United States Department of Agriculture,
Forest Service and Soil Conservation Service

In cooperation with the
Colorado Agricultural Experiment Station,
Colorado State University

Soil Survey of Uncompahgre National Forest Area, Colorado, Parts of Mesa, Montrose, Ouray, and San Miguel Counties

How To Use This Soil Survey

General Soil Map

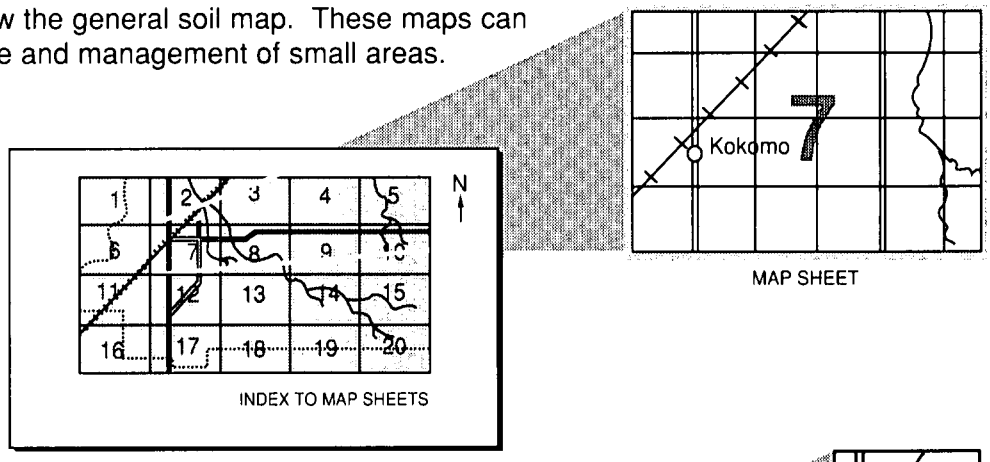
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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.

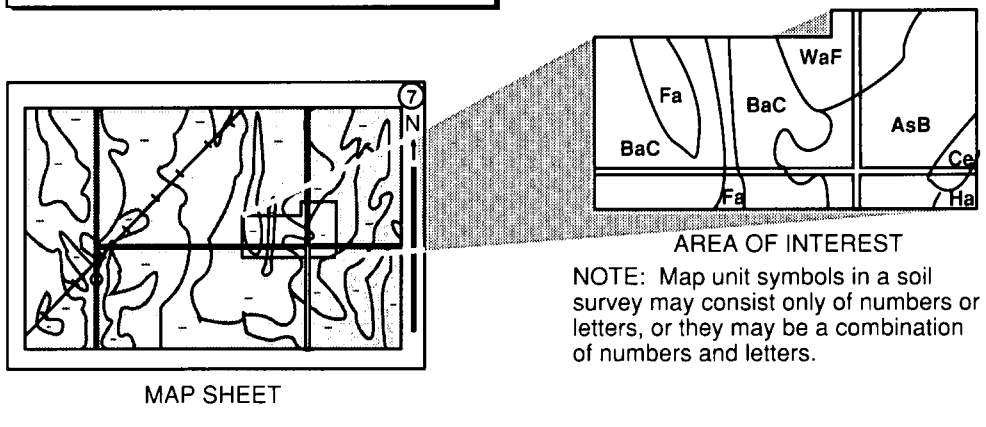
Detailed Soil Maps

The detailed soil maps follow the general soil map. These 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**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



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



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **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 Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1982. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Forest Service, the Soil Conservation Service, and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the National Forest Service Administration.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could result in 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.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Typical canyon and plateau topography of the Uncompahgre National Forest area.

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Issued March 1995

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Foreword

This soil survey contains basic soils data that is correlated to National standards. It contains information concerning the extent, capability, productivity, and limitations of the soils in the Uncompahgre Plateau area of the Uncompahgre National Forest. It has been designed to provide general soils information in a scientific manner for forest land management planning, program planning, and environmental assessments. The survey contains predictions of soil behavior for a variety of land uses. It also highlights certain limitations and potential hazards inherent in the soil, possible improvements needed to overcome the limitations, and the impact of selected practices on the environment.

Teachers, students, researchers, or anyone interested in the natural resources of the area can use this report to gain additional knowledge about the vegetation, geology, and environment of this National Forest.

Great differences in soil properties can occur within short distances. Some soils are very clayey or are seasonally wet. Some are shallow over bedrock or contain large amounts of gravel and stone. These factors may create large differences in forest and range production rates. Certain areas may be able to withstand offroad vehicle use with very little impact.

These and many other soil properties that affect the use and management of the land are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of soil map units is shown on detailed soil maps. The soils in the survey area are described, and information on specific uses is given for each soil. Help in using this publication and additional information are available from soil scientists in the Forest Service.

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Soil Survey of Uncompahgre National Forest Area, Colorado, Parts of Mesa, Montrose, Ouray, and San Miguel Counties

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United States Department of Agriculture, Forest Service and Soil Conservation Service, in cooperation with the Colorado Agricultural Experiment Station

The survey area is within the Uncompahgre National Forest in the southwestern part of Colorado (fig. 1). It has a total area of 578,600 acres, or about 904.1 square miles. It includes parts of Mesa, Montrose, Ouray, and San Miguel Counties. There are no towns within the National Forest, but Grand Junction, Delta, Montrose, Ridgway, Norwood, Nucla, and Naturita are nearby.

Approximately 94 percent of the survey area is under the administration of the Forest Service. This land is used for livestock grazing, wildlife habitat, timber production, watershed, and recreation. Mining and mineral exploration also are permitted by Federal law.

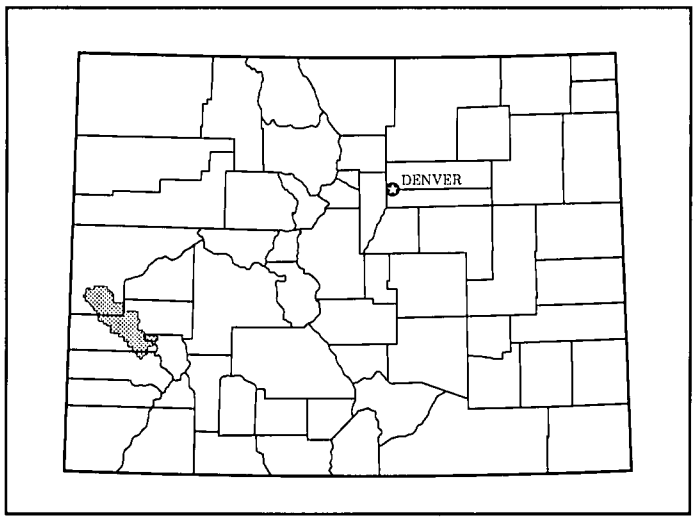

Figure 1.—Location of the survey area in Colorado.

General Nature of the Survey Area

This section provides general information about the survey area. It describes physiography and relief, history, vegetation, and climate.

