							
Rock outcrop	60	Not rated		Very limited		Not rated	
				Too steep	1.00		
Brewster	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
						Gravel content	1.00
RTE:							
Rock outcrop	50	Not rated		Very limited		Not rated	
				Too steep	1.00		
Terlingua	40	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Gravel content	1.00
		Too sandy	1.00			Too steep	1.00
						Too sandy	1.00
						Seepage	0.50
RTG:							
Rock outcrop	65	Not rated		Very limited		Not rated	
				Too steep	1.00		
Terlingua	25	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
		Too sandy	1.00			Gravel content	1.00
						Too sandy	1.00
						Seepage	0.50

Table 28.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
SKE:							
Solis	45	Very limited		Somewhat limited		Very limited	
		Depth to bedrock	1.00	Slope	0.37	Depth to bedrock	1.00
		Too sandy	1.00			Too sandy	1.00
		Slope	0.37			Seepage	0.50
						Slope	0.37
Rock outcrop	35	Not rated		Very limited		Not rated	
				Too steep	1.00		
SKG:							
Solis	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
		Too sandy	1.00			Too sandy	1.00
						Seepage	0.50
Rock outcrop	40	Not rated		Very limited		Not rated	
				Too steep	1.00		
STC:							
Strawhouse	60	Very limited		Not limited		Very limited	
		Depth to thick cemented pan	1.00			Depth to cemented pan	1.00
						Gravel content	1.00
						Carbonate content	1.00
						Seepage	0.50
Stillwell	25	Not limited		Not limited		Very limited	
						Gravel content	1.00
						Carbonate content	1.00
						Seepage	0.50
STE:							
Strawhouse	45	Very limited		Not limited		Very limited	
		Depth to thick cemented pan	1.00			Depth to cemented pan	1.00
						Gravel content	1.00
						Carbonate content	1.00
						Seepage	0.50
Stillwell	40	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Slope	0.16	Gravel content	1.00
						Carbonate content	1.00
						Seepage	0.50
						Slope	0.16
SUE:							
Studybutte	60	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Too steep	1.00	Depth to bedrock	1.00
		Too steep	1.00			Gravel content	1.00
						Too steep	1.00
						Seepage	0.50
Rock outcrop	20	Not rated		Very limited		Not rated	
				Too steep	1.00		

Table 28.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Trench sanitary landfill: Value	Area sanitary landfill: Rating class and limiting features	Area sanitary landfill: Value	Daily cover for landfill: Rating class and limiting features	Daily cover for landfill: Value
SUG:							
Studybutte	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00			Depth to bedrock	1.00
						Gravel content	1.00
						Seepage	0.50
Rock outcrop	30	Not rated		Very limited		Not rated	
				Too steep	1.00		
TOA:							
Tornillo	80	Very limited		Very limited		Not limited	
		Flooding	1.00	Flooding	1.00		
VCA:							
Vicente	40	Very limited		Very limited		Not limited	
		Flooding	1.00	Flooding	1.00		
Lomapelona	30	Very limited		Very limited		Not limited	
		Flooding	1.00	Flooding	1.00		
Castolon	25	Very limited		Very limited		Not limited	
		Flooding	1.00	Flooding	1.00		

Table 29.--Source of Gravel and Sand

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Gravel Source		Sand Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AAC:					
Altar	83	Fair		Fair	
		Thickest layer	0.55	Thickest layer	0.03
		Bottom layer	0.57	Bottom layer	0.05
ADE:					
Altuda	75	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
ADG:					
Altuda	60	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Rock outcrop	30	Not rated		Not rated	
BIE:					
Bissett	50	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Rock outcrop	30	Not rated		Not rated	
BIG:					
Bissett	55	Fair		Poor	
		Thickest layer	0.09	Bottom layer	0.00
		Bottom layer	0.20	Thickest layer	0.00
Rock outcrop	30	Not rated		Not rated	
BLD:					
Blackgap	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	10	Not rated		Not rated	
BLE:					
Blackgap	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	40	Not rated		Not rated	

Table 29.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Gravel Source: Rating class and limiting features	Gravel Source: Value	Sand Source: Rating class and limiting features	Sand Source: Value
BLG:					
Blackgap	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	40	Not rated		Not rated	
CIC:					
Chilicotal	70	Fair		Poor	
		Bottom layer	0.30	Bottom layer	0.00
		Thickest layer	0.30	Thickest layer	0.00
CLE:					
Chilicotal	60	Fair		Poor	
		Bottom layer	0.30	Bottom layer	0.00
		Thickest layer	0.30	Thickest layer	0.00
Paisano	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
CNB:					
Chillon	81	Fair		Fair	
		Bottom layer	0.03	Thickest layer	0.00
		Thickest layer	0.03	Bottom layer	0.01
COC:					
Corazones	85	Fair		Fair	
		Thickest layer	0.34	Thickest layer	0.00
		Bottom layer	0.57	Bottom layer	0.04
COE:					
Corazones	70	Fair		Poor	
		Thickest layer	0.34	Bottom layer	0.00
		Bottom layer	0.57	Thickest layer	0.00
EUB:					
Equipaje	45	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Agust	40	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.02
		Thickest layer	0.00	Thickest layer	0.16
GEE:					
Geefour	60	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
GEF:					
Geefour	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 29.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Gravel Source: Rating class and limiting features	Gravel Source: Value	Sand Source: Rating class and limiting features	Sand Source: Value
HRE:					
Hurds	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LEE:					
Leyva	75	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.18	Thickest layer	0.00
Rock outcrop	15	Not rated		Not rated	
LGG:					
Lingua	41	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.60	Thickest layer	0.00
Rock outcrop	36	Not rated		Not rated	
LMF:					
Liv	30	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Mainstay	30	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Rock outcrop	15	Not rated		Not rated	
MCC:					
Mariscal	70	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
MDE:					
Mariscal	45	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Rock outcrop	40	Not rated		Not rated	
MNE:					
Mariscal	45	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Terlingua	40	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.28	Thickest layer	0.00
MSE:					
Musgrave	92	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 29.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Gravel Source: Rating class and limiting features	Gravel Source: Value	Sand Source: Rating class and limiting features	Sand Source: Value
NNB:					
Ninepoint	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
NPB:					
Ninepoint, flat	35	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Ninepoint, pit	30	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Ninepoint, mound	20	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PUF:					
Puerta	50	Fair		Poor	
		Thickest layer	0.09	Bottom layer	0.00
		Bottom layer	0.15	Thickest layer	0.00
Madrone	35	Fair		Poor	
		Thickest layer	0.38	Bottom layer	0.00
		Bottom layer	0.38	Thickest layer	0.00
Lazarus	3	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
RIA:					
Riverwash	60	Not rated		Not rated	
Pantera	30	Fair		Fair	
		Thickest layer	0.00	Bottom layer	0.11
		Bottom layer	0.25	Thickest layer	0.28
RKG:					
Rock outcrop	60	Not rated		Not rated	
Brewster	30	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.18	Thickest layer	0.00
RTE:					
Rock outcrop	50	Not rated		Not rated	
Terlingua	40	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.20	Thickest layer	0.00

Table 29.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Gravel Source: Rating class and limiting features	Gravel Source: Value	Sand Source: Rating class and limiting features	Sand Source: Value
RTG:					
Rock outcrop	65	Not rated		Not rated	
Terlingua	25	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.20	Thickest layer	0.00
SKE:					
Solis	45	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	35	Not rated		Not rated	
SKG:					
Solis	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	40	Not rated		Not rated	
STC:					
Strawhouse	60	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.12	Thickest layer	0.00
Stillwell	25	Fair		Fair	
		Thickest layer	0.03	Thickest layer	0.02
		Bottom layer	0.57	Bottom layer	0.07
STE:					
Strawhouse	45	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.12	Thickest layer	0.00
Stillwell	40	Fair		Fair	
		Thickest layer	0.03	Thickest layer	0.02
		Bottom layer	0.57	Bottom layer	0.07
SUE:					
Studybutte	60	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.55	Thickest layer	0.00
Rock outcrop	20	Not rated		Not rated	
SUG:					
Studybutte	55	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.55	Thickest layer	0.00
Rock outcrop	30	Not rated		Not rated	

Table 29.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Gravel Source: Rating class and limiting features	Gravel Source: Value	Sand Source: Rating class and limiting features	Sand Source: Value
TOA:					
Tornillo	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
VCA:					
Vicente	40	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Lomapelona	30	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.52
Castolon	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 30.--Source of Reclamation Material, Roadfill, and Topsoil

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Reclamation Source: Rating class and limiting features	Reclamation Source: Value	Roadfill Source: Rating class and limiting features	Roadfill Source: Value	Topsoil Source: Rating class and limiting features	Topsoil Source: Value
AAC:							
Altar	83	Fair		Good		Poor	
		Organic matter content low	0.02			Rock fragments	0.00
		Droughty	0.50			Hard to reclaim (rock fragments)	0.00
ADE:							
Altuda	75	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Carbonate content	0.00	Cobble content	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.82	Carbonate content	0.00
ADG:							
Altuda	60	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Carbonate content	0.00	Cobble content	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.00	Slope	0.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BIE:							
Bissett	50	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Slope	0.50	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BIG:							
Bissett	55	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Slope	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Cobble content	0.98	Depth to bedrock	0.00
Rock outcrop	30	Not rated		Not rated		Not rated	
BLD:							
Blackgap	85	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Cobble content	0.01	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
Rock outcrop	10	Not rated		Not rated		Not rated	

Table 30.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source: Rating class and limiting features	Value	Roadfill Source: Rating class and limiting features	Value	Topsoil Source: Rating class and limiting features	Value
BLE:							
Blackgap	50	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Cobble content	0.01	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.82	Depth to bedrock	0.00
Rock outcrop	40	Not rated		Not rated		Not rated	
BLG:							
Blackgap	50	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Cobble content	0.01	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
Rock outcrop	40	Not rated		Not rated		Not rated	
CIC:							
Chilicotal	70	Fair		Good		Poor	
		Carbonate content	0.08			Rock fragments	0.00
		Organic matter content low	0.68			Hard to reclaim (rock fragments)	0.00
		Sodium content	0.78			Carbonate content	0.11
CLE:							
Chilicotal	60	Fair		Good		Poor	
		Carbonate content	0.08			Rock fragments	0.00
		Organic matter content low	0.68			Hard to reclaim (rock fragments)	0.00
		Sodium content	0.78			Carbonate content	0.14
Paisano	25	Poor		Poor		Poor	
		Droughty	0.00	Depth to cemented pan	0.00	Rock fragments	0.00
		Depth to cemented pan	0.00			Depth to cemented pan	0.00
		Carbonate content	0.00			Carbonate content	0.00
CNB:							
Chillon	81	Poor		Fair		Poor	
		Droughty	0.00	Stones	0.92	Rock fragments	0.00
		Organic matter content low	0.18			Hard to reclaim (rock fragments)	0.00
		Sodium content	0.00			Sodium content	0.00
COC:							
Corazones	85	Fair		Fair		Poor	
		Organic matter content low	0.50	Cobble content	0.97	Rock fragments	0.00
		Droughty	0.76			Hard to reclaim (rock fragments)	0.00
		Carbonate content	0.97			Carbonate content	0.99

Table 30.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source: Rating class and limiting features	Value	Roadfill Source: Rating class and limiting features	Value	Topsoil Source: Rating class and limiting features	Value
COE:							
Corazones	70	Fair		Fair		Poor	
		Organic matter content low	0.50	Cobble content	0.97	Rock fragments	0.00
		Droughty	0.76			Hard to reclaim (rock fragments)	0.00
		Carbonate content	0.97			Slope	0.84
EUB:							
Equipaje	45	Fair		Good		Fair	
		Organic matter content low	0.18			Rock fragments	0.98
Agust	40	Fair		Good		Poor	
		Organic matter content low	0.18			Rock fragments	0.00
		Too sandy	0.32			Too sandy	0.32
						Hard to reclaim (rock fragments)	0.88
GEE:							
Geefour	60	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Low strength	0.00	Too clayey	0.00
		Organic matter content low	0.18	Shrink-swell	0.12	Sodium content	0.60
GEF:							
Geefour	70	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Salinity	0.00
		Depth to bedrock	0.00	Low strength	0.00	Depth to bedrock	0.00
		Organic matter content low	0.08	Shrink-swell	0.12	Too clayey	0.00
HRE:							
Hurds	70	Fair		Fair		Poor	
		Organic matter content low	0.88	Cobble content	0.90	Hard to reclaim (rock fragments)	0.00
		Stone content	0.89	Stones	0.94	Rock fragments	0.00
		Too acid	0.95			Slope	0.00
LEE:							
Leyva	75	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.08	Depth to bedrock	0.00
		Too clayey	0.08	Shrink-swell	0.65	Too clayey	0.05
Rock outcrop	15	Not rated		Not rated		Not rated	
LGG:							
Lingua	41	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
		Organic matter content low	0.50			Slope	0.00
Rock outcrop	36	Not rated		Not rated		Not rated	

Table 30.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source: Rating class and limiting features	Value	Roadfill Source: Rating class and limiting features	Value	Topsoil Source: Rating class and limiting features	Value
LMF:							
Liv	30	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.00	Slope	0.00	Slope	0.00
		Stone content	0.16	Stones	0.16	Rock fragments	0.00
Mainstay	30	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.00	Slope	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Low strength	0.00	Slope	0.00
Rock outcrop	15	Not rated		Not rated		Not rated	
MCC:							
Mariscal	70	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Cobble content	0.00	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
MDE:							
Mariscal	45	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Cobble content	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.50	Depth to bedrock	0.00
Rock outcrop	40	Not rated		Not rated		Not rated	
MNE:							
Mariscal	45	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Carbonate content	0.00
		Carbonate content	0.00	Cobble content	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.50	Depth to bedrock	0.00
Terlingua	40	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.98	Depth to bedrock	0.00
						Slope	0.00
MSE:							
Musgrave	92	Poor		Poor		Poor	
		Too alkaline	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Low strength	0.00	Too clayey	0.00
		Organic matter content low	0.01	Shrink-swell	0.87	Sodium content	0.22
NNB:							
Ninepoint	85	Fair		Poor		Fair	
		Water erosion	0.90	Low strength	0.00	Carbonate content	0.20
		Carbonate content	0.20	Shrink-swell	0.87		
		Organic matter content low	0.50				

Table 30.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source: Rating class and limiting features	Value	Roadfill Source: Rating class and limiting features	Value	Topsoil Source: Rating class and limiting features	Value
NPB:							
Ninepoint, flat	35	Fair		Fair		Fair	
		Water erosion	0.90	Low strength	0.78	Carbonate content	0.68
		Carbonate content	0.68	Shrink-swell	0.87		
		Organic matter	0.88				
		content low					
Ninepoint, pit	30	Fair		Poor		Fair	
		Organic matter	0.08	Low strength	0.00	Too clayey	0.46
		content low					
		Water erosion	0.90	Shrink-swell	0.87	Carbonate content	0.68
		Carbonate content	0.68				
Ninepoint, mound	20	Fair		Poor		Fair	
		Water erosion	0.90	Low strength	0.00	Sodium content	0.60
		Sodium content	0.60	Shrink-swell	0.87	Carbonate content	0.68
		Carbonate content	0.68				
PUF:							
Puerta	50	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.00	Slope	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Shrink-swell	0.12	Depth to bedrock	0.00
Madrone	35	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.00	Slope	0.00	Rock fragments	0.00
		Too acid	0.74	Shrink-swell	0.87	Slope	0.00
Lazarus	3	Fair		Poor		Good	
		Water erosion	0.99	Low strength	0.00		
				Shrink-swell	0.87		
RIA:							
Riverwash	60	Not rated		Not rated		Not rated	
Pantera	30	Poor		Good		Poor	
		Wind erosion	0.00			Hard to reclaim	0.00
						(rock fragments)	
		Organic matter	0.08			Rock fragments	0.00
		content low					
		Too alkaline	0.00			Too sandy	0.68
RKG:							
Rock outcrop	60	Not rated		Not rated		Not rated	
Brewster	30	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
						Slope	0.00

Table 30.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source: Rating class and limiting features	Value	Roadfill Source: Rating class and limiting features	Value	Topsoil Source: Rating class and limiting features	Value
RTE:							
Rock outcrop	50	Not rated		Not rated		Not rated	
Terlingua	40	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.98	Depth to bedrock	0.00
						Slope	0.00
RTG:							
Rock outcrop	65	Not rated		Not rated		Not rated	
Terlingua	25	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
						Slope	0.00
SKE:							
Solis	45	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00			Slope	0.63
		Organic matter content low	0.88				
Rock outcrop	35	Not rated		Not rated		Not rated	
SKG:							
Solis	50	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.00	Slope	0.00
		Organic matter content low	0.88				
Rock outcrop	40	Not rated		Not rated		Not rated	
STC:							
Strawhouse	60	Poor		Poor		Poor	
		Droughty	0.00	Depth to cemented pan	0.00	Carbonate content	0.00
		Carbonate content	0.00			Rock fragments	0.00
		Depth to cemented pan	0.00			Depth to cemented pan	0.00
Stillwell	25	Poor		Good		Poor	
		Carbonate content	0.00			Carbonate content	0.00
		Organic matter content low	0.18			Hard to reclaim (rock fragments)	0.00
		Droughty	0.01			Rock fragments	0.00

Table 30.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source: Rating class and limiting features	Value	Roadfill Source: Rating class and limiting features	Value	Topsoil Source: Rating class and limiting features	Value
STE:							
Strawhouse----------	45	Poor		Poor		Poor	
		Droughty	0.00	Depth to cemented pan	0.00	Carbonate content	0.00
		Carbonate content	0.00			Rock fragments	0.00
		Depth to cemented pan	0.00			Depth to cemented pan	0.00
Stillwell-----------	40	Poor		Good		Poor	
		Carbonate content	0.00			Carbonate content	0.00
		Organic matter content low	0.18			Hard to reclaim (rock fragments)	0.00
		Droughty	0.01			Rock fragments	0.00
SUE:							
Studybutte----------	60	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.82	Depth to bedrock	0.00
						Slope	0.00
Rock outcrop--------	20	Not rated		Not rated		Not rated	
SUG:							
Studybutte----------	55	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
						Slope	0.00
Rock outcrop--------	30	Not rated		Not rated		Not rated	
TOA:							
Tornillo------------	80	Fair		Poor		Fair	
		Water erosion	0.90	Low strength	0.00	Sodium content	0.60
		Sodium content	0.60	Shrink-swell	0.87		
		Organic matter content low	0.88				
VCA:							
Vicente-------------	40	Fair		Fair		Good	
		Organic matter content low	0.50	Low strength	0.22		
		Water erosion	0.90				
Lomapelona----------	30	Fair		Good		Good	
		Organic matter content low	0.60				
Castolon------------	25	Fair		Good		Good	
		Organic matter content low	0.50				
		Water erosion	0.90				

Table 31.--Ponds and Embankments

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
AAC:							
Altar	83	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
ADE:							
Altuda	75	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.93		
				Piping	0.18		
ADG:							
Altuda	60	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.93		
				Piping	0.18		
Rock outcrop	30	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
BIE:							
Bissett	50	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00				
Rock outcrop	30	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
BIG:							
Bissett	55	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Seepage	0.30		
Rock outcrop	30	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
BLD:							
Blackgap	85	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00	Large stones	0.29		
Rock outcrop	10	Very limited		Not rated		Not rated	
		Depth to bedrock	1.00				
		Slope	1.00				
BLE:							
Blackgap	50	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.29		

Table 31.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Rock outcrop	40	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
BLG:							
Blackgap	50	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.29		
Rock outcrop	40	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
CIC:							
Chilicotal	70	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.78	Depth to water	1.00
				Seepage	0.99		
CLE:							
Chilicotal	60	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.70	Seepage	0.91		
Paisano	25	Very limited		Very limited		Very limited	
		Depth to cemented pan	1.00	Seepage	1.00	Depth to water	1.00
		Seepage	0.70	Thin layer	1.00		
		Slope	0.68				
CNB:							
Chillon	81	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Seepage	1.00	Depth to water	1.00
				Piping	1.00		
COC:							
Corazones	85	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
				Piping	0.22		
COE:							
Corazones	70	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	1.00	Piping	0.22		
EUB:							
Equipaje	45	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
Agust	40	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.23	Depth to water	1.00
GEE:							
Geefour	60	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Hard to pack	0.85	Depth to water	1.00
		Depth to bedrock	0.66				

Table 31.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
GEF:							
Geefour	70	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Hard to pack	0.90	Depth to water	1.00
		Depth to bedrock	0.78	Salinity	0.72		
HRE:							
Hurds	70	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Large stones	0.01	Depth to water	1.00
		Slope	1.00				
LEE:							
Leyva	75	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Seepage	0.40		
Rock outcrop	15	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
LGG:							
Lingua	41	Very limited		Very limited		Very limited	
		Slope	1.00	Seepage	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Thin layer	1.00		
Rock outcrop	36	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
LMF:							
Liv	30	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Large stones	0.53	Depth to water	1.00
		Seepage	0.03	Thin layer	0.56		
		Depth to bedrock	0.56				
Mainstay	30	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.46		
Rock outcrop	15	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
MCC:							
Mariscal	70	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	0.08	Large stones	0.68		
MDE:							
Mariscal	45	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00	Large stones	0.68		
Rock outcrop	40	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				

Table 31.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
MNE:							
Mariscal------------	45	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.68		
Terlingua-----------	40	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
MSE:							
Musgrave------------	92	Very limited		Very limited		Very limited	
		Slope	1.00	Hard to pack	1.00	Depth to water	1.00
		Depth to bedrock	0.50				
NNB:							
Ninepoint-----------	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.04	Piping	0.08	Depth to water	1.00
NPB:							
Ninepoint, flat-----	35	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.01	Depth to water	1.00
Ninepoint, pit------	30	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
Ninepoint, mound----	20	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Piping	1.00	Depth to water	1.00
PUF:							
Puerta--------------	50	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
		Seepage	0.19				
Madrone-------------	35	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Thin layer	0.81	Depth to water	1.00
		Depth to bedrock	0.81	Seepage	0.30		
		Seepage	0.19				
Lazarus-------------	3	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.03	Piping	0.03	Depth to water	1.00
RIA:							
Riverwash-----------	60	Not rated		Not rated		Not rated	
Pantera-------------	30	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
RKG:							
Rock outcrop--------	60	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
Brewster------------	30	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				

Table 31.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
RTE:							
Rock outcrop--------	50	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
Terlingua-----------	40	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
RTG:							
Rock outcrop--------	65	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
Terlingua-----------	25	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
SKE:							
Solis---------------	45	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	0.94				
Rock outcrop--------	35	Very limited		Not rated		Not rated	
		Depth to bedrock	1.00				
		Slope	1.00				
SKG:							
Solis---------------	50	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	0.94				
Rock outcrop--------	40	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
STC:							
Strawhouse----------	60	Very limited		Very limited		Very limited	
		Depth to cemented pan	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	1.00	Piping	0.40		
				Seepage	0.50		
Stillwell-----------	25	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.32	Piping	1.00		
STE:							
Strawhouse----------	45	Very limited		Very limited		Very limited	
		Depth to cemented pan	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	1.00	Piping	0.40		
		Slope	0.32	Seepage	0.50		

Table 31.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
Stillwell-----------	40	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	1.00	Piping	1.00		
SUE:							
Studybutte----------	60	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
Rock outcrop--------	20	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
SUG:							
Studybutte----------	55	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
Rock outcrop--------	30	Very limited		Not rated		Not rated	
		Slope	1.00				
		Depth to bedrock	1.00				
TOA:							
Tornillo------------	80	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00
VCA:							
Vicente-------------	40	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.94	Depth to water	1.00
Lomapelona----------	30	Somewhat limited		Very limited		Very limited	
		Seepage	0.03	Piping	1.00	Depth to water	1.00
Castolon------------	25	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.93	Depth to water	1.00

Table 32.--Engineering Index Properties

(Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
AAC:												
Altar-----------	0-7	*Gravelly sandy loam	*GC, GP-GC	*A-2-6, A-1-a	0	0	30-52	27-50	19-43	9-25	21-37	6-17
	7-19	*Extremely gravelly sandy loam, Very gravelly sandy loam	*GP-GC, GP, GC	*A-2-6, A-2-4	0-8	0-15	15-54	11-52	8-41	4-21	23-32	7-13
	19-80	*Extremely gravelly coarse sandy loam, Extremely gravelly sandy loam, extremely gravelly loamy sand	*GP-GC, GC, GW	*A-2-6, A-1-a	0-8	0-22	12-55	8-53	5-41	2-21	18-29	3-12
ADE:												
Altuda----------	0-6	*Very cobbly silt loam	*GM, GC, OH	*A-7-6, A-7-5, A-2-6	0-5	36-43	20-78	16-77	15-76	13-67	31-58	13-18
	6-10	*Very cobbly silt loam, Very cobbly silty clay loam	*CL, GC, MH	*A-7-6, A-7-5, A-2-6	0-17	32-56	29-79	26-78	21-75	19-70	33-55	13-21
	10-20	*Bedrock			---	---	---	---	---	---	---	---
ADG:												
Altuda----------	0-6	*Very cobbly silt loam	*GM, GC, OH	*A-7-6, A-7-5, A-2-6	0-5	36-43	20-78	16-77	15-77	13-68	31-58	13-19
	6-10	*Very cobbly silt loam, Very cobbly silty clay loam	*CL, MH, GC	*A-7-6, A-7-5, A-2-6	0-17	32-56	29-79	26-78	21-75	19-70	33-55	13-21
	10-20	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
BIE:												
Bissett---------	0-3	*Very gravelly loam	*GM, GC	*A-7-6, A-2-6	0	0-11	26-59	23-58	19-54	14-41	29-46	12-18
	3-9	*Very gravelly clay loam, Very gravelly loam	*GC, GM, GP-GC	*A-7-6, A-2-6	0	0-19	23-59	20-58	16-56	11-43	29-54	12-24
	9-19	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
BIG:												
Bissett---------	0-3	*Very gravelly loam	*GM, GC	*A-2-7, A-7-6, A-2-6	0	0	31-59	28-58	24-54	18-41	29-46	12-18
	3-17	*Very gravelly clay loam, Extremely cobbly loam, very gravelly loam	*GC, GM, GP-GC	*A-2-7, A-7-6, A-2-6	0	0-21	20-59	16-58	13-55	9-43	29-54	12-24
	17-27	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
BLD:												
Blackgap--------	0-5	*Very gravelly loam	*GM, GC	*A-2-4, A-7-5	0-1	0-17	27-54	24-52	20-52	16-43	25-52	8-19
	5-11	*Extremely cobbly silt loam, Very gravelly loam, very cobbly silt loam	*GM, MH, GC	*A-7-6, A-7-5, A-2-6	0-1	47-54	30-100	27-100	24-100	20-91	29-56	12-24
	11-21	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
BLE:												
Blackgap--------	0-5	*Very gravelly loam	*GM, GC	*A-2-4, A-7-5	0-1	0-17	27-54	24-52	20-52	16-43	25-52	8-19
	5-11	*Extremely cobbly silt loam, Very gravelly loam, very cobbly silt loam	*GM, MH, GC	*A-7-6, A-7-5, A-2-6	0-1	47-54	30-100	27-100	24-100	20-91	29-56	12-24
	11-21	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
BLG:												
Blackgap--------	0-5	*Very gravelly loam	*GM, GC	*A-2-4, A-7-5	0-1	0-17	27-54	24-52	20-52	16-43	25-52	8-19
	5-11	*Extremely cobbly silt loam, Very gravelly loam, very cobbly silt loam	*GM, MH, GC	*A-7-6, A-7-5, A-2-6	0-1	47-54	30-100	27-100	24-100	20-91	29-56	12-24
	11-21	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
CIC:												
Chilicotal------	0-2	*Very gravelly fine sandy loam	*GC, GC-GM	*A-2-4, A-6	0	0-6	32-59	29-57	26-57	15-37	24-39	7-17
	2-40	*Very gravelly loam, Very gravelly clay loam, extremely gravelly loam, very gravelly sandy loam	*GC, GP-GC	*A-2-6, A-6, A-1-a	0	0-11	21-53	18-51	14-48	9-36	21-39	6-19
	40-61	*Very gravelly sandy loam, Extremely gravelly sandy loam, extremely gravelly loam	*GM, GC, GP-GM	*A-1-b, A-1-a, A-2-6	0	0-16	22-54	18-52	13-49	8-35	16-35	2-16
CLE:												
Chilicotal------	0-2	*Very gravelly fine sandy loam	*GC, GC-GM	*A-2-4, A-6	0	0-6	32-59	29-57	26-55	15-37	24-36	7-15
	2-40	*Very gravelly loam, Extremely gravelly loam, very gravelly clay loam, very gravelly sandy loam	*GC, GP-GC	*A-2-6, A-6, A-1-a	0	0-11	21-53	18-51	14-48	9-36	21-39	6-19
	40-61	*Very gravelly sandy loam, Extremely gravelly sandy loam, extremely gravelly loam	*GM, GC, GP-GM	*A-1-b, A-1-a, A-2-6	0	0-16	22-54	18-52	14-51	9-37	16-34	2-16
Paisano---------	0-1	*Very gravelly fine sandy loam, Very gravelly fine sandy loam	*GC, GP-GC	*A-2-4, A-2-6	0	0-12	34-58	31-57	28-54	12-26	24-33	7-12
	1-4	*Very gravelly sandy loam, Very gravelly loam	*SC, SP-SC	*A-2-4, A-2-6	0	0-11	63-76	26-50	19-40	10-22	22-30	7-12
	4-12	*Very gravelly sandy clay loam, Very gravelly sandy loam	*SC, SP-SC	*A-2-6, A-2-7	0	0-11	63-76	26-50	21-50	11-31	27-45	11-25
	12-16	*Cemented material		*A-1-a,	---	---	---	---	---	---	---	---
	16-62	*Very gravelly loam	*GC, GP-GC	*A-2-6, A-1-a	0	0-16	25-52	21-50	17-45	10-29	18-37	4-19

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
CNB:												
Chillon---------	0-5	*Very gravelly fine sandy loam	*GC-GM,	*A-2-4, A-1-a, A-2-6	0	0	13-34	9-57	6-40	3-26	17-31	2-12
	5-42	*Very gravelly fine sandy loam, Extremely gravelly fine sandy loam, extremely gravelly coarse sandy loam	*GC, GP	*A-2-6, A-1-a	0-15	8-62	13-58	9-57	6-40	3-26	18-32	3-13
	42-61	*Very gravelly coarse sandy loam, Very gravelly loamy coarse sand, very gravelly fine sandy loam	*GC, GP	*A-2-6, A-1-a	0-15	8-62	13-58	9-57	6-40	3-26	18-44	3-25
COC:												
Corazones-------	0-4	*Very gravelly sandy loam	*GC, GC-GM	*A-2-6, A-6, A-1-b	0	0-12	34-59	32-57	25-56	17-42	20-38	5-19
	4-13	*Very gravelly loam, Extremely gravelly sandy loam, extremely gravelly coarse sandy loam, very gravelly coarse sandy loam	*GC, GP-GC	*A-2-4, A-6, A-1-a	0-1	0-11	21-54	18-52	14-51	10-38	20-38	5-19
	13-55	*Extremely gravelly loam, Very gravelly loam, extremely gravelly coarse sandy loam, extremely gravelly sandy loam, very gravelly coarse sandy loam	*GC, GW	*A-2-4, A-2-6, A-1-a	0-8	0-29	12-54	8-52	5-40	3-26	20-38	5-19
	55-80	*Extremely gravelly sandy loam, Extremely gravelly loamy coarse sand, very gravelly sandy loam, extremely gravelly coarse sandy loam	*GP, GC, GW	*A-2-4, A-2-6, A-1-a	0-15	0-29	12-54	8-52	4-32	1-15	18-28	3-11