Physiography and Relief

The Uncompahgre Plateau area is on the eastern edge of the Colorado Plateau physiographic province. It is a broad, gentle upwarp of sedimentary rocks that has been uplifted over geologic time to several thousand feet above the valleys that surround it *(10)*. The entire plateau stretches 125 miles from northwest to southeast, from the Colorado-Utah border to the San Juan Mountains. Because of its length, the plateau appears low *(6)*; but actually, major portions of the upland areas range from 8,000 to nearly 10,000 feet in elevation. This high, long uplift is broken on its flanks by numerous sharp and rugged canyons. The resultant topographic pattern is one of alternating deep canyons and isolated finger mesas surrounding a rather smooth, domed upland. Some of the canyon bottoms in the survey area extend down to elevations of 5,800 to 6,000 feet.

History

The word "Uncompahgre" is a Ute Indian term meaning "red lake," which was the Utes' name for the river that flows through the valley east of the plateau *(3)*. The first white men to enter the region were Spanish explorers. Don Juan Rivera crossed the area in the 1760's. He was followed by the Dominguez-Escalante expedition in 1776. In 1828, Joseph Roubideau, a French trapper, explored the area. He was followed by other trappers. Later, miners and ranchers moved in and conflict with the Indians over land escalated. After the Indians were forcibly removed in 1881, the area underwent rapid settlement *(4, 7)*. The climate of the lowlands and valleys surrounding the plateau was favorable for agriculture, but most homesteads on the plateau failed. The plateau was instead used as a source of lumber and forage. In 1905, President Theodore Roosevelt created the Uncompahgre Forest Reserve, which later became the Uncompahgre National Forest.

Presently, the Uncompahgre National Forest is managed under the principles of multiple use and sustained yield. Multiple use means that renewable resources (water, timber, forage, and wildlife) are managed so that they are utilized in the combination that meets the needs of the American people. Sustained yield means that these resources are managed so as to provide a continuous high-level output of products and services without harming the productivity of the land. This soil survey is designed with these principles in mind.

Vegetation

The kinds of vegetation in the survey area depend on such factors as climate, slope, and elevation. The main plant communities in the area are pinyon-juniper, oakbrush-pine, aspen, and spruce-fir *(5, 15)*.

The pinyon-juniper zone occurs at the lower elevations, ranging generally from 6,000 to 7,600 feet. It includes pinyon pine, Utah juniper, and Rocky Mountain juniper as overstory and understories of western wheatgrass, muttongrass, and bottlebrush squirreltail in the lower areas and serviceberry, mountainmahogany, and big sagebrush in the upper areas.

The oakbrush-pine zone occurs at elevations ranging from 7,200 to 8,800 feet. This zone includes a plant community that is often called mountain shrub. Gambel oak, serviceberry, and snowberry are the principal shrub species, and the forbs and grasses consist of Indian ricegrass, mountain muhly, muttongrass, and Letterman needlegrass. Ponderosa pine occurs in the mid and upper portions of this zone. In the northern portions of the plateau, scattered clumps of greenleaf manzanita are included with the pine.

The aspen occurs at elevations ranging from slightly under 8,000 feet to nearly 10,000 feet. In this woodland type, quaking aspen is the principal overstory species. The understory typically contains Thurber fescue, elk sedge, needlegrass, aspen peavine, and snowberry. At the upper elevations, the aspen is mixed with spruce-fir.

The spruce-fir zone occurs at the upper portions of the survey area at elevations ranging from 8,800 feet to the top of the plateau, which is at an elevation of nearly 10,000 feet. This subalpine woodland type consists of an overstory that includes both Engelmann spruce and subalpine fir. The understory typically consists of elk sedge, nodding bromegrass, meadowrue, snowberry, dwarf blueberry, and kinnikinnick. A few quaking aspen are also in this zone.

Climate

The climate in the survey area varies greatly, depending on elevation and aspect. Generally, it is a cool, semiarid to moist, southwestern mountain type climate. The air masses that bring moisture into the area are mainly polar Pacific and, to some extent, tropical Pacific and tropical Gulf air masses. In winter, high-pressure zones move to the southeast, drawing moist polar Pacific air from the northwest *(14)*. Orographic uplift storms result from this air being raised in elevation up and over the Uncompahgre Plateau, thus producing condensation and precipitation. In summer, low-pressure systems result from the continental land mass heating at a faster rate than the oceans and moist, oceanic air being pulled inland from the Pacific and the Gulf of Mexico. The storms that result are mainly orographic uplift in nature, as in the winter, but convective storms are also possible *(9)*. The convective storms tend to be local phenomena of short duration. They are the local afternoon mountain showers. They result from the rise of hot, moist, ground-level air to altitudes of less pressure, where expansion and cooling result in condensation and precipitation.

Very little specific climatic data has been gathered on the remote, unpopulated Uncompahgre Plateau. Generally, air temperatures decrease as elevation increases—at a rate of about 2 degrees Celsius per 1,000 feet of elevation *(9)*. Precipitation generally varies with elevation also, but the rate of change is unpredictable.

Tables 1, 2, and 3 display climatic data gathered at Norwood, Colorado, during the period 1951 to 1980. Norwood is several miles southwest of the southern part

of the survey area, but the climate there is typical of that at the lower elevations on the plateau.

From information gathered at other high-elevation sites throughout Colorado, the following general statements can be made *(9)*. The mean annual air temperature ranges from around 35 degrees F at the upper elevations to around 45 degrees at the lower elevations. Summer temperatures in most of the area are cool and rarely exceed 75 to 80 degrees F. Typical nighttime low temperatures in summer range from 35 to 45 degrees, but they may occasionally range to -30 degrees. Freezing temperatures can occur at any time of the year. The frost-free period ranges from 40 to 100 days, depending on elevation and aspect.

Annual precipitation ranges from just under 15 inches to around 35 inches. Generally, at least half of the annual precipitation is in the form of snow. Below an elevation of 9,000 feet, snow may cover the ground for approximately 4 months of the year with depths ranging from 2 to 4 feet. Some south and west exposures at the lower elevations may be relatively free of snow most of the winter. Above an elevation of 9,000 feet, snow covers the ground from 6½ to 8 months each year with typical depths of 4 to 6 feet. The spring snowmelt usually occurs in April or May at the lower elevations and begins in mid-June at the upper elevations.

The greatest amounts of precipitation occur in late July; in August, September, and October; and in March. The lowest precipitation occurs during May and June. Generally, the distribution of precipitation from month to month is more uniform at the higher elevations.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil or miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate

and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The map unit descriptions, names, and delineations in this soil survey do not fully agree with those in the soil surveys of adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, and variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, 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 soils or miscellaneous areas making up one 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 or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

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

Map Unit Descriptions

1. Ula-Agneston-Pendergrass Families

Deep to shallow, well drained, medium textured and moderately fine textured, nearly level to steep soils on uplands, knobs, ridges, and mountain side slopes

This map unit is in the central and southeastern parts of the survey area. Elevation is 8,400 to 10,000 feet. The average annual precipitation is about 22 to 26 inches, the average annual air temperature is 36 to 42 degrees F, and the average frost-free season is 40 to 60 days.

This unit makes up about 15 percent of the survey area. It is about 40 percent Ula family, 25 percent Agneston family, 15 percent Pendergrass family, and 20 percent components of minor extent.

The Ula family is on uplands and knobs. These soils are moderately deep or deep. They formed in residuum derived dominantly from interbedded sandstone and shale. They support open stands of Engelmann spruce and subalpine fir. The surface layer is loam. The subsoil is cobbly sandy clay loam and overlies unweathered bedrock at a depth of 20 to more than 40 inches.

The Agneston family is on ridges and mountain side slopes. These soils are deep. They formed in residuum and colluvium derived dominantly from interbedded sandstone and shale. They support dense stands of Engelmann spruce and subalpine fir. The surface layer is very cobbly fine sandy loam. The subsoil is very cobbly clay loam. Unweathered sandstone is at a depth of 40 inches or more.

The Pendergrass family is on ridges and knobs. These soils are shallow. They formed in residuum derived dominantly from interbedded sandstone and shale. They support dense stands of Engelmann spruce and subalpine fir. The soils are very cobbly fine sandy loam underlain by unweathered bedrock at a depth of 10 to 20 inches.

Of minor extent in this unit are areas of the very steep Borolls-Boralfs-Rock outcrop complex and soils in the Grenadier, Olathe, Lamphier, and Cebone families.

This unit is used for recreation, wildlife habitat, livestock grazing, or timber production. In the areas used for recreational development, the main limitations are the slope and the shallowness to bedrock in the Pendergrass family.

2. Lamphier-Hapgood Families

Deep and moderately deep, well drained, moderately fine textured and medium textured, nearly level to steep soils on upland hills, ridges, and mountain side slopes

This map unit is throughout most of the survey area. Elevation is 8,400 to 10,000 feet. The vegetation is mainly aspen. The average annual precipitation is about 21 to 25 inches, the average annual air temperature is 38 to 42 degrees F, and the average frost-free season is 40 to 60 days.

This unit makes up about 19 percent of the survey area. It is about 40 percent Lamphier family, 35 percent Hapgood family, and 25 percent components of minor extent (fig. 2).

The Lamphier family is on upland hills, ridges, and mountain side slopes. These soils are deep. They formed in residuum and colluvium derived dominantly

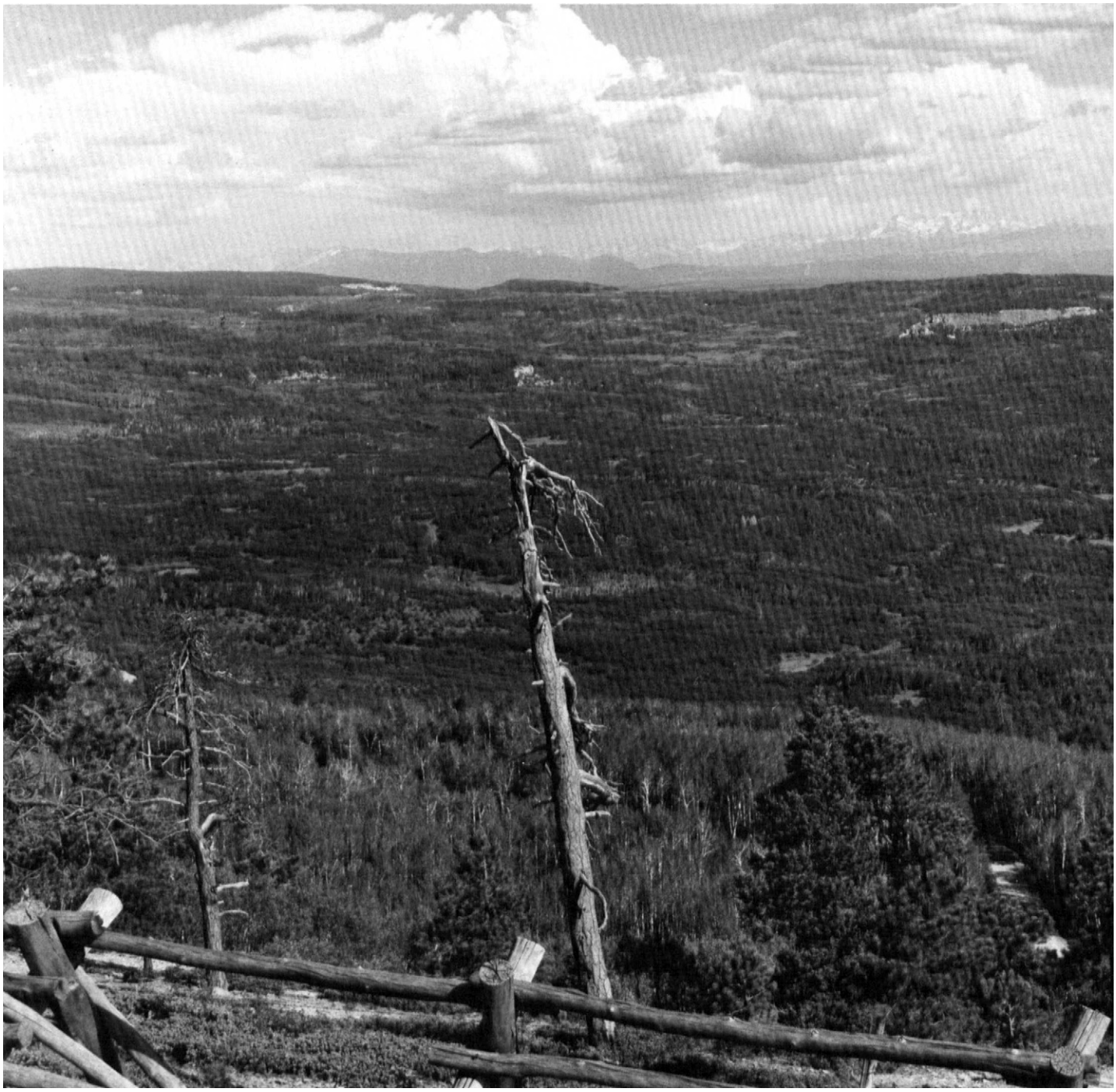

Figure 2.—An area of the Lamphier-Hapgood families general soil map unit is in the foreground. The soils in the middleground are in the Kubler-Delson-Cerro families general soil map unit. The mountains in the distance are the San Juan Mountains.

from interbedded sandstone and shale. The surface layer is typically loam. The subsoil is clay loam. Unweathered bedrock is at a depth of 40 to more than 60 inches.

The Hapgood family is on upland hills, ridges, and mountain side slopes. These soils are deep or moderately deep. They formed in residuum and colluvium derived dominantly from interbedded sandstone and shale. The surface layer is cobbly loam. The subsoil is very cobbly loam. Unweathered bedrock

generally is at a depth of 20 to 60 inches.

Of minor extent in this unit are soils in the Supervisor, Splitro, Sawcreek, Hoosan, and Leaps families. Some areas of the very steep Borolls-Boralfs-Rock outcrop complex are geographically associated with this map unit.

This unit is used for recreation, wildlife habitat, livestock grazing, or timber production. It is moderately well suited or poorly suited to recreational development. In the areas used for recreational development, the main limitations are large stones and the slope.

3. Lamphier-Hoosan Families

Deep, well drained, moderately fine textured and fine textured, gently sloping to moderately steep soils on hilltops and hillsides

This map unit is in the northwestern part of the survey area. Elevation is 8,400 to 9,500 feet. The average annual precipitation is about 22 to 24 inches, the average annual air temperature is 41 to 43 degrees F, and the average frost-free season is 50 to 70 days.