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
COE:												
Corazones-------	0-4	*Very gravelly sandy loam	*GC, GC-GM	*A-2-6, A-6, A-1-b	0	0-12	34-59	32-57	25-56	17-42	20-38	5-19
	4-13	*Very gravelly loam, Extremely gravelly sandy loam, extremely gravelly coarse sandy loam, very gravelly coarse sandy loam	*GC, GP-GC	*A-2-4, A-6, A-1-a	0-1	0-11	21-54	18-52	14-51	10-38	20-38	5-19
	13-55	*Extremely gravelly loam, Very gravelly loam, extremely gravelly coarse sandy loam, extremely gravelly sandy loam, very gravelly coarse sandy loam	*GC, GW	*A-2-4, A-2-6, A-1-a	0-8	0-29	12-54	8-52	5-40	3-26	20-38	5-19
	55-80	*Extremely gravelly sandy loam, Extremely gravelly loamy coarse sand, very gravelly sandy loam, extremely gravelly coarse sandy loam	*GP, GC, GW	*A-2-4, A-2-6, A-1-a	0-15	0-29	12-54	8-52	4-32	1-15	18-28	3-11
EUB:												
Equipaje--------	0-2	*Fine sandy loam	*SC,	*A-6, A-4	0	0	92-100	91-100	84-97	40-48	26-32	9-13
	2-26	*Fine sandy loam, Sandy loam	*SC,	*A-6, A-2-4	0	0	92-100	76-100	70-97	33-48	25-32	9-13
	26-53	*Sandy loam, Fine sandy loam	*SC,	*A-6, A-2-4	0	0	92-100	76-100	70-97	33-48	25-32	9-13
	53-80	*Fine sandy loam, Sandy loam	*SC,	*A-6, A-2-4	0	0	92-100	76-100	70-97	33-48	25-32	9-13
Agust-----------	0-2	*Gravelly fine sandy loam	*SC, SM	*A-2-4, A-1-b, A-6	0	0-4	73-100	51-97	41-92	14-42	0-31	NP-12
	2-11	*Gravelly fine sandy loam, Gravelly sandy loam, gravelly loamy sand, fine sandy loam	*SC, SM	*A-2-6, A-6, A-1-b	0	0-6	79-97	43-88	36-84	13-37	16-31	2-12
	11-28	*Gravelly loamy sand, Gravelly loam, fine sandy loam, gravelly sandy loam	*SC-SM, SC, SP-SM	*A-2-4, A-2-6, A-1-b	0	0-8	79-97	43-88	33-78	8-28	16-38	2-18
	28-80	*Gravelly fine sandy loam	*SC,	*A-2-6, A-2-4	0	0-8	79-97	43-88	40-83	16-35	26-30	10-12

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
GEE:												
Geefour---------	0-6	*Silty clay, Clay, silty clay loam	*CH, CL	*A-7-6,	0	0	92-100	91-100	84-100	73-100	46-66	25-40
	6-15	*Silty clay, Paragravelly silty clay, silty clay loam, clay	*CH, CL	*A-7-6,	0	0	100	100	92-100	81-100	42-62	21-36
	15-25	*Silty clay, Silty clay loam, clay	*CH, CL	*A-7-6,	0	0	100	100	92-100	82-100	41-61	21-37
GEF:												
Geefour---------	0-5	*Silty clay, Clay, silty clay loam	*CH,	*A-7-6,	0	0	100	100	97-100	85-100	50-66	29-40
	5-12	*Silty clay, Clay, silty clay loam	*CH, CL	*A-7-6,	0	0	100	100	91-100	81-96	46-61	25-36
	12-39	*Silty clay, Silty clay loam, clay	*CH, CL	*A-7-6,	0	0	100	100	85-100	79-94	45-60	25-37
HRE:												
Hurds-----------	0-10	*Very cobbly loam, Very cobbly sandy clay loam, very gravelly sandy loam, very gravelly sandy clay loam, very cobbly sandy loam	*GC,	*A-2-6, A-7-6	0-16	16-43	39-75	36-74	28-70	15-44	27-41	11-19
	10-80	*Very cobbly sandy clay loam, Very gravelly sandy clay loam, very gravelly loam, very gravelly loamy sand, very gravelly sandy loam	*GC, CL, GC-GM	*A-2-6, A-7-6, A-1-b	0-16	16-43	39-83	36-82	29-79	20-59	20-45	4-25
LEE:												
Leyva-----------	0-4	*Very gravelly loam	*GC,	*A-2-6, A-7-6	0	0-18	35-59	26-54	22-54	16-42	31-48	13-25
	4-15	*Very gravelly clay loam, Very gravelly clay	*GC, GP-GC	*A-2-7, A-7-6	0	0-17	28-56	19-50	16-50	12-42	44-57	25-33
	15-25	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
LGG:												
Lingua----------	0-5	*Very gravelly sandy clay loam	*GC,	*A-2-6, A-2-7	0	0-11	25-57	22-56	18-53	10-32	29-42	12-21
	5-13	*Extremely gravelly sandy clay loam	*GP-GC, GC	*A-2-6,	0	0-15	11-53	7-51	6-46	3-27	30-40	13-21
	13-23	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
LMF:												
Liv-------------	0-9	*Very gravelly clay loam	*GC, CH	*A-2-7, A-7-6, A-2-6	0	12-33	27-83	24-82	21-82	17-69	37-54	18-28
	9-23	*Very gravelly clay, Very cobbly clay	*GC, CH	*A-7-6, A-2-7	8-23	16-42	35-82	32-81	28-81	26-81	57-79	36-51
	23-38	*Extremely cobbly clay, Very gravelly clay	*GC, CH	*A-7-6, A-2-7	8-23	16-42	35-82	32-81	28-81	26-81	57-79	36-51
	38-48	*Bedrock			---	---	---	---	---	---	---	---
Mainstay--------	0-5	*Very gravelly loam	*GC, CL, GC-GM	*A-6, A-7-6, A-2-4	0-13	15-34	37-82	34-82	29-82	24-70	24-43	7-18
	5-18	*Very gravelly clay, Very cobbly clay	*GC, CH	*A-7-6, A-2-7	0-13	15-34	36-82	34-81	29-81	27-81	57-79	36-51
	18-28	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
MCC:												
Mariscal--------	0-5	*Extremely channery loam	*GC, GP-GC	*A-2-6, A-7-6, A-1-a	0-18	25-43	19-67	18-67	14-65	10-48	22-41	6-19
	5-15	*Bedrock			---	---	---	---	---	---	---	---
MDE:												
Mariscal--------	0-5	*Extremely channery loam	*GC, GP-GC	*A-2-6, A-7-6, A-1-a	0-18	25-43	19-67	18-67	14-65	10-48	22-41	6-19
	5-15	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
MNE:												
Mariscal--------	0-5	*Extremely channery loam	*GC, GP-GC	*A-2-6, A-7-6, A-1-a	0-18	25-43	19-67	18-67	14-65	10-48	22-41	6-19
	5-15	*Bedrock			---	---	---	---	---	---	---	---
Terlingua-------	0-4	*Very gravelly sandy loam	*GC-GM, GP-GM, GC	*A-1-b, A-1-a, A-2-4	0-5	0-11	26-53	23-51	17-43	10-28	17-28	2-10
	4-8	*Very gravelly loam, Extremely gravelly loam, very gravelly sandy loam	*GC, GP-GM, GC-GM	*A-2-4, A-2-6, A-1-a	0-5	0-11	24-52	24-52	18-45	10-29	17-32	2-12
	8-16	*Bedrock			---	---	---	---	---	---	---	---
	16-26	*Bedrock			---	---	---	---	---	---	---	---
MSE:												
Musgrave--------	0-6	*Silty clay	*CH,	*A-7-6,	0	0	100	100	94-100	87-97	50-62	28-36
	6-19	*Silty clay, Clay loam, clay	*CH, CL	*A-7-6,	0	0	100	100	98-100	82-97	44-59	25-36
	19-41	*Silty clay, Clay, clay loam	*CH, CL	*A-7-6,	0	0	100	100	95-100	79-89	43-58	25-36
NNB:												
Ninepoint-------	0-4	*Clay loam	*CL,	*A-6, A-7-6	0	0	100	100	89-100	71-84	37-49	17-24
	4-80	*Clay loam, Loam, silt loam, silty clay loam	*CL,	*A-6, A-7-6	0	0	100	100	86-96	66-76	34-45	15-21
NPB:												
Ninepoint, flat-	0-2	*Clay loam	*CL, SC	*A-7-6, A-4	0	0	100	100	75-95	49-69	27-47	10-25
	2-20	*Clay loam, Silt loam, loam, silty clay loam	*CL,	*A-6, A-7-6, A-4	0	0	100	100	78-98	59-79	27-47	10-25
	20-80	*Sandy clay loam, Silty clay loam, loam	*CL, SC	*A-6, A-7-6	0	0	100	100	78-95	42-59	30-47	12-25
Ninepoint, pit--	0-2	*Clay loam	*CL, SC	*A-7-6, A-6	0	0	100	100	75-92	49-66	30-47	12-25
	2-10	*Clay loam, Silt loam, silty clay loam, loam	*CL,	*A-7-6, A-6	0	0	100	100	74-91	52-69	29-46	12-25
	10-80	*Clay loam, Sandy clay loam, silt loam, silty clay loam	*CL, SC-SM	*A-7-6, A-2-4	0	0	100	100	66-89	32-55	24-46	7-25
Ninepoint, mound	0-5	*Clay loam	*CL,	*A-7-6, A-6	0	0	100	100	78-95	54-71	30-47	12-25
	5-39	*Sandy clay loam, Silty clay loam, loam	*CL, SC	*A-6, A-7-6	0	0	100	100	78-95	42-59	30-47	12-25
	39-80	*Clay loam	*SC, GC-GM	*A-2-6, A-2-7, A-2-4	0	0	58-84	56-83	41-65	19-33	25-47	7-25

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
PUF:												
Puerta----------	0-4	*Very gravelly silt loam	*GC, GM	*A-2-6, A-7-6, A-2-4	0-5	0-17	28-58	24-56	21-56	18-47	29-47	9-18
	4-5	*Very gravelly loam	*GC,	*A-2-6, A-7-6, A-2-4	0-5	0-17	28-58	24-56	20-54	15-41	26-41	9-21
	5-19	*Very gravelly clay, Very cobbly clay	*GC,	*A-7-6, A-2-7	0-11	0-22	21-52	17-50	15-50	14-50	60-81	36-51
	19-30	*Bedrock			---	---	---	---	---	---	---	---
Madrone---------	0-4	*Very gravelly loam	*GC,	*A-2-6, A-7-6, A-2-4	0-5	0-17	28-58	24-56	20-54	15-41	26-41	9-21
	4-6	*Very gravelly loam	*GC,	*A-2-6, A-7-6, A-2-4	0-5	0-17	28-58	24-56	20-54	15-41	26-41	9-21
	6-32	*Very gravelly clay, Very cobbly silty clay, very cobbly clay	*GC,	*A-2-7, A-7-6	0-17	0-24	20-52	16-50	14-50	13-46	53-68	32-44
	32-42	*Bedrock			---	---	---	---	---	---	---	---
Lazarus---------	0-5	*Loam	*CL, SC	*A-6,	0	0	100	100	93-100	69-84	26-39	9-17
	5-80	*Clay loam, Loam, silty clay loam	*CL, SC, ML	*A-7-6, A-6	0	0	100	100	91-100	68-83	32-50	13-25
RIA:												
Riverwash-------	---	---	---	---	---	---	---	---	---	---	---	---
Pantera---------	0-10	*Gravelly sand	*SP-SC, SC, GP	*A-1-b, A-1-a, A-2-4	0-5	0-17	33-76	30-75	23-65	3-16	16-27	2-10
	10-80	*Very gravelly loamy sand, Gravelly sand, gravelly loamy sand, very gravelly loamy sand, extremely gravelly loamy sand, very cobbly loamy coarse sand	*GP-GC, GP	*A-1-a, A-2-4	0-9	1-17	25-50	22-48	12-29	3-10	20-27	NP-10
RKG:												
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
Brewster--------	0-4	*Very gravelly loam	*GC, GM, GP-GC	*A-2-7, A-7-5, A-2-6	0-5	0-21	20-53	17-51	14-50	10-39	29-54	12-24
	4-14	*Bedrock			---	---	---	---	---	---	---	---

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
RTE:												
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
Terlingua-------	0-4	*Very gravelly sandy loam	*GC-GM, GP-GM, GC	*A-1-b, A-1-a, A-2-4	0-5	0-11	26-53	23-51	17-43	10-28	17-28	2-10
	4-8	*Very gravelly loam, Very gravelly sandy loam, extremely gravelly loam	*GC-GM, GC, GP-GM	*A-1-b, A-2-6, A-1-a	0-5	0-11	27-54	24-52	19-48	12-32	17-33	2-12
	8-16	*Bedrock			---	---	---	---	---	---	---	---
	16-26	*Bedrock			---	---	---	---	---	---	---	---
RTG:												
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
Terlingua-------	0-4	*Very gravelly sandy loam	*GC-GM, GP-GM, GC	*A-1-b, A-1-a, A-2-4	0-5	0-11	26-53	23-51	17-43	10-28	17-28	2-10
	4-8	*Very gravelly loam, Very gravelly sandy loam, extremely gravelly loam	*GC-GM, GC, GP-GM	*A-1-b, A-2-6, A-1-a	0-5	0-11	27-54	24-52	19-48	12-32	17-33	2-12
	8-16	*Bedrock			---	---	---	---	---	---	---	---
	16-26	*Bedrock			---	---	---	---	---	---	---	---
SKE:												
Solis-----------	0-6	*Fine sandy loam	*SC-SM, CL, SM	*A-4, A-6	0	0	100	100	85-98	41-54	17-31	2-12
	6-28	*Bedrock			---	---	---	---	---	---	---	---
	28-38	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
SKG:												
Solis-----------	0-6	*Fine sandy loam	*SC-SM, CL, SM	*A-4, A-6	0	0	100	100	85-98	41-54	17-31	2-12
	6-28	*Bedrock			---	---	---	---	---	---	---	---
	28-38	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
STC:												
Strawhouse------	0-5	*Very gravelly loam, Very gravelly sandy loam	*GC-GM, GC, GP-GM	*A-1-b, A-2-6, A-1-a	0-5	0-5	20-52	17-50	13-49	8-32	19-39	3-19
	5-15	*Very gravelly loam, Very gravelly fine sandy loam, very gravelly sandy loam	*GC, GP-GC	*A-2-4, A-2-6, A-1-a	0-5	0-5	20-52	17-50	13-49	8-34	20-40	6-21
	15-19	*Cemented material			---	---	---	---	---	---	---	---
	19-80	*Very gravelly loam, Extremely gravelly loam, gravelly loam	*GC, CL, GC-GM	*A-2-4, A-6, A-1-b	0-8	0-16	35-77	33-76	28-76	19-58	20-40	6-21
Stillwell-------	0-3	*Very gravelly sandy loam, Very gravelly coarse sandy loam	*GM, GC, GW-GM	*A-1-b, A-2-6, A-1-a	0-1	0-5	32-54	29-52	21-44	9-23	17-33	2-12
	3-30	*Very gravelly sandy loam, Very gravelly loam, very gravelly fine sandy loam	*GC-GM, GC, GP-GM	*A-1-b, A-2-6, A-1-a	0-1	0-5	32-54	29-52	21-43	11-25	18-30	3-12
	30-80	*Extremely gravelly coarse sandy loam, Extremely gravelly loam, extremely gravelly sandy loam	*GP-GC, GC, GP	*A-1-a, A-1-b	0-1	0-8	17-45	13-42	8-31	4-18	18-30	3-12
STE:												
Strawhouse------	0-5	*Very gravelly loam, Very gravelly sandy loam	*GC-GM, GC, GP-GM	*A-1-b, A-2-6, A-1-a	0-5	0-5	20-52	17-50	13-49	8-32	19-39	3-19
	5-15	*Very gravelly loam, Very gravelly fine sandy loam, very gravelly sandy loam	*GC, GP-GC	*A-2-4, A-2-6, A-1-a	0-5	0-5	20-52	17-50	13-49	8-34	20-40	6-21
	15-19	*Cemented material			---	---	---	---	---	---	---	---
	19-80	*Very gravelly loam, Extremely gravelly loam, gravelly loam	*GC, CL, GC-GM	*A-2-4, A-6, A-1-b	0-8	0-16	35-77	33-76	28-76	19-58	20-40	6-21