This unit makes up about 5 percent of the survey area. It is about 40 percent Lamphier family, 35 percent Hoosan family, and 25 percent components of minor extent.

The Lamphier family is on hilltops and hillsides. These soils formed in residuum derived dominantly from interbedded sandstone and shale. They support aspen. The surface layer is typically loam. The subsoil is clay loam. Unweathered bedrock is at a depth of 40 inches or more.

The Hoosan family is on hilltops and hillsides. These soils formed in loess over slope alluvium and residuum derived from interbedded sandstone and shale. They support open grassland. The upper part of the surface layer is loam, and the lower part is clay loam. The substratum is stony clay in the upper part and clay in the lower part.

Of minor extent in this unit are soils in the Cebone and Supervisor families. Areas of the very steep Borolls-Boralfs-Rock outcrop complex are geographically associated with this unit.

This unit is used for recreation, wildlife habitat, livestock grazing, or timber production. It is moderately well suited or poorly suited to recreational development. In the areas used for recreational development, the main limitations are slow permeability and the slope.

4. Kubler-Delson-Cerro Families

Deep, well drained, moderately fine textured and fine textured, nearly level to steep soils on plateau tops, alluvial fans, and mountain foot slopes and toe slopes

This map unit is interspersed throughout the survey area. The vegetation is mainly Gambel oak and perennial grasses. Elevation is 7,400 to 9,000 feet. The average annual precipitation is about 16 to 20 inches, the average annual air temperature is 43 to 47 degrees F, and the average frost-free season is 70 to 100 days.

This unit makes up about 22 percent of the survey area. It is about 35 percent Kubler family, 30 percent Delson family, 15 percent Cerro family, and 20 percent components of minor extent.

The Kubler family is on outwash fans and mountain foot slopes. These soils formed in alluvium and residuum derived dominantly from interbedded sandstone and shale. The surface layer is typically loam. The subsoil is clay loam or clay. Unweathered bedrock is at a depth of 40 inches or more.

The Delson family is on mountain foot slopes and toe slopes. These soils formed in residuum and colluvium derived dominantly from interbedded sandstone and shale. The surface layer is typically loam. The subsoil is silty clay loam or clay. Unweathered bedrock is at a depth of 40 inches or more.

The Cerro family is on plateau tops and alluvial fans. These soils formed in residuum and alluvium derived dominantly from interbedded sandstone and shale. The surface layer is typically loam. The subsoil is clay loam or clay. Unweathered bedrock is at a depth of 40 inches or more.

Of minor extent in this unit are soils in the Chilson family and areas of the very steep Borolls-Boralfs-Rock outcrop complex.

This unit is used for recreation, wildlife habitat, or livestock grazing. It is moderately well suited or poorly suited to recreational development. In the areas used for recreational development, the main limitations are the slope and the lack of access roads.

5. Delson, moderately deep-Chilson-Dough Families

Deep to shallow, well drained, moderately fine textured and moderately coarse textured, nearly level to steep soils on mesa tops and side slopes

This map unit is in the central and southern parts of the survey area. It is characterized by deeply dissected drainageways. The vegetation is mainly ponderosa pine and Gambel oak. Elevation is 7,200 to 8,900 feet. The average annual precipitation is about 15 to 18 inches, the average annual air temperature is 44 to 48 degrees F, and the average frost-free season is 70 to 100 days.

This unit makes up about 19 percent of the survey area. It is about 35 percent moderately deep Delson family, 20 percent Chilson family, 15 percent Dough family, and 30 percent components of minor extent.

The Delson family is on mesa tops and side slopes. These soils are moderately deep or deep. They formed

in loess and residuum and colluvium derived dominantly from interbedded sandstone and shale. The surface layer is typically loam. The subsoil is clay loam or very cobbly clay loam. Unweathered bedrock is at a depth of 20 to 60 inches.

The Chilson family is on mesa tops. These soils are shallow. They formed in residuum derived dominantly from interbedded sandstone and shale. The surface layer is typically loam. The subsoil is gravelly clay loam. Unweathered bedrock is at a depth of 10 to 20 inches.

The Dough family is on mesa tops. These soils are shallow. They formed in residuum derived dominantly from sandstone. They are sandy loam throughout. Unweathered bedrock is at a depth of 10 to 20 inches.

Of minor extent in this unit are soils in the Trampas, Sharrott, and Beenom families and areas of the Borolls-Boralfs-Rock outcrop complex on steep slopes.

This unit is used for recreation, wildlife habitat, livestock grazing, or timber and cordwood production. It is moderately well suited or poorly suited to recreational development. In the areas used for recreational development, the main limitation is the shallowness to bedrock. The slope is also a concern in some areas.

6. Jodero-Sawcreek-Dough Families

Deep to shallow, well drained, moderately fine textured and moderately coarse textured, nearly level to strongly sloping soils on valley bottoms, plateau tops, and benches

This map unit is in the northern part of the survey area. Elevation is 7,200 to 9,400 feet. The average annual precipitation is about 16 to 18 inches, the average annual air temperature is 44 to 47 degrees F, and the average frost-free season is 70 to 100 days.

This unit makes up about 8 percent of the survey area. It is about 30 percent Jodero family, 20 percent Sawcreek family, 15 percent Dough family, and 35 percent components of minor extent.

The Jodero family is on valley bottoms and alluvial fans. These soils are deep. They formed in alluvium derived dominantly from sandstone and shale. The soils support big sagebrush and grasses. The surface layer is typically loam. The substratum to a depth of 40 inches or more is clay loam.

The Sawcreek family is on plateau tops and benches. These soils are shallow. They formed in residuum derived dominantly from sandstone. The soils support scattered stands of ponderosa pine and big sagebrush. They are sandy loam throughout. Unweathered bedrock is at a depth of 10 to 20 inches.

The Dough family is on mesa tops. These soils are shallow. They formed in residuum derived dominantly from sandstone. They are sandy loam throughout. Unweathered bedrock is at a depth of 10 to 20 inches.

Of minor extent in this unit are soils in the Empedrado and Belain families and areas of the very steep Borolls-Boralfs-Rock outcrop complex.

This unit is used for recreation, wildlife habitat, livestock grazing, or timber production. It is moderately suited to recreational development. In the areas used for recreational development, the main limitation is the shallowness to bedrock.

7. Mirand Family-Arabrab Family-Chilson Variant

Deep to shallow, well drained, moderately fine textured, nearly level to steep soils on plateau tops, structural benches, mesa tops, and mesa side slopes

This map unit is in the western part of the survey area. The vegetation is mainly pinyon pine, Utah juniper, and big sagebrush. Elevation is 6,400 to 7,700 feet. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is 48 to 53 degrees F, and the average frost-free season is 110 to 150 days.

This unit makes up about 6 percent of the survey area. It is about 35 percent Mirand family, 25 percent Arabrab family, 15 percent Chilson Variant, and 25 percent components of minor extent.

The Mirand family is on plateau tops. These soils are moderately deep or deep. They formed in mixed loess and alluvium derived dominantly from interbedded sandstone and shale. The surface layer is typically loam. The subsoil is clay loam. Unweathered bedrock is at a depth of 20 to more than 60 inches.

The Arabrab family is on plateau side slopes, terraces, and benches. These soils are shallow. They formed in residuum and alluvium derived dominantly from interbedded sandstone and shale. The surface layer is typically sandy loam. The subsoil is cobbly sandy clay loam. Unweathered bedrock is at a depth of 10 to 20 inches.

The Chilson Variant is on mesa tops, benches, and side slopes. These soils are shallow. They formed in residuum derived dominantly from interbedded sandstone and shale. The surface layer is typically sandy loam. The subsoil is cobbly sandy clay loam. Unweathered bedrock is at a depth of 10 to 20 inches.

Of minor extent in this unit are soils in the Delson, Kubler, and Showalter families and some steep areas of the Borolls-Boralfs-Rock outcrop complex.

This unit is used for recreation, wildlife habitat, livestock grazing, or firewood production. It is poorly suited to wood production or recreational development. The main limitations are the shallowness to bedrock and a low available water capacity.

8. Arabrab-Durango Families

Shallow to deep, well drained, moderately fine textured, nearly level to strongly sloping soils on mesa tops and structural benches

This map unit is in the eastern part of the survey area. Elevation is 6,400 to 7,700 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 51 to 55 degrees F, and the average frost-free season is 120 to 150 days.

This unit makes up about 6 percent of the survey area. It is about 35 percent Arabrab family, 25 percent Durango family, and 40 percent components of minor extent.

The Arabrab family is on mesa tops and structural benches. These soils are shallow. They formed in residuum derived dominantly from sandstone. The soils support pinyon pine and Utah juniper. The surface layer is sandy loam. The subsoil is cobbly sandy clay loam. Unweathered bedrock is at a depth of 10 to 20 inches.

The Durango family is on mesa tops and structural benches. These soils are moderately deep or deep. They formed in residuum and colluvium derived dominantly from interbedded sandstone and shale. The soils support serviceberry and big sagebrush. The surface layer is sandy loam. The subsoil ranges from sandy clay loam to clay. Unweathered bedrock is at a depth of 20 to more than 40 inches.

Of minor extent in this unit are soils in the Callan, Dalhart, Delson, and Sharrott families and areas of the very steep Ustorthents-Ustochrepts-Rock outcrop complex.

This unit is used for recreation, wildlife habitat, livestock grazing, or cordwood production. It is moderately well suited or poorly suited to recreational development. In the areas used for recreational development, the main limitation is the shallowness to bedrock.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of 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. More information about each map unit is given under the heading "Use and Management of the Soils."

A map unit delineation on a 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 or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas 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 "included" areas that belong to other taxonomic classes.

Most included 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, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas 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 included areas 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 segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, 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 and gives the principal hazards and limitations to be considered in planning for specific uses.

In this survey most of the soils have been identified at the family level of classification (see the section "Classification of the Soils"). At this level, the soils are grouped based on certain physical and chemical properties and other features that affect use and management. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, and depth of the root zone.

Most of the map units are made up of two or more major soils or miscellaneous areas. These map units are called 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. Belain-Falcon families complex, 1 to 15 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The Rock outcrop component of Borolls-Boralfs-Rock outcrop complex, 40 to 150 percent slopes, is an example.

Table 4 gives the acreage and proportionate extent

of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

10—Arabrab-Dalhart families complex, 3 to 15 percent slopes. These gently sloping to strongly sloping soils formed in material weathered from sandstone. They are on upland plateaus in the central part of the survey area. The Arabrab family is on ridges and near the edges of mesas, and the Dalhart family is on smooth and concave slopes. Elevation ranges from 6,400 to 7,700 feet. The slope dominantly is 3 to 8 percent. The average annual precipitation is about 14 inches, and the average annual soil temperature is about 53 degrees F. The unit is about 50 percent Arabrab family sandy loam and 40 percent Dalhart family sandy loam. Individual areas range from 100 to more than 1,000 acres in size.

The Arabrab family is shallow and well drained. Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The subsoil is reddish brown sandy clay loam about 8 inches thick. The underlying material is calcareous, light reddish brown gravelly sandy clay loam about 5 inches thick. It is underlain by Dakota sandstone. The depth to sandstone ranges from 10 to 20 inches.

Permeability is moderate or moderately rapid in the Arabrab family. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Dalhart family is moderately deep or deep and is well drained. Typically, the surface layer is brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam about 9 inches thick. The underlying material is calcareous, pink sandy clay loam about 24 inches thick. The depth to bedrock ranges from 20 to more than 60 inches. The content of coarse fragments may be as much as 30 percent in any one horizon but is less than 15 percent by weighted average.

Permeability is moderately slow in the Dalhart family. Available water capacity is low to high. The effective rooting depth ranges from 20 to more than 60 inches. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are small areas of soils that are more strongly developed than the soils in the Arabrab and Dalhart families. Also included, on the bottom land along Escalante Creek, are highly stratified soils that formed in alluvial material over Precambrian granite. Included areas make up about 10 percent of the unit.

The vegetation on the Arabrab family is pinyon pine and Utah juniper. Bottlebrush squirreltail, Indian ricegrass, and big sagebrush make up most of the understory vegetation. The Dalhart family supports a community of grasses and shrubs, mainly galleta, blue grama, needleandthread, and big sagebrush. When the range deteriorates, pinyon pine and Utah juniper invade the site. Understory production on this site varies greatly because of the density of the canopy cover.

The wildlife species that inhabit areas of this unit are mule deer, snowshoe rabbits, cottontail rabbits, and whitetail jackrabbits. Also, elk inhabit these areas during the winter.

This unit is well suited to the production of pinyon pine-Utah juniper cordwood. The potential production is 5 to 12 cords per acre. The shallowness to bedrock and the low or very low available water capacity limit revegetation on this unit.

The capability subclass is VIs.

11—Belain-Falcon families complex, 1 to 15 percent slopes. These gently sloping to gently rolling, shallow to deep, well drained soils formed in residuum derived dominantly from sandstone. They are in the northern part of the survey area. Elevation is 8,000 to 8,800 feet. The average annual precipitation is about 16 to 18 inches. The average annual soil temperature is about 46 degrees F. The unit is about 50 percent Belain family loam and 35 percent Falcon family stony sandy loam.

The Belain family typically has a surface layer of brown loam about 5 inches thick. The subsoil is brown sandy loam about 6 inches thick. The substratum is brown to reddish yellow sandy loam. It is underlain by Dakota sandstone. The depth to bedrock ranges from 20 to more than 60 inches.

Permeability is moderately rapid in the Belain family. Available water capacity is low or moderate. The effective rooting depth is dominantly 20 to 40 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The surface of the Falcon family is covered with a layer of partially decomposed needles, leaves, twigs, and roots about 2 inches thick. The surface layer is brown stony sandy loam about 3 inches thick. The subsoil is brown sandy loam about 7 inches thick. It is underlain by Wingate sandstone. The depth to bedrock is less than 20 inches.