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
Stillwell-------	0-3	*Very gravelly sandy loam, Very gravelly coarse sandy loam	*GM, GC, GW-GM	*A-1-b, A-2-6, A-1-a	0-1	0-5	32-54	29-52	21-44	9-23	17-33	2-12
	3-30	*Very gravelly sandy loam, Very gravelly loam, very gravelly fine sandy loam	*GC-GM, GC, GP-GM	*A-1-b, A-2-4, A-1-a	0-1	0-5	32-54	29-52	21-43	11-25	18-30	3-12
	30-80	*Extremely gravelly coarse sandy loam, Extremely gravelly loam, extremely gravelly sandy loam	*GP-GC, GC, GP	*A-1-a, A-2-6	0-1	0-8	17-45	13-42	8-31	4-18	18-30	3-12
SUE:												
Studybutte------	0-6	*Very gravelly loam	*GC, GC-GM	*A-2-4, A-2-6, A-1-a	0-1	0-16	18-53	14-51	11-46	8-33	20-33	4-12
	6-16	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
SUG:												
Studybutte------	0-6	*Very gravelly loam	*GC, GP-GC	*A-2-4, A-4, A-1-a	0-1	0-16	18-59	14-57	11-51	8-36	20-33	4-12
	6-16	*Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-10	*Bedrock			---	---	---	---	---	---	---	---
TOA:												
Tornillo--------	0-19	*Loam	*CL,	*A-6, A-7-6	0	0	98-100	92-100	87-100	71-94	30-47	12-25
	19-26	*Gravelly sandy loam	*SC,	*A-6, A-2-4	0	0	85-95	62-86	41-66	30-50	27-39	10-17
	26-80	*Loam, Silty clay loam, silt loam	*CL,	*A-6, A-7-6	0	0	98-100	93-100	78-100	61-83	30-47	12-25

Table 32.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
VCA:												
Vicente---------	0-2	*Silty clay loam	*CL, CH	*A-7-6, A-6	0	0	100	100	97-100	93-100	39-51	19-29
	2-10	*Very fine sandy loam	*CL,	*A-6, A-4	0	0	100	100	96-100	58-62	29-34	10-14
	10-60	*Very fine sandy loam, Silt loam, loam	*CL,	*A-6, A-4	0	0	100	100	95-100	73-81	26-37	10-18
	60-80	*Loam, Silt loam, very fine sandy loam	*CL, CL-ML	*A-4, A-6	0	0	100	100	95-100	73-81	21-30	6-12
Lomapelona------	0-8	*Fine sandy loam, Loam	*CL, CL-ML	*A-4, A-6	0	0	100	100	84-100	52-70	21-39	6-19
	8-42	*Fine sandy loam, Sandy loam, very fine sandy loam, loam	*CL-ML, CL, SC-SM	*A-4, A-2-4, A-6	0	0	85-100	62-100	60-100	34-65	21-32	6-13
	42-60	*Loam, Fine sandy loam, sandy loam, very fine sandy loam	*CL, SC-SM	*A-6, A-2-4	0	0	85-100	62-100	60-100	34-65	21-32	6-13
	60-80	*Sand, Very fine sandy loam, sandy loam, fine sandy loam, loam	*CL-ML, CL, SM	*A-4, A-6, A-2-4	0	0	85-100	62-100	60-100	34-65	16-32	2-13
Castolon--------	0-9	*Silty clay loam	*CL, CH	*A-7-6, A-6	0	0	100	100	97-100	93-100	39-51	19-29
	9-35	*Silt loam, Loam, very fine sandy loam	*CL, CL-ML	*A-6, A-4	0	0	100	100	95-100	73-81	21-37	6-18
	35-80	*Loam, Silt loam, very fine sandy loam	*CL, CL-ML	*A-4, A-6	0	0	100	100	95-100	73-81	21-30	6-12

Table 33.--Physical Soil Properties

(Sand, silt and clay values are shown either as a range or a representative value (rv). Absence of an entry indicates that data were not estimated. Soil properties are measured or inferred from direct observations in the field or laboratory)

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
AAC:									
Altar -----------	0-7	63	19	10-25	1.30-1.60	0.6-2.0	0.09-0.13	0.0-3.0	0.5-1.0
	7-19	66	15	12-20	1.45-1.65	0.6-2.0	0.14-0.16	0.0-3.0	0.3-0.6
	19-80	65	17	7-18	1.50-1.70	2.0-5.9	0.02-0.04	0.0-3.0	0.1-0.3
ADE:									
Altuda ----------	0-6	20	55	20-27	1.30-1.45	0.6-2.0	0.08-0.12	0.0-2.9	1.0-10
	6-10	14	61	20-30	1.30-1.45	0.6-2.0	0.05-0.10	3.0-5.9	1.0-7.0
	10-20				---	0.1-2.0	---	---	---
ADG:									
Altuda ----------	0-6	20	55	20-28	1.30-1.45	0.6-2.0	0.08-0.12	0.0-2.9	1.0-10
	6-10	14	61	20-30	1.30-1.45	0.6-2.0	0.05-0.10	3.0-5.9	1.0-7.0
	10-20				---	0.1-2.0	---	---	---
BIE:									
Bissett ---------	0-3	38	39	18-26	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-5.0
	3-9	37	34	18-35	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	0.8-5.0
	9-19				---	0.1-2.0	---	---	---
BIG:									
Bissett ---------	0-3	38	39	18-26	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-5.0
	3-17	38	33	18-35	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	0.8-5.0
	17-27				---	0.1-2.0	---	---	---
BLD:									
Blackgap --------	0-5	33	49	13-28	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-7.0
	5-11	26	51	18-35	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-6.0
	11-21				---	0.1-2.0	---	---	---
BLE:									
Blackgap --------	0-5	33	49	13-28	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-7.0
	5-11	26	51	18-35	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-6.0
	11-21				---	0.1-2.0	---	---	---
BLG:									
Blackgap --------	0-5	33	49	13-28	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-7.0
	5-11	26	51	18-35	1.45-1.65	0.6-2.0	0.07-0.12	0.0-2.9	1.0-6.0
	11-21				---	0.1-2.0	---	---	---

Table 33.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
CIC:									
Chilicotal -----	0-2	55	32	12-25	1.40-1.60	0.6-2.0	0.08-0.12	0.0-2.9	0.8-2.0
	2-40	42	36	10-27	1.40-1.60	0.6-2.0	0.05-0.12	0.0-2.9	0.2-1.0
	40-61	59	35	5-24	1.40-1.65	0.6-2.0	0.05-0.12	0.0-2.9	0.1-0.5
CLE:									
Chilicotal -----	0-2	55	32	12-22	1.40-1.60	0.6-2.0	0.08-0.12	0.0-2.9	0.8-2.0
	2-40	42	36	10-27	1.40-1.60	0.6-2.0	0.05-0.12	0.0-2.9	0.2-1.0
	40-61	59	35	5-23	1.40-1.65	0.6-2.0	0.05-0.12	0.0-2.9	0.1-0.5
Paisano --------	0-1	66	19	12-18	1.35-1.60	2.0-5.9	0.06-0.08	0.0-2.9	1.0-2.0
	1-4	66	19	12-18	1.35-1.55	0.6-2.0	0.07-0.09	0.0-2.9	0.3-0.8
	4-12	60	18	17-35	1.35-1.55	0.6-2.0	0.07-0.09	0.0-2.9	0.3-0.8
	12-16				---	0.1-0.6	---	---	---
	16-62	43	40	8-27	1.35-1.55	0.6-2.0	0.07-0.09	0.0-2.9	0.0-0.3
CNB:									
Chillon --------	0-5	57	31	5-18	1.30-1.60	0.6-2.0	0.09-0.13	0.0-3.0	0.5-1.0
	5-42	67	15	7-20	1.50-1.70	0.6-2.0	0.02-0.04	0.0-3.0	0.1-0.5
	42-61	60	18	7-35	1.50-1.70	0.6-2.0	0.02-0.04	0.0-3.0	0.1-0.5
COC:									
Corazones ------	0-4	55	32	9-27	1.45-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.2-0.6
	4-13	43	40	9-27	1.45-1.65	2.0-5.9	0.04-0.08	0.0-2.9	0.3-0.8
	13-55	43	40	9-27	1.45-1.65	2.0-5.9	0.04-0.08	0.0-2.9	0.3-0.8
	55-80	68	20	7-17	1.45-1.65	2.0-5.9	0.04-0.08	0.0-2.9	0.0-0.3
COE:									
Corazones ------	0-4	55	32	9-27	1.45-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.2-0.6
	4-13	43	40	9-27	1.45-1.65	2.0-5.9	0.04-0.08	0.0-2.9	0.3-0.8
	13-55	43	40	9-27	1.45-1.65	2.0-5.9	0.04-0.08	0.0-2.9	0.3-0.8
	55-80	68	20	7-17	1.45-1.65	2.0-5.9	0.04-0.08	0.0-2.9	0.0-0.3
EUB:									
Equipaje -------	0-2	63	19	15-20	1.45-1.55	2.0-5.9	0.13-0.15	0.0-2.9	0.5-0.8
	2-26	63	19	15-20	1.45-1.55	2.0-5.9	0.13-0.15	0.0-2.9	0.1-0.5
	26-53	63	19	15-20	1.45-1.55	2.0-5.9	0.13-0.15	0.0-2.9	0.1-0.5
	53-80	63	19	15-20	1.45-1.55	2.0-5.9	0.13-0.15	0.0-2.9	0.1-0.5
Agust ----------	0-2	68	16	3-18	1.45-1.65	2.0-5.9	0.05-0.10	0.0-2.9	0.1-1.0
	2-11	68	14	5-18	1.35-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.1-1.0
	11-28	88	0	5-26	1.35-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.1-1.0
	28-80	72	12	16-18	1.35-1.60	2.0-5.9	0.05-0.12	0.0-2.9	0.1-0.5

Table 33.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
GEE:									
Geefour --------	0-6	20	40	35-55	1.35-1.55	0.1-0.2	0.04-0.08	6.0-8.9	0.5-1.0
	6-15	18	41	30-50	1.40-1.60	0.1-0.2	0.02-0.06	6.0-8.9	0.5-1.0
	15-25	17	42	30-50	1.40-1.60	0.1-0.2	0.02-0.06	6.0-8.9	0.1-0.5
GEF:									
Geefour --------	0-5	19	40	35-55	1.35-1.55	0.1-0.2	0.04-0.08	6.0-8.9	0.5-1.0
	5-12	16	42	35-50	1.40-1.60	0.1-0.2	0.02-0.06	6.0-8.9	0.4-0.8
	12-39	9	42	35-50	1.40-1.60	0.1-0.2	0.02-0.06	6.0-8.9	0.1-0.3
HRE:									
Hurds ----------	0-10	56	20	17-27	1.40-1.60	0.6-2.0	0.05-0.12	0.0-2.9	0.5-2.0
	10-80	46	24	8-35	1.40-1.60	2.0-5.9	0.03-0.10	0.0-2.9	0.5-1.0
LEE:									
Leyva ----------	0-4	38	36	20-35	1.30-1.55	0.2-2.0	0.07-0.13	1.0-5.9	0.8-1.5
	4-15	31	31	35-45	1.30-1.60	0.1-0.6	0.05-0.13	3.0-8.9	0.3-0.8
	15-25				---	0.0-0.1	---	---	---
LGG:									
Lingua ---------	0-5	56	21	18-30	1.30-1.50	0.6-2.0	0.07-0.09	0.5-2.5	0.8-1.5
	5-13	58	16	20-30	1.35-1.50	0.6-2.0	0.07-0.09	0.5-2.5	0.3-0.8
	13-23				---	0.1-2.0	---	---	---
LMF:									
Liv ------------	0-9	31	39	27-40	1.35-1.55	0.6-2.0	0.06-0.14	0.0-2.9	1.0-3.0
	9-23	12	28	50-70	1.35-1.55	0.2-0.6	0.04-0.07	3.0-5.9	0.5-2.0
	23-38	12	28	50-70	1.35-1.55	0.2-0.6	0.04-0.07	3.0-5.9	0.5-2.0
	38-48				---	0.1-2.0	---	---	---
Mainstay -------	0-5	30	49	12-27	1.30-1.55	0.6-2.0	0.06-0.14	0.0-2.9	1.0-3.0
	5-18	12	28	50-70	1.30-1.50	0.2-0.6	0.05-0.12	3.0-5.9	0.5-2.0
	18-28				---	0.1-2.0	---	---	---
MCC:									
Mariscal -------	0-5	43	38	10-27	1.30-1.50	0.6-2.0	0.05-0.10	0.0-2.9	1.0-2.0
	5-15				---	0.1-2.0	---	---	---
MDE:									
Mariscal -------	0-5	43	38	10-27	1.30-1.50	0.6-2.0	0.05-0.10	0.0-2.9	1.0-2.0
	5-15				---	0.1-2.0	---	---	---