Permeability is moderately rapid in the Falcon family. Available water capacity is very low. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are small areas of rock outcrop, soils containing larger amounts of coarse fragments

than the soils in the Belain and Falcon families, and some areas of the Empedrado family. Included areas make up about 15 percent of the unit.

This map unit has an overstory of ponderosa pine and an understory of manzanita, mountain muhly, elk sedge, herbaceous sagebrush, and Gambel oak. The potential vegetation is ponderosa pine and Arizona fescue. The understory vegetation on the Falcon family is Arizona fescue, Indian ricegrass, junegrass, mountain muhly, blue grama, muttongrass, bitterbrush, true mountainmahogany, manzanita, hairy goldaster, and Letterman needlegrass. The understory vegetation on the Belain family is Arizona fescue, Columbia needlegrass, Parry oatgrass, western wheatgrass, muttongrass, elk sedge, Gambel oak, lupine, and snowberry.

The main concerns in producing and harvesting timber are the depth to bedrock and the very low available water capacity of the Falcon family. Reforestation by mechanical methods may be difficult because of the limited depth to bedrock. Because of soil-related factors, the production of ponderosa pine is not optimal on this unit.

The capability subclass is VIs.

12—Borolls-Boralfs-Rock outcrop complex, 40 to 150 percent slopes. This steep to extremely steep map unit is on plateau escarpments and canyon side slopes at elevations of 6,700 to 9,400 feet (fig. 3). The Rock outcrop is typically on the steeper slopes throughout the survey area. The Borolls generally support shrubs and grasses, and the Boralfs support woodland plants. The average annual precipitation is about 20 inches, and the average annual soil temperature is about 44 degrees F. Individual areas are generally several hundred acres in size. The unit is about 45 percent Borolls, 25 percent Boralfs, and 20 percent Rock outcrop.

Borolls are shallow to deep and are well drained. A reference pedon has a surface layer of dark reddish brown sandy loam about 11 inches thick and a subsoil of reddish brown and yellowish red very cobbly loam about 29 inches thick. The depth to bedrock ranges from 8 to more than 60 inches. The subsoil ranges from sandy loam to clay and has 15 to 80 percent rock fragments. In places the soils have no subsoil.

Boralfs are shallow to deep and are well drained. A reference pedon has a surface layer of dark reddish brown loam about 9 inches thick and a subsoil of dark yellowish red and reddish brown clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is yellowish red loam. The depth to bedrock ranges from 8 to more than 60 inches. The subsoil ranges from loam to clay and has 5 to 70 percent rock fragments.

Permeability ranges from moderately rapid to slow in both soils. Available water capacity is very low to high. The effective rooting depth is 8 to more than 60 inches. Surface runoff is rapid or very rapid, and the hazard of water erosion is severe.

The Rock outcrop occurs as exposures of Dakota sandstone.

Included in this unit are areas of Ochrepts and Orthents. Also included are areas of Ustolls and Ustalfs at the lower elevations. Included areas make up about 10 percent of the unit.

The vegetation on this unit is generally a coniferous forest dominated by ponderosa pine at the lower elevations and Engelmann spruce and subalpine fir at the higher elevations. The potential vegetation varies greatly on this broadly defined unit.

The slope, the Rock outcrop, and the depth to bedrock greatly limit management alternatives. Onsite investigation is needed prior to implementation of any planned land use.

The capability subclass is VIIIe.

13—Chilson-Delson, moderately deep-Beenom families complex, 1 to 20 percent slopes. These gently sloping soils formed in mixed loess and material weathered from sandstone. They are on plateau tops in the southern two-thirds of the survey area. The Chilson and Beenom families are on convex slopes and near the edges of mesas, and the Delson family is in nearly level and concave areas. Elevation ranges from 7,300 to 8,300 feet. The slope dominantly is 1 to 6 percent. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F. The unit is about 35 percent Chilson family fine sandy loam, 30 percent moderately deep Delson family loam, and 25 percent Beenom family sandy loam. Individual areas range from several hundred to more than 1,000 acres in size.

The Chilson family is shallow and well drained. Typically, the surface is covered with a layer of decomposed and undecomposed needles and grass about 1 inch thick. The upper part of the surface layer is very dark grayish brown fine sandy loam about 4 inches thick, and the lower part is dark brown gravelly clay loam about 4 inches thick. The subsoil is brown gravelly clay loam about 7 inches thick. It is underlain by Dakota sandstone. The depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Chilson family. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Delson family is moderately deep and well drained. Typically, the surface layer is dark brown loam

Figure 3.—A typical area of Borolls-Boralfs-Rock outcrop complex, 40 to 150 percent slopes. This unit provides habitat for various raptors.

about 7 inches thick. The upper 4 inches of the subsoil is dark brown clay loam, and the lower 13 inches is brown clay. The underlying material is pinkish gray cobbly clay loam about 6 inches thick. It is underlain by fractured Dakota sandstone. The depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Delson family. Available water capacity is typically low but ranges from low to high. The effective rooting depth is dominantly 20 to 40 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Beenom family is shallow and well drained. Typically, the surface layer is dark brown sandy loam about 2 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil is brown sandy clay loam about 8 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderately slow in the Beenom family. Available water capacity is very low or low. The effective rooting depth is 10 to 20 inches. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are small areas of the Falcon family, the Showalter family, and soils that are lighter colored in the surface layer than the soils in the

Chilson, Delson, and Beenom families. Included areas make up about 10 percent of the unit.

This unit has an overstory of ponderosa pine and an understory of Gambel oak, elk sedge, mountain muhly, and herbaceous sagebrush (fig. 4). As the range condition deteriorates, less desirable plants, such as cheatgrass, broom snakeweed, and rabbitbrush, invade the site. Forage production depends on the density of the trees. The understory on the Beenom and Chilson families includes junegrass, mountain muhly, blue grama, muttongrass, and Letterman needlegrass. The understory on the Delson family includes Arizona fescue, Parry oatgrass, western wheatgrass, muttongrass, elk sedge, Gambel oak, lupine, and snowberry.

This unit is well suited to the production of ponderosa pine. The main concerns in producing and harvesting timber are the depth to bedrock and competition by understory plants. Reforestation by mechanical methods may be difficult on the Chilson and Beenom families because of the shallowness to bedrock. Competition by Gambel oak limits the natural regeneration of ponderosa pine. Natural revegetation results in a sparse stand of trees. In areas where tree cutting is moderate

Figure 4.—An open area of grasses and sagebrush in a ponderosa pine woodland on Chilson-Delson, moderately deep-Beenom families complex, 1 to 20 percent slopes.

or heavy, reforestation may be essential.

Elk, mule deer, turkeys, and cottontail rabbits commonly inhabit areas of this unit.

The capability subclass is VIs.

14—Chilson Variant-Rock outcrop complex, 3 to 20 percent slopes. This map unit consists of areas of Rock outcrop and a shallow, well drained soil that formed in material weathered from sandstone. It is along the eastern rim of Roubideau Canyon at an elevation of 7,400 to 7,800 feet. The average annual precipitation is about 16 inches, and the average annual soil temperature is about 46 degrees F. The unit is about 60 percent Chilson Variant sandy loam and 25 percent Rock outcrop.

The Chilson Variant is shallow and well drained. Typically, the surface layer is brown sandy loam about 5 inches thick. The upper part of the subsoil is reddish brown sandy clay loam about 3 inches thick. The next part is light reddish brown cobbly sandy clay loam about 4 inches thick. The lower part is light reddish brown cobbly clay about 5 inches thick. It is underlain by Dakota sandstone. The depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Chilson Variant. Available water capacity typically is low, but it is very low in some areas. The effective rooting depth is less than 20 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Rock outcrop occurs as exposures of sandstone on the tops of mesas.

Included in this unit are a few small areas of soils that are lighter colored, are less well developed, and are coarser textured than the Chilson Variant. Included areas make up about 15 percent of the unit.

This unit supports a community of pinyon pine, Utah juniper, and scattered Gambel oak. The understory consists of western wheatgrass, muttongrass, junegrass, Sandberg bluegrass, bottlebrush squirreltail, serviceberry, true mountainmahogany, and big sagebrush. As the tree canopy closes in, the understory deteriorates and cheatgrass and prickly pear cactus become dominant. Understory production on this site varies greatly, depending on the density of the canopy cover.

This unit is well suited to the production of pinyon-juniper cordwood. It produces about 5 to 12 cords per acre.

Many species of wildlife inhabit areas of this unit, including mule deer, elk, snowshoe rabbits, whitetail jackrabbits, chipmunks, and a variety of birds.

The depth to bedrock and the Rock outcrop limit management alternatives. Onsite investigation is needed prior to implementation of range improvement projects.

The capability subclass is VIs.

15—Delson-Kubler-Showalter families complex, 15 to 45 percent slopes. These hilly to steep soils formed in alluvium and residuum derived mainly from shale. They are on alluvial fans and mountain side slopes throughout the survey area. Elevation ranges from 7,700 to 8,800 feet. The slope dominantly is 15 to 30 percent. The average annual precipitation is about 18 inches, and the average annual soil temperature is about 45 degrees F. The unit is about 30 percent Delson family gravelly loam, 25 percent Kubler family loam, and 25 percent Showalter family gravelly loam. Individual areas range from 300 to more than 800 acres in size.

The Delson family is deep and well drained. Typically, the upper part of the surface layer is dark brown gravelly loam about 6 inches thick. The lower part is brown loam about 5 inches thick. The upper 8 inches of the subsoil is brown clay loam. The lower 26 inches is light brown clay grading to clay loam. The substratum is pinkish gray very gravelly clay loam. The depth to bedrock is generally 40 inches or more.

Permeability is slow in the Delson family. Available water capacity is high. The effective rooting depth is 40 inches or more. Surface runoff is medium, and the hazard of water erosion is moderate or slight.

The Kubler family is deep and well drained. Typically, the upper part of the surface layer is dark brown loam about 7 inches thick. The lower part is dark brown clay loam about 4 inches thick. The upper 11 inches of the subsoil is brown silty clay loam. The lower part is reddish brown clay about 38 inches thick. The depth to bedrock is generally more than 40 inches.

Permeability is slow in the Kubler family. Available water capacity is high. The effective rooting depth is 40 inches or more. Surface runoff is medium, and the hazard of water erosion is moderate or slight.

The Showalter family is deep and well drained. Typically, the upper part of the surface layer is dark brown gravelly loam about 11 inches thick. The lower part is brown gravelly clay loam about 5 inches thick. The upper 16 inches of the subsoil is light brown very cobbly clay and very cobbly clay loam. The lower part to a depth of 60 inches or more is light brown extremely cobbly clay loam.

Permeability is slow in the Showalter family. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of water erosion is moderate or slight.

Included in this unit are small areas of soils in the Cerro and Chilson families and light-colored soils that contain more clay than the major soils. Included areas make up about 20 percent of the unit.

The vegetation on this unit is dominated by Gambel oak and perennial grasses. Serviceberry and Gambel oak are the major brush species. Letterman needlegrass, Columbia needlegrass, bottlebrush squirreltail, and junegrass are the major grasses. If the range condition deteriorates, Canada thistle and cheatgrass become more dominant. The potential vegetation on this unit is an overstory of Gambel oak and an understory dominated by nodding brome, western wheatgrass, and elk sedge.

The slow permeability, a high shrink-swell potential, and rock fragments limit management alternatives on this unit. The unit is well suited to the production of oak cordwood. Erosion is a potential problem on the steeper slopes.

The major species of wildlife in areas of this unit are elk, mule deer, snowshoe rabbits, cottontail rabbits, and blue grouse.

The capability subclass is VIIe.

16—Delson, moderately deep-Sharrott families complex, 1 to 15 percent slopes. These nearly level to strongly sloping soils formed in material weathered from sandstone. They are on plateaus throughout the survey area. The moderately deep Delson family is generally on slight rises and in convex areas, and the Sharrott family is on broad flats and slope breaks. Elevation ranges from 8,200 to 8,500 feet. The slope dominantly is 3 to 6 percent. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F. The unit is about 55 percent Delson family loam and 30 percent Sharrott family cobbly loam. Individual areas range from 100 to several hundred acres in size.

The Delson family is moderately deep and well drained. Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is brown clay loam and clay about 17 inches thick. The underlying material is pinkish gray cobbly clay loam about 6 inches thick. It is underlain by Dakota sandstone. The depth to bedrock dominantly ranges from 20 to 40 inches but may range to 60 inches in some places.

Permeability is slow in the Delson family. Available water capacity is low or moderate. The effective rooting depth is 20 to more than 40 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Sharrott family is shallow and well drained. Typically, the surface layer is brown cobbly loam about 4 inches thick. The upper part of the subsoil is brown gravelly loam about 8 inches thick. The lower part is yellowish brown extremely gravelly sandy loam about 3 inches thick. It is underlain by Dakota sandstone. The depth to bedrock ranges from 10 to 20 inches.

Permeability is moderately rapid in the Sharrott family. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are small areas of rock outcrop, areas of shallow soils that are darker than the major soils, a few areas of soils that are coarser textured than the major soils, and some soils that are deeper, lighter colored, and less well developed than the major soils. Included areas make up about 15 percent of the unit.

The vegetation on this unit is dominated by ponderosa pine and aspen. The understory vegetation includes grasses, elk sedge, mountain muhly, and bottlebrush squirreltail (fig. 5). Forbs and shrubs include hairy goldaster, Gambel oak, and herbaceous sagebrush. If the range condition deteriorates, Canada thistle, rabbitbrush, and broom snakeweed become dominant. The understory vegetation on the Delson family is Arizona fescue, Parry oatgrass, western wheatgrass, muttongrass, elk sedge, Gambel oak, lupine, and snowberry. The understory vegetation on the Sharrott family is dominated by Indian ricegrass, junegrass, mountain muhly, blue grama, muttongrass, bitterbrush, true mountainmahogany, manzanita, hairy goldaster, and Letterman needlegrass.

This unit is well suited to the production of ponderosa pine (fig. 6). The main concerns in producing and harvesting timber are the shallowness to bedrock and competition by understory plants. Competition by Gambel oak limits the natural revegetation of ponderosa pine. Reforestation by mechanical methods may be difficult on the Sharrott family because of the shallowness to bedrock.