Table 33.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
MNE:									
Mariscal -------	0-5	43	38	10-27	1.30-1.50	0.6-2.0	0.05-0.10	0.0-2.9	1.0-2.0
	5-15				---	0.1-2.0	---	---	---
Terlingua ------	0-4	59	33	5-15	1.40-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.5-1.0
	4-8	55	30	5-18	1.45-1.65	2.0-5.9	0.03-0.09	0.0-2.9	0.5-1.5
	8-16				---	0.1-2.0	---	---	---
	16-26				---	0.1-2.0	---	---	---
MSE:									
Musgrave -------	0-6	11	44	35-50	1.00-1.35	0.2-0.6	0.16-0.20	2.9-5.9	1.0-2.0
	6-19	21	33	35-50	1.00-1.35	0.2-0.6	0.12-0.18	2.9-5.9	0.2-0.7
	19-41	20	37	35-50	1.20-1.60	0.0-0.1	---	2.9-5.9	0.0-0.1
NNB:									
Ninepoint ------	0-4	31	39	27-40	1.45-1.55	0.2-0.6	0.13-0.19	3.0-5.9	0.5-1.0
	4-80	35	35	25-35	1.20-1.30	0.2-0.6	0.16-0.21	3.0-5.9	0.3-1.0
NPB:									
Ninepoint flat--	0-2	44	27	15-35	1.20-1.45	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
	2-20	34	38	15-35	1.30-1.55	0.6-2.0	0.14-0.20	3.0-5.9	0.3-0.8
	20-80	55	18	18-35	1.30-1.55	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
Ninepoint pit---	0-2	44	24	18-35	1.20-1.45	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
	2-10	38	28	18-35	1.30-1.55	0.6-2.0	0.14-0.20	3.0-5.9	0.2-0.5
	10-80	39	28	12-35	1.30-1.55	0.6-2.0	0.14-0.20	3.0-5.9	0.1-0.3
Ninepoint mound-	0-5	42	29	18-35	1.20-1.45	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
	5-39	55	18	18-35	1.30-1.55	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
	39-80	32	41	12-35	1.30-1.55	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
PUF:									
Puerta ---------	0-4	26	53	15-27	1.30-1.55	0.6-2.0	0.05-0.14	0.0-2.9	2.0-5.0
	4-5	40	38	15-30	1.30-1.55	0.6-2.0	0.05-0.14	0.0-2.9	0.5-1.0
	5-19	12	28	50-70	1.30-1.50	0.2-0.6	0.05-0.10	6.0-8.9	1.0-2.0
	19-30				---	0.1-1.4	---	---	---
Madrone --------	0-4	40	38	15-30	1.30-1.55	0.6-2.0	0.05-0.14	0.0-2.9	0.5-1.0
	4-6	40	38	15-30	1.30-1.55	0.6-2.0	0.05-0.14	0.0-2.9	0.5-1.0
	6-32	18	29	45-60	1.30-1.55	0.2-0.6	0.04-0.10	3.0-5.9	0.5-1.0
	32-42				---	0.1-1.4	---	---	---
Lazarus --------	0-5	41	34	20-35	1.30-1.60	0.2-0.6	0.19-0.21	3.0-6.0	2.0-3.0
	5-80	39	33	20-35	1.45-1.70	0.2-0.6	0.19-0.21	3.0-6.0	0.8-2.3

Table 33.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
RIA:									
Pantera --------	0-10	90	4	5-15	1.40-1.60	2.0-5.9	0.04-0.08	0.0-2.9	0.1-0.5
	10-80	83	4	10-15	1.20-1.50	5.9-20.0	0.04-0.08	0.0-2.9	0.1-0.3
RKG:									
Brewster -------	0-4	38	36	18-35	1.30-1.45	0.6-2.0	0.05-0.14	0.0-2.9	1.0-5.0
	4-14				---	0.1-2.0	---	---	---
RTE:									
Terlingua ------	0-4	59	33	5-15	1.40-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.5-1.0
	4-8	55	34	5-18	1.45-1.65	2.0-5.9	0.03-0.09	0.0-2.9	0.5-2.0
	8-16				---	0.1-2.0	---	---	---
	16-26				---	0.1-2.0	---	---	---
RTG:									
Terlingua ------	0-4	59	33	5-15	1.40-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.5-1.0
	4-8	55	34	5-18	1.45-1.65	2.0-5.9	0.03-0.09	0.0-2.9	0.5-2.0
	8-16				---	0.1-2.0	---	---	---
	16-26				---	0.1-2.0	---	---	---
SKE:									
Solis ----------	0-6	62	26	5-18	1.40-1.55	2.0-5.9	0.06-0.11	0.0-2.9	0.5-1.0
	6-28				---	0.1-2.0	---	---	---
	28-38				---	0.1-2.0	---	---	---
SKG:									
Solis ----------	0-6	62	26	5-18	1.40-1.55	2.0-5.9	0.08-0.12	0.0-2.9	0.5-1.0
	6-28				---	0.1-2.0	---	---	---
	28-38				---	0.1-2.0	---	---	---
STC:									
Strawhouse -----	0-5	62	28	7-27	1.30-1.50	2.0-5.9	0.08-0.14	0.0-2.9	0.5-1.0
	5-15	51	31	10-30	1.30-1.50	2.0-5.9	0.08-0.14	0.0-2.9	0.1-0.5
	15-19				---	0.1-0.6	---	---	---
	19-80	50	34	10-30	1.35-1.55	2.0-5.9	0.01-0.06	0.0-2.9	0.0-0.3
Stillwell ------	0-3	74	18	5-18	1.45-1.65	2.0-5.9	0.02-0.06	0.0-2.9	0.5-2.0
	3-30	63	24	7-18	1.45-1.65	2.0-5.9	0.02-0.06	0.0-2.9	0.1-0.5
	30-80	69	19	7-18	1.50-1.70	2.0-5.9	0.02-0.06	0.0-2.9	0.1-0.5

Table 33.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
STE:									
Strawhouse -----	0-5	62	28	7-27	1.30-1.50	2.0-5.9	0.08-0.14	0.0-2.9	0.5-1.0
	5-15	51	31	10-30	1.30-1.50	2.0-5.9	0.08-0.14	0.0-2.9	0.1-0.5
	15-19				---	0.1-0.6	---	---	---
	19-80	50	34	10-30	1.35-1.55	2.0-5.9	0.01-0.06	0.0-2.9	0.0-0.3
Stillwell ------	0-3	74	18	5-18	1.45-1.65	2.0-5.9	0.02-0.06	0.0-2.9	0.5-2.0
	3-30	63	24	7-18	1.45-1.65	2.0-5.9	0.02-0.06	0.0-2.9	0.1-0.5
	30-80	69	19	7-18	1.50-1.70	2.0-5.9	0.02-0.06	0.0-2.9	0.1-0.5
SUE:									
Studybutte -----	0-6	47	38	8-18	1.40-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.5-2.0
	6-16				---	0.1-2.0	---	---	---
SUG:									
Studybutte -----	0-6	47	38	8-18	1.40-1.60	2.0-5.9	0.05-0.10	0.0-2.9	0.5-2.0
	6-16				---	0.1-2.0	---	---	---
TOA:									
Tornillo -------	0-19	30	49	18-35	1.20-1.45	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
	19-26	56	28	15-25	1.30-1.55	2.0-5.9	0.14-0.20	3.0-5.9	0.5-1.0
	26-80	34	42	18-35	1.30-1.55	0.6-2.0	0.14-0.20	3.0-5.9	0.5-1.0
VCA:									
Vicente --------	0-2	7	63	28-40	1.45-1.55	0.2-0.6	0.15-0.19	3.0-5.9	0.8-1.0
	2-10	59	23	16-20	1.45-1.55	0.2-0.6	0.15-0.19	3.0-5.9	0.8-1.0
	10-60	59	23	16-26	1.40-1.50	0.6-2.0	0.13-0.19	0.0-2.9	0.3-0.8
	60-80	37	48	10-18	1.40-1.50	0.6-2.0	0.13-0.19	0.0-2.9	0.3-0.8
Lomapelona -----	0-8	50	35	10-28	1.50-1.60	0.6-2.0	0.13-0.18	0.0-2.9	0.5-1.0
	8-42	54	34	10-20	1.30-1.60	0.2-0.6	0.18-0.20	0.0-2.9	0.3-0.8
	42-60	54	28	10-20	1.30-1.60	0.2-0.6	0.18-0.20	0.0-2.9	0.3-0.8
	60-80	90	5	5-20	1.30-1.60	0.2-0.6	0.18-0.20	0.0-2.9	0.3-0.8
Castolon -------	0-9	7	63	28-40	1.45-1.55	0.2-0.6	0.15-0.19	3.0-5.9	0.8-1.0
	9-35	12	70	10-26	1.40-1.50	0.6-2.0	0.13-0.19	0.0-2.9	0.3-0.8
	35-80	37	48	10-18	1.40-1.50	0.6-2.0	0.13-0.19	0.0-2.9	0.3-0.8

Table 33.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors Kw	Kf	T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
STE:												
Strawhouse----------	0-5	7-27	1.30-1.50	2-6	0.08-0.14	0.0-2.9	0.5-1.0	.15	.28	1	6	48
	5-15	10-30	1.30-1.50	2-6	0.08-0.14	0.0-2.9	0.1-0.5	.15	.28			
	15-19	---	---	0.06-0.6	---	---	---	---	---			
	19-80	10-30	1.35-1.55	2-6	0.01-0.06	0.0-2.9	0.0-0.3	.15	.32			
Stillwell-----------	0-3	5-18	1.45-1.65	2-6	0.02-0.06	0.0-2.9	0.5-2.0	.10	.20	5	6	48
	3-30	7-18	1.45-1.65	2-6	0.02-0.06	0.0-2.9	0.1-0.5	.10	.20			
	30-80	7-18	1.50-1.70	2-6	0.02-0.06	0.0-2.9	0.1-0.5	.05	.20			
SUE:												
Studybutte----------	0-6	8-18	1.40-1.60	2-6	0.05-0.10	0.0-2.9	0.5-2.0	.10	.43	1	8	0
	6-16	---	---	0.06-2	---	---	---	---	---			
Rock outcrop--------	0-10	---	---	0.06-2	---	---	---	---	---	-	---	---
SUG:												
Studybutte----------	0-6	8-18	1.40-1.60	2-6	0.05-0.10	0.0-2.9	0.5-2.0	.10	.43	1	8	0
	6-16	---	---	0.06-2	---	---	---	---	---			
Rock outcrop--------	0-10	---	---	0.06-2	---	---	---	---	---	-	---	---
TOA:												
Tornillo------------	0-19	18-35	1.20-1.45	0.6-2	0.14-0.20	3.0-5.9	0.5-1.0	.43	.43	5	4L	86
	19-26	15-25	1.30-1.55	2-6	0.14-0.20	3.0-5.9	0.5-1.0	.43	.43			
	26-80	18-35	1.30-1.55	0.6-2	0.14-0.20	3.0-5.9	0.5-1.0	.43	.43			
VCA:												
Vicente-------------	0-2	28-40	1.45-1.55	0.2-0.6	0.15-0.19	3.0-5.9	0.8-1.0	.37	.37	5	4L	86
	2-10	16-20	1.45-1.55	0.2-0.6	0.15-0.19	3.0-5.9	0.8-1.0	.37	.37			
	10-60	16-26	1.40-1.50	0.6-2	0.13-0.19	0.0-2.9	0.3-0.8	.43	.43			
	60-80	10-18	1.40-1.50	0.6-2	0.13-0.19	0.0-2.9	0.3-0.8	.43	.43			
Lomapelona----------	0-8	10-28	1.50-1.60	0.6-2	0.13-0.18	0.0-2.9	0.5-1.0	.32	.32	5	3	86
	8-42	10-20	1.30-1.60	0.2-0.6	0.18-0.20	0.0-2.9	0.3-0.8	.32	.37			
	42-60	10-20	1.30-1.60	0.2-0.6	0.18-0.20	0.0-2.9	0.3-0.8	.32	.37			
	60-80	5-20	1.30-1.60	0.2-0.6	0.18-0.20	0.0-2.9	0.3-0.8	.32	.37			
Castolon------------	0-9	28-40	1.45-1.55	0.2-0.6	0.15-0.19	3.0-5.9	0.8-1.0	.37	.37	5	4L	86
	9-35	10-26	1.40-1.50	0.6-2	0.13-0.19	0.0-2.9	0.3-0.8	.43	.43			
	35-80	10-18	1.40-1.50	0.6-2	0.13-0.19	0.0-2.9	0.3-0.8	.43	.43			

Table 34.--Erosion Properties of Soils

(Entries under "Erosion factors" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer)

Map symbol and soil name	Depth (inches)	Erosion factors: Kw	Erosion factors: Kf	Erosion factors: T	Wind erodi-bility group	Wind erodi-bility index
AAC:						
Altar	0-7	.05	.32	5	6	48
	7-19	.24	.32			
	19-80	.02	.10			
ADE:						
Altuda	0-6	.15	.43	1	6	48
	6-10	.15	.37			
	10-20	---	---			
ADG:						
Altuda	0-6	.15	.43	1	6	48
	6-10	.15	.37			
	10-20	---	---			
Rock Outcrop	0-10	---	---	-	---	---
BIE:						
Bissett	0-3	.15	.43	1	6	48
	3-9	.15	.43			
	9-19	---	---			
Rock Outcrop	0-10	---	---	-	---	---
BIG:						
Bissett	0-3	.15	.43	1	6	48
	3-17	.15	.43			
	17-27	---	---			
Rock Outcrop	0-10	---	---	-	---	---
BLD:						
Blackgap	0-5	.15	.43	1	6	48
	5-11	.15	.43			
	11-21	---	---			
Rock Outcrop	0-10	---	---	-	---	---
BLE:						
Blackgap	0-5	.15	.43	1	6	48
	5-11	.15	.43			
	11-21	---	---			
Rock Outcrop	0-10	---	---	-	---	---
BLG:						
Blackgap	0-5	.15	.43	1	6	48
	5-11	.15	.43			
	11-21	---	---			
Rock Outcrop	0-10	---	---	-	---	---
CIC:						
Chilicotal	0-2	.15	.32	5	6	48
	2-40	.10	.32			
	40-61	.10	.32			

Table 34.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth (inches)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
CLE:						
Chilicotal	0-2	.15	.32	5	6	48
	2-40	.10	.32			
	40-61	.10	.32			
Paisano	0-1	.10	.24	1	6	48
	1-4	.10	.24			
	4-12	.10	.24			
	12-16	---	---			
	16-62	.10	.32			
CNB:						
Chillon	0-5	.05	.32	2	6	48
	5-42	.02	.10			
	42-61	.02	.10			
COC:						
Corazones	0-4	.10	.28	5	6	48
	4-13	.05	.20			
	13-55	.05	.20			
	55-80	.05	.20			
COE:						
Corazones	0-4	.10	.28	5	6	48
	4-13	.05	.20			
	13-55	.05	.20			
	55-80	.05	.20			
EUB:						
Equipaje	0-2	.24	.24	5	3	86
	2-26	.24	.24			
	26-53	.24	.24			
	53-80	.24	.24			
Agust	0-2	.20	.20	5	5	56
	2-11	.10	.24			
	11-28	.10	.24			
	28-80	.10	.32			
GEE:						
Geefour	0-6	.10	.43	1	4	86
	6-15	.43	.43			
	15-25	.43	.43			
GEF:						
Geefour	0-5	.10	.43	1	4	86
	5-12	.43	.43			
	12-39	.43	.43			
HRE:						
Hurds	0-10	.10	.32	5	6	48
	10-80	.10	.28			
LEE:						
Leyva	0-4	.10	.32	1	8	0
	4-15	.10	.32			
	15-25	---	---			
Rock Outcrop	0-10	---	---	-	---	---

Table 34.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth (inches)	Erosion factors: Kw	Erosion factors: Kf	Erosion factors: T	Wind erodi-bility group	Wind erodi-bility index
LGG:						
Lingua	0-5	.05	.28	1	7	38
	5-13	.05	.24			
	13-23	---	---			
Rock Outcrop	0-10	---	---	-	---	---
LMF:						
Liv	0-9	.10	.37	3	8	0
	9-23	.10	.32			
	23-38	.10	.32			
	38-48	---	---			
Mainstay	0-5	.10	.37	1	7	38
	5-18	.10	.32			
	18-28	---	---			
Rock Outcrop	0-10	---	---	-	---	---
MCC:						
Mariscal	0-5	.10	.32	1	8	0
	5-15	---	---			
MDE:						
Mariscal	0-5	.10	.32	1	8	0
	5-15	---	---			
Rock Outcrop	0-10	---	---	-	---	---
MNE:						
Mariscal	0-5	.10	.32	1	8	0
	5-15	---	---			
Terlingua	0-4	.15	.24	1	6	48
	4-8	.10	.37			
	8-16	---	---			
	16-26	---	---			
MSE:						
Musgrave	0-6	.37	.37	2	4	86
	6-19	.37	.37			
	19-41	.37	.37			
NNB:						
Ninepoint	0-4	.43	.43	5	4L	86
	4-80	.37	.37			
NPB:						
Ninepoint, flat	0-2	.43	.43	5	4L	86
	2-20	.43	.43			
	20-80	.43	.43			
Ninepoint, pit	0-2	.43	.43	5	4L	86
	2-10	.43	.43			
	10-80	.43	.43			
Ninepoint, mound	0-5	.43	.43	5	4L	86
	5-39	.43	.43			
	39-80	.43	.43			
PUF:						
Puerta	0-4	.10	.37	1	8	0
	4-5	.10	.37			
	5-19	.10	.32			
	19-30	---	---			

Table 34.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth (inches)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
Madrone	0-4	.10	.37	2	8	0
	4-6	.10	.37			
	6-32	.10	.32			
	32-42	---	---			
Lazarus	0-5	.37	.37	5	6	48
	5-80	.37	.37			
RIA:						
Riverwash	---	---	---	5	---	---
Pantera	0-10	.10	.32	5	1	220
	10-80	.10	.32			
RKG:						
Rock Outcrop	0-10	---	---	-	---	---
Brewster	0-4	.15	.43	1	8	0
	4-14	---	---			
RTE:						
Rock Outcrop	0-10	---	---	-	---	---
Terlingua	0-4	.15	.24	1	6	48
	4-8	.10	.37			
	8-16	---	---			
	16-26	---	---			
RTG:						
Rock Outcrop	0-10	---	---	-	---	---
Terlingua	0-4	.15	.24	1	6	48
	4-8	.10	.37			
	8-16	---	---			
	16-26	---	---			
SKE:						
Solis	0-6	.15	.24	1	3	86
	6-28	---	---			
	28-38	---	---			
Rock Outcrop	0-10	---	---	-	---	---
SKG:						
Solis	0-6	.24	.24	1	3	86
	6-28	---	---			
	28-38	---	---			
Rock Outcrop	0-10	---	---	-	---	---
STC:						
Strawhouse	0-5	.15	.28	2	6	48
	5-15	.15	.28			
	15-19	---	---			
	19-80	.15	.32			
Stillwell	0-3	.10	.20	5	6	48
	3-30	.10	.20			
	30-80	.05	.20			

Table 34.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth (inches)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
STE:						
Strawhouse	0-5	.15	.28	1	6	48
	5-15	.15	.28			
	15-19	---	---			
	19-80	.15	.32			
Stillwell	0-3	.10	.20	5	6	48
	3-30	.10	.20			
	30-80	.05	.20			
SUE:						
Studybutte	0-6	.10	.43	1	8	0
	6-16	---	---			
Rock Outcrop	0-10	---	---	-	---	---
SUG:						
Studybutte	0-6	.10	.43	1	8	0
	6-16	---	---			
Rock Outcrop	0-10	---	---	-	---	---
TOA:						
Tornillo	0-19	.43	.43	5	4L	86
	19-26	.43	.43			
	26-80	.43	.43			
VCA:						
Vicente	0-2	.37	.37	5	4L	86
	2-10	.37	.37			
	10-60	.43	.43			
	60-80	.43	.43			
Lomapelona	0-8	.32	.32	5	3	86
	8-42	.32	.37			
	42-60	.32	.37			
	60-80	.32	.37			
Castolon	0-9	.37	.37	5	4L	86
	9-35	.43	.43			
	35-80	.43	.43			

Table 35.--Chemical Soil Properties

(Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 g	pH	Pct	Pct	dS/m	
AAC:							
Altar	0-7	8.6-20	6.6-7.3	0-1	0	0.0-2.0	0
	7-19	10-16	6.6-7.3	1-5	0	0.0-2.0	0
	19-80	5.7-14	6.6-7.3	1-15	0	1.0-5.0	0
ADE:							
Altuda	0-6	14-33	7.9-8.4	15-40	0	0	0
	6-10	14-33	7.9-8.4	40-70	0	0	0
	10-20	---	---	---	---	---	---
ADG:							
Altuda	0-6	14-34	7.9-8.4	15-40	0	0	0
	6-10	14-33	7.9-8.4	40-70	0	0	0
	10-20	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---
BIE:							
Bissett	0-3	13-27	7.9-8.4	40-80	0	0.0-2.0	0
	3-9	12-34	7.9-8.4	40-80	0	0.0-2.0	0
	9-19	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---
BIG:							
Bissett	0-3	13-27	7.9-8.4	40-80	0	0.0-2.0	0
	3-17	12-34	7.9-8.4	40-80	0	0.0-2.0	0
	17-27	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---
BLD:							
Blackgap	0-5	10-31	7.9-8.4	40-80	0	0.0-2.0	0
	5-11	13-36	7.9-8.4	40-80	0	0.0-2.0	0
	11-21	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---
BLE:							
Blackgap	0-5	10-31	7.9-8.4	40-80	0	0.0-2.0	0
	5-11	13-36	7.9-8.4	40-80	0	0.0-2.0	0
	11-21	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---
BLG:							
Blackgap	0-5	10-31	7.9-8.4	40-80	0	0.0-2.0	0
	5-11	13-36	7.9-8.4	40-80	0	0.0-2.0	0
	11-21	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---
CIC:							
Chilicotal	0-2	10-21	7.9-8.4	10-30	0	0.0-2.0	0-2
	2-40	8.3-22	7.9-8.4	20-50	0	0.0-2.0	4-10
	40-61	4.3-19	7.9-9.0	20-50	0-5	0.0-2.0	4-15

Table 35.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	dS/m	
CLE:							
Chilicotal-----------	0-2	10-19	7.8-8.4	0-10	0	0.0-2.0	0-2
	2-40	8.3-22	7.9-8.4	20-50	0	0.0-2.0	4-10
	40-61	4.3-18	7.9-9.0	20-50	0-5	0.0-2.0	4-30
Paisano--------------	0-1	9.4-16	7.9-8.4	20-50	0	0	0
	1-4	6.6-12	7.9-8.4	25-50	0	0.0-2.0	0
	4-12	8.8-21	7.9-8.4	25-55	0	0.0-2.0	0
	12-16	---	---	---	---	---	---
	16-62	2.4-13	7.9-8.4	10-50	0	0.0-4.0	0-4
CNB:							
Chillon--------------	0-5	4.6-15	7.4-8.4	0-1	0	0.0-2.0	0-30
	5-42	5.9-16	7.4-8.4	1-15	0	2.0-8.0	2-30
	42-61	5.9-27	7.4-8.4	1-15	0	2.0-8.0	2-30
COC:							
Corazones------------	0-4	7.6-21	7.9-8.4	5-15	0	0.0-2.0	0
	4-13	7.7-22	7.9-8.4	10-20	0	0.0-2.0	0-2
	13-55	7.7-22	7.9-8.4	10-20	0	0.0-2.0	0-5
	55-80	5.5-14	7.4-8.4	5-10	0-2	0.0-4.0	2-8
COE:							
Corazones------------	0-4	7.6-21	7.9-8.4	5-15	0	0.0-2.0	0
	4-13	7.7-22	7.9-8.4	10-20	0	0.0-2.0	0-2
	13-55	7.7-22	7.9-8.4	10-20	0	0.0-2.0	0-5
	55-80	5.5-14	7.4-8.4	5-10	0-2	0.0-4.0	2-8
EUB:							
Equipaje-------------	0-2	13-16	6.6-8.4	0	0	0.0-2.0	0-4
	2-26	12-16	7.9-8.4	0-5	0	0.0-2.0	0-4
	26-53	12-16	7.9-8.4	0-5	0	0.0-2.0	0-4
	53-80	12-16	7.9-8.4	0-5	0	0.0-2.0	0-4
Agust----------------	0-2	2.7-15	7.9-8.4	0-5	0	0.0-2.0	0
	2-11	4.3-15	7.9-8.4	5-15	0	0.0-2.0	0
	11-28	4.3-21	7.9-8.4	5-15	0	0.0-2.0	0
	28-80	12-15	7.9-8.4	5-10	0	0.0-2.0	0
GEE:							
Geefour--------------	0-6	26-40	7.4-8.4	1-5	0-1	2.0-6.0	2-13
	6-15	23-37	7.9-8.5	2-10	0-2	4.0-9.0	2-13
	15-25	22-36	7.9-8.5	2-10	0-2	4.0-8.0	2-13
GEF:							
Geefour--------------	0-5	29-40	7.9-9.7	1-9	0-1	0.5-3.0	1-8
	5-12	26-36	7.9-9.2	2-10	0-2	1.0-6.0	2-10
	12-39	25-35	7.9-8.4	2-10	0-2	9.0-16.0	2-13
HRE:							
Hurds----------------	0-10	14-22	5.6-6.5	0	0	0	0
	10-80	7.1-28	6.1-8.4	0	0	0	0
LEE:							
Leyva----------------	0-4	16-28	6.1-7.8	0-2	0	0.0-1.0	0
	4-15	26-34	6.1-7.8	0-2	0	0.0-1.0	0
	15-25	---	---	---	---	---	---
Rock outcrop---------	0-10	---	---	---	---	---	---

Table 35.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	dS/m	
LGG:							
Lingua----------------	0-5	15-24	6.5-7.3	0	0	0.0-1.0	0
	5-13	16-24	6.1-6.6	0	0	0.0-1.0	0
	13-23	---	---	---	---	---	---
Rock outcrop---------	0-10	---	---	---	---	---	---
LMF:							
Liv------------------	0-9	22-31	6.6-7.3	0-1	0	0.0-2.0	0
	9-23	36-50	6.1-7.8	0-25	0	0.0-2.0	0
	23-38	36-50	6.1-7.8	0-25	0	0.0-2.0	0
	38-48	---	---	---	---	---	---
Mainstay-------------	0-5	11-22	6.6-7.8	0-1	0	0.0-2.0	0
	5-18	36-50	6.1-7.8	0-10	0	0.0-2.0	0
	18-28	---	---	---	---	---	---
Rock outcrop---------	0-10	---	---	---	---	---	---
MCC:							
Mariscal-------------	0-5	8.1-22	7.9-8.4	40-70	0	0	0-2
	5-15	---	---	---	---	---	---
MDE:							
Mariscal-------------	0-5	8.1-22	7.9-8.4	40-70	0	0	0-2
	5-15	---	---	---	---	---	---
Rock outcrop---------	0-10	---	---	---	---	---	---
MNE:							
Mariscal-------------	0-5	8.1-22	7.9-8.4	40-70	0	0	0-2
	5-15	---	---	---	---	---	---
Terlingua------------	0-4	4.6-13	7.9-8.4	2-10	0	0.0-2.0	0
	4-8	4.6-15	7.9-8.4	5-15	0	0.0-2.0	0
	8-16	---	---	---	---	---	---
	16-26	---	---	---	---	---	---
MSE:							
Musgrave-------------	0-6	31-39	7.9-8.4	0-15	0-5	1.0-10.0	5-15
	6-19	26-37	7.9-8.4	0-15	0-5	1.0-12.0	5-15
	19-41	23-35	8.7-9.5	5-20	0-5	1.0-10.0	5-15
NNB:							
Ninepoint------------	0-4	18-25	7.2-8.2	20-35	0	0.0-2.0	0
	4-80	16-21	7.4-8.4	20-35	0-2	0.0-2.0	0-2
NPB:							
Ninepoint, flat------	0-2	13-28	7.4-8.4	10-35	0	0.0-4.0	0-5
	2-20	12-27	7.4-8.4	10-35	0-2	0.0-4.0	0-5
	20-80	15-28	7.4-8.4	10-35	0-2	0.0-4.0	0-5
Ninepoint, pit-------	0-2	15-28	7.4-8.4	10-35	0	0.0-4.0	0-5
	2-10	14-27	7.4-8.4	10-35	0-2	0.0-4.0	0-5
	10-80	9.6-26	7.4-8.4	10-35	0-2	0.0-4.0	0-5
Ninepoint, mound-----	0-5	15-28	7.4-8.4	10-35	0	0.0-4.0	5-10
	5-39	15-28	7.4-8.4	10-35	0-2	0.0-4.0	5-10
	39-80	10-28	7.4-8.4	10-35	0-2	0.0-4.0	10-20

Table 35.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	dS/m	
PUF:							
Puerta	0-4	13-23	6.6-7.3	0	0	0.0-2.0	0
	4-5	13-24	6.1-7.3	0	0	0	0
	5-19	37-50	5.1-6.0	0	0	0.0-2.0	0
	19-30	---	---	---	---	---	---
Madrone	0-4	13-24	6.1-7.3	0	0	0	0
	4-6	13-24	6.1-7.3	0	0	0	0
	6-32	33-43	5.1-6.0	0	0	0	0
	32-42	---	---	---	---	---	---
Lazarus	0-5	17-29	6.6-7.3	0	0	0.0-0.4	0
	5-80	16-28	6.1-6.5	0	0	0.0-0.5	0
RIA:							
Riverwash	---	---	---	---	---	---	---
Pantera	0-10	3.6-11	8.0-8.9	2-5	0	0.0-2.0	0
	10-80	6.5-10	8.0-8.9	4-10	0	0.0-3.0	0
RKG:							
Rock outcrop	0-10	---	---	---	---	---	---
Brewster	0-4	15-29	6.1-7.8	0-5	0	0	0
	4-14	---	---	---	---	---	---
RTE:							
Rock outcrop	0-10	---	---	---	---	---	---
Terlingua	0-4	4.6-13	7.9-8.4	2-10	0	0.0-2.0	0
	4-8	4.6-16	7.9-8.4	5-15	0	0.0-2.0	0
	8-16	---	---	---	---	---	---
	16-26	---	---	---	---	---	---
RTG:							
Rock outcrop	0-10	---	---	---	---	---	---
Terlingua	0-4	4.6-13	7.9-8.4	2-10	0	0.0-2.0	0
	4-8	4.6-16	7.9-8.4	5-15	0	0.0-2.0	0
	8-16	---	---	---	---	---	---
	16-26	---	---	---	---	---	---
SKE:							
Solis	0-6	4.6-15	7.9-8.4	5-25	0	0.0-2.0	0
	6-28	---	---	---	---	---	---
	28-38	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---
SKG:							
Solis	0-6	4.6-15	7.9-8.4	5-25	0	0.0-2.0	0
	6-28	---	---	---	---	---	---
	28-38	---	---	---	---	---	---
Rock outcrop	0-10	---	---	---	---	---	---

Table 35.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 g	pH	Pct	Pct	dS/m	
STC:							
Strawhouse-----------	0-5	5.0-18	7.9-8.4	40-60	0	0	0
	5-15	4.5-17	7.4-8.4	40-75	0	1.0-4.0	0-5
	15-19	---	---	---	---	---	---
	19-80	3.0-15	7.4-8.4	40-75	0	2.0-8.0	2-13
Stillwell------------	0-3	3.7-16	7.4-8.4	40-80	0	0.0-2.0	0
	3-30	3.4-11	7.4-8.4	40-80	0	0.0-4.0	0-5
	30-80	3.4-11	7.4-8.4	40-80	0	2.0-8.0	20-35
STE:							
Strawhouse-----------	0-5	5.0-18	7.9-8.4	40-60	0	0	0
	5-15	4.5-17	7.4-8.4	40-75	0	1.0-4.0	0-5
	15-19	---	---	---	---	---	---
	19-80	3.0-15	7.4-8.4	40-75	0	2.0-8.0	2-13
Stillwell------------	0-3	3.7-16	7.4-8.4	40-80	0	0.0-2.0	0
	3-30	3.4-11	7.4-8.4	40-80	0	0.0-4.0	0-5
	30-80	3.4-11	7.4-8.4	40-80	0	2.0-8.0	20-35
SUE:							
Studybutte-----------	0-6	7.1-16	6.6-8.4	0-2	0	0	0
	6-16	---	---	---	---	---	---
Rock outcrop---------	0-10	---	---	---	---	---	---
SUG:							
Studybutte-----------	0-6	7.1-16	6.6-8.4	0-2	0	0	0
	6-16	---	---	---	---	---	---
Rock outcrop---------	0-10	---	---	---	---	---	---
TOA:							
Tornillo-------------	0-19	15-28	7.9-8.4	2-10	0	0.0-4.0	5-10
	19-26	13-20	7.9-8.4	5-15	0	0.0-4.0	5-10
	26-80	15-28	7.9-8.4	5-15	0	0.0-4.0	10-20
VCA:							
Vicente--------------	0-2	22-31	7.4-8.4	5-10	0	0.0-4.0	2-4
	2-10	14-17	7.4-8.4	5-10	0	0.0-4.0	2-4
	10-60	13-21	7.4-8.4	10-15	0	0.0-4.0	2-4
	60-80	8.4-15	7.4-8.4	10-15	0	0.0-4.0	2-4
Lomapelona-----------	0-8	8.6-23	7.4-8.4	2-10	0	0.0-4.0	0-2
	8-42	8.4-16	7.4-8.4	2-10	0	0.0-4.0	0-2
	42-60	8.4-16	7.4-8.4	2-10	0	0.0-4.0	0-2
	60-80	4.5-16	7.4-8.4	2-10	0	0.0-4.0	0-2
Castolon-------------	0-9	22-31	7.4-8.4	5-10	0	0.0-4.0	2-4
	9-35	8.4-21	7.4-8.4	10-15	0	0.0-4.0	2-4
	35-80	8.4-15	7.4-8.4	10-15	0	0.0-4.0	2-4

Table 36.--Total Soil Carbon

(This report displays soil organic carbon (SOC) and soil inorganic carbon (SIC) in kilograms per square meter to a 2-meter depth or to representative top depth of any bedrock kind or any cemented soil horizon. Only major components of a map unit are displayed in this report.)

Map unit symbol, component name and component percentage	Total Soil Carbon	
	SOC	SIC
	kg/m2	kg/m2
AAC:		
Altar (83%)	1	7
ADE:		
Altuda (75%)	4	7
ADG:		
Altuda (60%)	4	7
Rock Outcrop (30%)	0	0
BIE:		
Bissett (50%)	5	14
Rock Outcrop (30%)	0	0
BIG:		
Bissett (55%)	6	19
Rock Outcrop (30%)	0	0
BLD:		
Blackgap (85%)	6	10
Rock Outcrop (10%)	0	0
BLE:		
Blackgap (50%)	6	10
Rock Outcrop (40%)	0	0
BLG:		
Blackgap (50%)	6	10
Rock Outcrop (40%)	0	0
CIC:		
Chilicotal (70%)	3	49
CLE:		
Chilicotal (60%)	3	45
Paisano (25%)	1	36
CNB:		
Chillon (81%)	2	11
COC:		
Corazones (85%)	2	17
COE:		
Corazones (70%)	2	17

Table 36.--Total Soil Carbon--Continued

Map unit symbol, component name and component percentage	Total Soil Carbon	
	SOC	SIC
	kg/m2	kg/m2
EUB:		
Equipaje (45%)	5	10
Agust (40%)	5	24
GEE:		
Geefour (60%)	3	6
GEF:		
Geefour (70%)	3	11
HRE:		
Hurds (70%)	8	0
LEE:		
Leyva (75%)	1	0
Rock Outcrop (15%)	0	0
LGG:		
Lingua (41%)	1	0
Rock Outcrop (36%)	0	0
LMF:		
Liv (30%)	7	12
Mainstay (30%)	3	1
Rock Outcrop (15%)	0	0
MCC:		
Mariscal (70%)	1	5
MDE:		
Mariscal (45%)	1	5
Rock Outcrop (40%)	0	0
MNE:		
Mariscal (45%)	1	5
Terlingua (40%)	1	1
MSE:		
Musgrave (92%)	3	13
NNB:		
Ninepoint (85%)	8	86
NPB:		
Ninepoint, flat (35%)	11	86
Ninepoint, pit (30%)	4	86
Ninepoint, mound (20%)	12	80

Table 36.--Total Soil Carbon--Continued

Map unit symbol, component name and component percentage	Total Soil Carbon	
	SOC	SIC
	kg/m2	kg/m2
PUF:		
Puerta (50%)	6	0
Madrone (35%)	5	0
Lazarus (3%)	28	0
RIA:		
Riverwash (60%)	0	0
Pantera (30%)	2	9
RKG:		
Rock Outcrop (60%)	0	0
Brewster (30%)	1	0
RTE:		
Rock Outcrop (50%)	0	0
Terlingua (40%)	1	2
RTG:		
Rock Outcrop (65%)	0	0
Terlingua (25%)	1	2
SKE:		
Solis (45%)	1	4
Rock Outcrop (35%)	0	0
SKG:		
Solis (50%)	1	4
Rock Outcrop (40%)	0	0
STC:		
Strawhouse (60%)	1	119
Stillwell (25%)	3	112
STE:		
Strawhouse (45%)	1	119
Stillwell (40%)	3	112
SUE:		
Studybutte (60%)	1	0
Rock Outcrop (20%)	0	0
SUG:		
Studybutte (55%)	1	0
Rock Outcrop (30%)	0	0
TOA:		
Tornillo (80%)	12	29

Table 36.--Total Soil Carbon--Continued

Map unit symbol, component name and component percentage	Total Soil Carbon	
	SOC	SIC
	kg/m2	kg/m2
VCA:		
Vicente (40%)	9	43
Lomapelona (30%)	9	17
Castolon (25%)	9	43

Table 37.--Water Features

(Depths of layers are in feet. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
AAC:										
Altar	B	Very low	Jan-Dec	---	---	---	---	None	---	None
ADE:										
Altuda	D	High	Jan-Dec	---	---	---	---	None	---	None
ADG:										
Altuda	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
BIE:										
Bissett	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
BIG:										
Bissett	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
BLD:										
Blackgap	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
BLE:										
Blackgap	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
BLG:										
Blackgap	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
CIC:										
Chilicotal	B	Low	Jan-Dec	---	---	---	---	None	---	None
CLE:										
Chilicotal	B	Medium	Jan-Dec	---	---	---	---	None	---	None
Paisano	D	Very high	Jan-Dec	---	---	---	---	None	---	None

Table 37.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
CNB:										
Chillon	B	Low	Jun-Sep	---	---	---	---	None	---	Rare
COC:										
Corazones	A	Low	Jan-Dec	---	---	---	---	None	---	None
COE:										
Corazones	A	Medium	Jan-Dec	---	---	---	---	None	---	None
EUB:										
Equipaje	A	Very low	Jan-Dec	---	---	---	---	None	---	None
Agust	A	Negligible	Jan-Dec	---	---	---	---	None	---	None
GEE:										
Geefour	D	Very high	Jan-Dec	---	---	---	---	None	---	None
GEF:										
Geefour	D	Very high	Jan-Dec	---	---	---	---	None	---	None
HRE:										
Hurds	B	High	Jan-Dec	---	---	---	---	None	---	None
LEE:										
Leyva	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
LGG:										
Lingua	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
LMF:										
Liv	C	High	Jan-Dec	---	---	---	---	None	---	None
Mainstay	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
MCC:										
Mariscal	D	Low	Jan-Dec	---	---	---	---	None	---	None
MDE:										
Mariscal	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None

Table 37.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
MNE:										
Mariscal	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Terlingua	D	Very high	Jan-Dec	---	---	---	---	None	---	None
MSE:										
Musgrave	D	Very high	Jan-Dec	---	---	---	---	None	---	None
NNB:										
Ninepoint	C	Very low	Jan-Dec	---	---	---	---	None	---	None
NPB:										
Ninepoint, flat	B	Very low	Jan-Dec	---	---	---	---	None	---	None
Ninepoint, pit	B	Very low	Jan-Dec	---	---	---	---	None	---	None
Ninepoint, mound	B	Very low	Jan-Dec	---	---	---	---	None	---	None
PUF:										
Puerta	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Madrone	C	Very high	Jan-Dec	---	---	---	---	None	---	None
Lazarus	C	Medium	Jan-Dec	---	---	---	---	None	---	None
RIA:										
Riverwash	---	Negligible	Jun-Sep	---	---	---	---	None	Very brief	Frequent
Pantera	A	Negligible	Jun-Sep	---	---	---	---	None	Extremely brief	Frequent
RKG:										
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
Brewster	D	High	Jan-Dec	---	---	---	---	None	---	None
RTE:										
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
Terlingua	D	Very high	Jan-Dec	---	---	---	---	None	---	None
RTG:										
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
Terlingua	D	Very high	Jan-Dec	---	---	---	---	None	---	None
SKE:										
Solis	D	Medium	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None

Table 37.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
SKG:										
Solis	D	Medium	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
STC:										
Strawhouse	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Stillwell	A	Medium	Jan-Dec	---	---	---	---	None	---	None
STE:										
Strawhouse	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Stillwell	A	Medium	Jan-Dec	---	---	---	---	None	---	None
SUE:										
Studybutte	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
SUG:										
Studybutte	D	Very high	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	Very high	Jan-Dec	---	---	---	---	None	---	None
TOA:										
Tornillo	B	Very low	Jun-Sep	---	---	---	---	None	Very brief	Occasional
VCA:										
Vicente	C	Negligible	Jun-Sep	---	---	---	---	None	Long	Occasional
Lomapelona	C	Low	Jun-Sep	---	---	---	---	None	Long	Frequent
Castolon	C	Low	Jun-Sep	---	---	---	---	None	Long	Occasional

Table 38.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Restrictive layer				Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Uncoated steel	Concrete
AAC:						
Altar	---	---	---	---	Moderate	Moderate
ADE:						
Altuda	Lithic bedrock	6-19	---	Indurated	Moderate	Low
ADG:						
Altuda	Lithic bedrock	6-19	---	Indurated	Moderate	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
BIE:						
Bissett	Lithic bedrock	6-19	---	Indurated	Moderate	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
BIG:						
Bissett	Lithic bedrock	7-20	---	Indurated	Moderate	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
BLD:						
Blackgap	Lithic bedrock	7-20	---	Indurated	Moderate	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
BLE:						
Blackgap	Lithic bedrock	7-20	---	Indurated	Moderate	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
BLG:						
Blackgap	Lithic bedrock	7-20	---	Indurated	Moderate	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
CIC:						
Chilicotal	---	---	---	---	Moderate	High
CLE:						
Chilicotal	---	---	---	---	Moderate	High
Paisano	Petrocalcic	7-20	---	Strongly cemented	Moderate	Moderate
CNB:						
Chillon	---	---	---	---	High	Moderate
COC:						
Corazones	---	---	---	---	Moderate	Moderate
COE:						
Corazones	---	---	---	---	Moderate	Moderate
EUB:						
Equipaje	---	---	---	---	Moderate	Low
Agust	---	---	---	---	Moderate	Low
GEE:						
Geefour	Densic bedrock	3-20	---	Noncemented	High	Moderate
GEF:						
Geefour	Densic bedrock	3-19	---	Noncemented	High	High
HRE:						
Hurds	---	---	---	---	Low	Low

Table 38.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Uncoated steel	Concrete
LEE:						
Leyva	Lithic bedrock	7-20	---	Indurated	Moderate	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
LGG:						
Lingua	Lithic bedrock	6-15	---	Indurated	Moderate	Moderate
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
LMF:						
Liv	Lithic bedrock	20-40	---	Indurated	High	Low
Mainstay	Lithic bedrock	8-20	---	Indurated	High	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
MCC:						
Mariscal	Lithic bedrock	4-20	---	Very strongly cemented	Low	Low
MDE:						
Mariscal	Lithic bedrock	4-19	---	Very strongly cemented	Low	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
MNE:						
Mariscal	Lithic bedrock	4-19	---	Very strongly cemented	Low	Low
Terlingua	Paralithic bedrock	4-12	---	Moderately cemented	Moderate	Low
	Lithic bedrock	8-20	---	Indurated		
MSE:						
Musgrave	Densic bedrock	3-20	---	Noncemented	High	High
NNB:						
Ninepoint	---	---	---	---	Moderate	Low
NPB:						
Ninepoint, flat	---	---	---	---	Moderate	Moderate
Ninepoint, pit	---	---	---	---	Moderate	Moderate
Ninepoint, mound	---	---	---	---	Moderate	Moderate
PUF:						
Puerta	Lithic bedrock	11-20	---	Indurated	High	Moderate
Madrone	Lithic bedrock	21-40	---	Indurated	High	Moderate
Lazarus	---	---	---	---	Low	Low
RIA:						
Riverwash	---	---	---	---	---	---
Pantera	---	---	---	---	Moderate	High
RKG:						
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
Brewster	Lithic bedrock	4-20	---	Indurated	Low	Low

Table 38.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Uncoated steel	Concrete
RTE:						
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
Terlingua	Paralithic bedrock	4-16	---	Moderately cemented	Low	Low
	Lithic bedrock	8-20	---	Indurated		
RTG:						
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
Terlingua	Paralithic bedrock	4-16	---	Moderately cemented	Low	Low
	Lithic bedrock	8-20	---	Indurated		
SKE:						
Solis	Paralithic bedrock	4-20	---	Moderately cemented	Moderate	Low
	Densic bedrock	20-36	---	Noncemented		
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
SKG:						
Solis	Paralithic bedrock	4-20	---	Moderately cemented	Moderate	Low
	Densic bedrock	20-36	---	Noncemented		
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
STC:						
Strawhouse	Petrocalcic	4-20	---	Strongly cemented	High	Moderate
Stillwell	---	---	---	---	High	Moderate
STE:						
Strawhouse	Petrocalcic	4-20	---	Strongly cemented	High	Moderate
Stillwell	---	---	---	---	High	Moderate
SUE:						
Studybutte	Lithic bedrock	4-19	---	Very strongly cemented	Low	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
SUG:						
Studybutte	Lithic bedrock	4-19	---	Very strongly cemented	Low	Low
Rock outcrop	Lithic bedrock	---	---	Indurated	---	---
TOA:						
Tornillo	---	---	---	---	Moderate	Moderate
VCA:						
Vicente	---	---	---	---	Moderate	Moderate
Lomapelona	---	---	---	---	Moderate	Moderate
Castolon	---	---	---	---	Moderate	Moderate

Table 39.—Physical Analyses of Selected Soils

(The abbreviation “COLE” means coefficient of linear extensibility. Analysis by the National Soil Survey Laboratory, USDA NRCS, Lincoln, Nebraska; and the Soil Characterization Laboratory, Texas AgriLife Research, College Station, Texas. Dashes indicate that data were not available.)

Soil name and sample number	Depth	Horizon	Particle-size distribution								Coarse Frag-ments
			Sand						Silt (0.05-0.002 mm)	Clay (<0.02 mm)	
			Very coarse (2.0-1.0 mm)	Coarse (1.0-0.5mm)	Medium (0.5-0.25mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2.0-0.05 mm)			
	In		Pct								
Chilicotal (2,4) (S80TX043-011)	0-2	A	4.3	4.8	7.4	16.3	22.4	55.2	31.5	13.3	43.0
	2-8	Bw	4.3	3.5	4.0	10.9	21.1	43.8	37.9	18.3	54.0
	8-14	Bk1	7.1	3.8	3.8	9.6	17.4	41.7	35.8	22.5	73.0
	14-23	Bk2	9.3	3.6	3.4	7.6	13.5	37.4	35.1	27.5	76.0
	23-28	Bk3	8.8	3.8	3.8	7.6	14.3	38.3	36.2	25.5	81.0
	28-40	Bk4	9.8	5.4	5.2	9.5	15.7	45.6	39.3	15.1	80.0
	40-51	BCk1	13.9	7.5	6.0	13.3	18.5	59.2	34.8	6.0	69.0
	51-61	BCk2	11.5	5.6	6.6	16.7	20.0	60.4	34.4	5.4	81.0
	61-79	Bkm	12.0	7.8	8.8	15.3	19.4	63.3	30.4	6.3	80.0
	79-85	Ck	13.1	6.4	7.8	17.1	21.4	65.8	30.5	3.7	66.0
Chilicotal (3,5) (S86TX043003)	0-2	A	7.4	10.0	13.4	18.6	15.8	65.2	22.8	12.0	13.1
	2-8	Bk1	13.2	10.5	11.2	13.5	13.3	61.7	23.1	15.2	12.1
	8-12	Bk2	11.6	10.2	10.6	13.5	11.2	57.1	24.7	18.2	12.7
	12-20	Bk3	21.1	10.1	9.7	11.1	8.3	60.3	23.3	16.4	9.0
	20-30	Bk4	24.8	11.1	10.6	11.0	7.6	65.1	21.0	13.9	8.8
	30-34	2Bk1	39.6	11.7	11.0	9.2	5.3	76.8	11.1	12.1	5.0
	34-45	2Bk2	20.9	15.0	16.8	14.7	6.6	74.0	14.8	11.2	6.2
	45-60	2Bk3	16.5	21.3	21.3	13.4	4.6	77.1	11.3	11.6	3.7
	60-71	3Bt	14.1	8.7	11.2	11.8	6.9	52.7	19.1	28.2	6.2
	71-80	3Bk	8.4	10.5	15.2	13.2	5.5	52.8	16.5	30.7	4.8
Corazones (3,6) (S86TX043002)	0-1	A	9.1	8.2	10.5	18.7	15.6	62.1	25.4	12.5	9.2
	1-6	Ak	5.7	8.1	10.8	20.7	15.9	61.2	24.8	14.0	10.1
	6-12	Bw1	7.5	9.0	11.3	20.0	16.7	64.5	24.3	11.2	8.9
	12-17	Bw2	13.3	10.7	11.0	17.6	14.0	66.6	22.9	10.5	7.6
	17-30	2Bk1	20.2	16.2	18.4	16.2	6.5	77.5	9.5	13.0	2.3
	30-37	2Bk2	27.6	23.9	18.3	12.4	3.1	85.3	5.1	9.6	4.1
	37-46	2Bk3	29.1	11.4	14.1	15.0	5.6	75.2	8.6	16.2	4.2
	46-55	2Bk4	22.3	22.1	20.6	10.9	2.4	78.3	4.9	16.8	1.0
	55-67	2Bk5	35.7	24.3	12.2	4.3	4.3	80.8	4.5	14.7	1.1
	67-80	3Bt	28.3	18.4	12.1	11.1	4.1	74.0	8.0	18.0	2.8

Table 39.--Physical Analyses of Selected Soils—Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution								Coarse Frag-ments
			Sand						Silt (0.05-0.002 mm)	Clay (<0.02 mm)	
			Very coarse (2.0-1.0 mm)	Coarse (1.0-0.5mm)	Medium (0.5-0.25mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2.0-0.05 mm)			
	In		- - - - - - - -	- - - - - - - -	- - - - - - - -	Pct	- - - - - - - -	- - - - - - - -	- - - - - - - -	- - - - - - - -	
Terlingua (1,2)											
(S80TX-043-012)	0-4	A	17.2	9.8	9.2	11.4	11.8	59.4	33.4	7.2	40
	4-8	Bk	14.3	8.6	9.4	10.4	12.3	55.0	34.5	10.5	56
Tornillo (2,7)											
(S80TX-043-010)	0-9	A	0.6	0.5	2.8	15.0	19.8	38.7	40.3	21.0	---
	9-17	Bw	0.1	0.2	1.0	5.8	12.3	19.4	51.4	29.2	---
	17-25	Bk1	0.1	0.2	0.6	3.2	10.5	14.6	57.6	27.8	---
	25-33	Bk2	0.6	1.1	2.3	9.3	14.1	27.4	46.2	26.4	---
	33-43	Bk3	1.1	1.1	4.5	20.8	21.8	49.3	30.2	20.5	---
	43-50	A1b	0.1	0.2	1.4	8.4	17.5	27.6	43.6	28.8	---
	50-64	A2b	0.1	0.2	0.9	6.1	12.7	20.0	52.4	27.6	---
	64-75	A3b	---	---	---	---	---	---	---	---	---
	75-80	Bwb	0.0	0.0	0.1	1.3	9.8	11.2	59.3	29.5	---

(1) Location of pedon sample is the same as the pedon given as typical for series in "Soil Series and Their Morphology."

(2) Analysis by Soil Characterization Laboratory, Texas A&M University, College Station, Texas.

(3) Analysis by National Soil Survey Laboratory, USDA-NRCS, Lincoln, Nebraska.

(4) Location of the pedon sample: USGS Panther Junction topographic quadrangle; UTM coordinates: 672072 m Easting; 3249676 m Northing; Zone 13, NAD83. This pedon is located in the park.

(5) Location of the pedon sample: USGS Roys Peak topographic quadrangle; UTM coordinates: 683953 m Easting; 3237870 m Northing. This pedon is located in the park.

(6) Location of the pedon sample: USGS San Vicente topographic quadrangle; UTM coordinates: 688706 m Easting; 3244406 m Northing; Zone 13, NAD83. This pedon is located in the park.

(7) Location of the pedon sample: USGS Solis topographic quadrangle; UTM coordinates: 688670 m Easting; 3221627 m Northing; Zone 13, NAD83. This pedon is located in the park.

Table 40.--Chemical Analyses of Selected Soils

(Analysis by the National Soil Survey Laboratory, USDA-NRCS, Lincoln, Nebraska, and Soil Characterization Laboratory, Texas AgriLife Research, College Station, Texas. Dashes indicate that analyses were not made).

Soil name and sample number	Depth	Horizon	Extractable bases Ca	Mg	Na	K	Cation Exchange Capacity	Base satura-tion	Organic carbon	pH 1:1 (soil:water)	$CaCO_3$ Equiv-alent	Electric Conduc tivity	Sodium adsorption ratio (SAR)
	In		------- Meq/soil --------					Pct	Pct	pH	Pct	(dS/m)	
Chilicotal (2,4)	0-2	A	10.7	2.3	0.2	1.0	13.2	100	0.33	8.0	0.8	0.4	0
(S80TX043-011)	2-8	Bw	17.4	1.9	0.2	0.7	16.9	100	0.53	7.8	1.0	0.8	1
	8-14	Bk1	41.1	1.7	0.4	0.5	20.6	100	0.69	7.8	1.9	1.0	1
	14-23	Bk2	56.9	1.6	0.9	0.5	22.6	100	0.43	7.9	4.1	0.9	1
	23-28	Bk3	50.2	1.7	1.1	0.5	21.4	100	0.08	7.9	9.0	0.9	1
	28-40	Bk4	44.9	1.3	1.4	0.3	15.2	100	0.05	7.8	13.8	1.2	2
	40-51	BCk1	40.5	1.1	0.7	0.2	13.1	100	0.00	8.0	14.8	1.3	3
	51-61	BCk2	43.9	3.2	2.6	0.3	18.3	100	0.00	8.3	12.4	1.5	11
	61-79	Bkm	46.2	3.6	3.7	0.3	16.8	100	0.17	8.7	17.1	1.7	16
	79-85	Ck	39.1	3.8	5.3	0.3	13.7	100	0.13	8.9	13.6	2.5	24
Chilicotal (3,5)	0-2	A	44.0 *	1.0	---	0.5	17.0	100	0.53	8.3	3.0	---	---
(S86TX043003)	2-8	Bk1	51.4 *	0.6	0.1	0.4	20.7	100	0.73	8.3	6.0	0.47	tr
	8-12	Bk2	54.8 *	0.4	0.1	0.3	21.9	100	0.81	8.3	7.0	0.53	tr
	12-20	Bk3	54.2 *	0.3	0.5	0.2	21.2	100	0.37	8.3	10.0	0.52	1
	20-30	Bk4	52.8 *	0.4	1.8	0.2	19.9	100	0.21	8.6	12.0	1.13	6
	30-34	2Bk1	30.1 *	0.4	2.2	0.1	14.3	100	0.05	8.7	8.0	1.85	10
	34-45	2Bk2	49.5 *	0.9	3.9	0.2	16.6	100	0.07	8.0	9.0	5.82	10
	45-60	2Bk3	46.0 *	1.1	3.8	0.2	15.9	100	0.03	8.1	6.0	5.81	12
	60-71	3Bt	48.3 *	1.6	5.2	0.4	22.3	100	0.06	7.9	6.0	8.04	12
	71-80	3Bk	53.5 *	1.9	5.7	0.5	24.7	100	0.05	7.7	6.0	8.46	12
Corazones (3,6)	0-1	A	48.0 *	0.9	0.1	0.6	15.5	100	0.18	8.4	10.0	---	---
(S86TX043002)	1-6	Ak	50.4 *	0.7	0.7	0.5	17.8	100	0.12	8.7	16.0	---	---
	6-12	Bw1	47.4 *	0.4	3.1	0.2	17.8	100	0.15	9.0	12.0	0.67	11
	12-17	Bw2	47.2 *	0.3	6.5	0.2	17.6	100	0.15	9.0	13.0	2.02	24
	17-30	2Bk1	55.7 *	0.3	9.0	0.2	15.8	100	0.08	8.0	11.0	9.59	28
	30-37	2Bk2	43.9 *	0.3	8.2	0.2	15.5	100	0.05	8.5	6.0	8.31	26
	37-46	2Bk3	42.9 *	0.4	9.4	0.3	18.3	100	0.03	8.6	7.0	5.95	32
	46-55	2Bk4	34.7 *	0.4	8.6	0.3	17.2	100	0.04	8.7	5.0	5.60	32
	55-67	2Bk5	35.0 *	0.5	8.1	0.3	17.9	100	0.03	8.6	4.0	5.19	31
	67-80	3Bt	43.8 *	0.6	9.2	0.4	20.4	100	0.03	8.5	5.0	5.16	28

Table 40.--Chemical Analyses of Selected Soils--Continued

Soil name and sample number	Depth	Horizon	Extractable bases				Cation Exchange Capacity	Base saturation	Organic carbon	pH 1:1 (soil:water)	$CaCO_3$ Equivalent	Electric Conductivity	Sodium adsorption ratio (SAR)
			Ca	Mg	K	Na							
	In		------- Meq/soil --------					Pct	Pct	pH		(dS/m)	
Terlingua (1,2)													
(S80TX-043-012)	0-4	A	41.9	0.7	0.1	0.4	15.1	100	0.37	8.4	5.0	0.4	1
	4-8	Bk	49.8	0.4	0.2	0.2	17.9	100	0.75	8.2	8.4	0.4	1
Tornillo (2,7)													
(S80TX-043-010)	0-9	A	58.1	1.2	1.4	0.4	27.0	100	0.16	8.3	3.7	0.5	7
	9-17	Bw	59.5	1.9	2.1	0.4	34.8	100	0.17	7.7	6.4	2.9	5
	17-25	Bk1	63.3	1.9	1.9	0.4	34.0	100	0.14	7.9	7.3	2.0	5
	25-33	Bk2	59.5	1.9	2.2	0.3	30.5	100	0.12	7.7	8.7	1.9	6
	33-43	Bk3	49.6	1.8	3.0	0.2	25.4	100	0.02	8.4	8.9	1.0	10
	43-50	A1b	56.2	2.5	4.7	0.3	34.1	100	0.10	8.5	8.3	0.9	18
	50-64	A2b	59.5	2.9	5.6	0.3	36.5	100	0.10	8.6	10.0	0.8	21
	64-75	A3b	57.5	2.9	5.7	0.3	36.6	100	0.07	8.7	9.6	0.9	23
	75-80	Bwb	56.0	3.1	7.2	0.4	38.0	100	0.09	8.6	10.0	1.1	24

(1) Location of pedon sample is the same as the pedon given as typical for series in "Soil Series and Their Morphology."

(2) Analysis by Soil Characterization Laboratory, Texas A&M University, College Station, Texas.

(3) Analysis by National Soil Survey Laboratory, USDA-NRCS, Lincoln, Nebraska.

(4) Location of the pedon sample: USGS Panther Junction topographic quadrangle; UTM coordinates: 672072 m Easting; 3249676 m Northing; Zone 13, NAD83. This pedon is located in the park.

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(7) Location of the pedon sample: USGS Solis topographic quadrangle; UTM coordinates: 688670 m Easting; 3221627 m Northing; Zone 13, NAD83. This pedon is located in the park.

Table 41.--Taxonomic Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series.)

Soil name	Family or higher taxonomic class
Agust	Coarse-loamy, mixed, superactive, hyperthermic Ustic Haplocalcids
Altar	Loamy-skeletal, mixed, superactive, thermic Ustic Haplocambids
Altuda	Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Bissett	Loamy-skeletal, carbonatic, thermic Lithic Ustic Haplocalcids
Blackgap	Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Haplocalcids
Brewster	Loamy-skeletal, mixed, superactive, thermic Aridic Lithic Haplustolls
Castolon	Fine-silty, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Chilicotal	Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids
Chillon	Loamy-skeletal, mixed, superactive, hyperthermic Ustic Haplocambids
Corazones	Loamy-skeletal, mixed, superactive, hyperthermic Ustic Haplocalcids
Equipaje	Coarse-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Geefour	Clayey, smectitic, calcareous, hyperthermic, shallow Ustic Torriorthents
Hurds	Loamy-skeletal, mixed, superactive, thermic Aridic Argiustolls
*Lazarus	Fine-loamy, mixed, superactive, mesic Pachic Argiustolls
Leyva	Clayey-skeletal, mixed, superactive, thermic Lithic Ustic Haplargids
Lingua	Loamy-skeletal, mixed, superactive, nonacid, thermic Lithic Ustic Torriorthents
Liv	Clayey-skeletal, smectitic, thermic Pachic Paleustolls
Lomapelona	Coarse-loamy, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents
Madrone	Clayey-skeletal, smectitic, mesic Typic Paleustalfs
Mainstay	Clayey-skeletal, smectitic, thermic Aridic Lithic Argiustolls
Mariscal	Loamy-skeletal, carbonatic, hyperthermic Lithic Ustic Torriorthents
Musgrave	Clayey, mixed, superactive, calcareous, hyperthermic, shallow Ustic Torriorthents
Ninepoint	Fine-loamy, mixed, superactive, hyperthermic Ustic Haplocambids
Paisano	Loamy-skeletal, carbonatic, thermic, shallow Calcic Petrocalcids
Pantera	Sandy-skeletal, mixed, hyperthermic Ustic Torrifluvents
Puerta	Clayey-skeletal, smectitic, mesic Alfic Lithic Argiustolls
Solis	Loamy, mixed, superactive, calcareous, hyperthermic, shallow Ustic Torriorthents
Stillwell	Loamy-skeletal, carbonatic, hyperthermic Sodic Ustic Haplocalcids
Strawhouse	Loamy-skeletal, carbonatic, hyperthermic, shallow Calcic Petrocalcids
Studybutte	Loamy-skeletal, mixed, superactive, nonacid, hyperthermic Lithic Ustic Torriorthents
Terlingua	Loamy-skeletal, mixed, superactive, calcareous, hyperthermic Lithic Ustic Torriorthents
Tornillo	Fine-loamy, mixed, superactive, hyperthermic Ustifluventic Haplocambids
Vicente	Coarse-silty, mixed, superactive, calcareous, hyperthermic Ustic Torrifluvents

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