Elk, mule deer, turkeys, and cottontail rabbits commonly inhabit areas of this unit.

The capability subclass is VIs.

17—Dough family, dry-Rock outcrop complex, 1 to 15 percent slopes. This map unit consists of areas of Rock outcrop and a shallow, well drained soil that formed in material weathered from sandstone. It is on benches and mesa tops in the northern part of the survey area. Elevation ranges from 7,400 to 8,100 feet. The average annual precipitation is about 14 inches, and the average annual soil temperature is about 46 degrees F. The unit is about 55 percent Dough family sandy loam and 20 percent Rock outcrop.

The Dough family, dry, is shallow and well drained. Typically, the surface layer is reddish brown sandy loam about 3 inches thick. The subsoil is light reddish brown sandy loam about 13 inches thick. It is underlain by

Figure 5.—Cattle grazing the forage in an area of Delson, moderately deep-Sharrott families complex, 1 to 15 percent slopes.

Wingate sandstone. The depth to bedrock ranges from 8 to 20 inches.

Permeability is moderately rapid in the Dough family. Available water capacity is very low. The effective rooting depth is 8 to 20 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Rock outcrop consists of exposures of Wingate sandstone.

Included in this unit are small areas of soils in the Belain family and some soils, in open park areas, that are deeper and lighter colored than the Dough family and that support grasses and shrubs. Also included are small areas of soils in the Sharrott family. Included areas make up about 25 percent of the unit.

The vegetation on this unit consists of pinyon pine, Rocky Mountain juniper, big sagebrush, junegrass, and muttongrass. Annual production depends on the density of the overstory canopy.

This unit is suited to the production of pinyon pine and juniper firewood. Average yields, dominantly of pinyon pine, are 5 to 10 cords per acre. Management concerns include the lack of access roads, the shallowness to bedrock, the very low available water capacity, and the large areas of Rock outcrop. Revegetation is very difficult in areas of this unit.

The capability subclass is VIIs.

18—Durango-Arabrab families complex, 3 to 15 percent slopes. These gently sloping to gently rolling soils formed in locally transported alluvium and material weathered from sandstone. They are on benches, mainly in the central part of the survey area. The Durango family is in gently sloping areas, and the Arabrab family is on small knobs and near the edges of benches. Elevation ranges from 6,400 to 7,600 feet.

Figure 6.—Ponderosa pine reforestation in an area of Delson, moderately deep-Sharrott families complex, 1 to 15 percent slopes.

The slope dominantly is 3 to 8 percent, but some areas on small knobs are steeper. The average annual precipitation is about 15 inches, and the average annual soil temperature is about 52 degrees F. The unit is about 60 percent Durango family sandy loam, 3 to 10 percent slopes, and 30 percent Arabrab family sandy loam, 5 to 15 percent slopes. Individual areas range from 100 to more than 1,000 acres in size.

The Durango family is moderately deep or deep and is well drained. Typically, the surface layer is light brown sandy loam about 4 inches thick. The next layer is reddish brown sandy clay loam about 6 inches thick. The upper 15 inches of the subsoil is reddish brown clay loam. The lower 17 inches is reddish brown clay. The underlying material is calcareous, light reddish brown clay about 18 inches thick. The depth to bedrock is 20 to more than 60 inches.

Permeability is slow in the Durango family. Available water capacity is high to low. The effective rooting depth is 20 to more than 60 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Arabrab family is shallow and well drained. Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The subsoil is reddish brown sandy clay loam about 8 inches thick. The underlying material is calcareous, light reddish brown gravelly sandy clay loam about 5 inches thick. The depth to Dakota sandstone ranges from 10 to 20 inches.

Permeability is moderate in the Arabrab family. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Surface runoff is slow, and the hazard of water erosion is slight or moderate.

Included in this unit are small areas of soils that are less well developed than the major soils. Included areas make up about 10 percent of the unit.

The vegetation on the Durango family consists of serviceberry, big sagebrush, Gambel oak, western wheatgrass, and junegrass and scattered pinyon pine and Utah juniper (fig. 7). The vegetation on the Arabrab family consists of pinyon pine, Utah juniper, and Rocky Mountain juniper. The Rocky Mountain juniper is restricted to the western part of the survey area. The understory species include bottlebrush squirreltail and prickly pear cactus.

The potential vegetation on the Durango family is a grass-shrub community. Muttongrass, western wheatgrass, and big sagebrush make up a large percentage of the potential. If the range condition deteriorates, pinyon pine and Utah juniper invade the site. Understory production on the Arabrab family varies, depending on the density of the overstory canopy. Understory plants include blue grama, galleta, Indian ricegrass, bottlebrush squirreltail, junegrass, stemless goldenweed, and Wyoming big sagebrush.

The wildlife species that inhabit areas of this unit are mule deer, whitetail jackrabbits, and cottontail rabbits. Also, elk graze in these areas during the winter.

Soil-moisture relationships are variable on this unit but are fairly good overall. Erosion is a hazard on the steeper slopes. Because of the variability of the soils, onsite investigation is needed prior to implementation of any planned land use.

The capability subclass is VIIs.

19—Falcon-Dough families-Rock outcrop complex, 1 to 10 percent slopes. This map unit consists of areas of Rock outcrop and shallow, well drained soils that formed in material weathered from sandstone (fig. 8). It is on nearly level to gently sloping plateau tops and benches in the northern part of the survey area. Elevation is 8,000 to 8,400 feet. The average annual precipitation is 16 to 18 inches, and the average annual soil temperature is about 46 degrees F. The unit is about 35 percent Falcon family stony sandy loam, 30 percent Dough family sandy loam, and 25 percent Rock outcrop.

The Falcon family is shallow and well drained. Typically, the surface is covered with a layer of partially decomposed needles, leaves, twigs, and roots about 2 inches thick. The surface layer is brown stony sandy loam about 3 inches thick. The subsoil is brown sandy loam about 7 inches thick. It is underlain by Wingate sandstone at a depth of 7 to 20 inches.

Permeability is moderately rapid in the Falcon family. Available water capacity is very low. Surface runoff is slow, and the hazard of water erosion is slight.

The Dough family is shallow and well drained. Typically, the surface layer is reddish brown sandy loam about 3 inches thick. The subsoil is light reddish brown sandy loam about 13 inches thick. It is underlain by Wingate sandstone at a depth of 6 to 20 inches.

Permeability is moderately rapid in the Dough family. Available water capacity is very low. Surface runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

The Rock outcrop consists of exposures of Wingate sandstone.

Included in this unit are small areas of soils in the Belain family and areas of soils that are deeper and lighter colored than the major soils. Included areas make up about 10 percent of the unit.

This unit has an overstory of scattered ponderosa pine and an understory of mountain big sagebrush, Gambel oak, sedum, muttongrass, and junegrass. The potential vegetation is ponderosa pine and an understory of Indian ricegrass, junegrass, mountain

Figure 7.—Typical pinyon-juniper-sagebrush vegetation in an area of Durango-Arabrab families complex, 3 to 15 percent slopes.

muhly, blue grama, muttongrass, bitterbrush, true mountainmahogany, manzanita, hairy goldaster, and Letterman needlegrass.

This unit is not suitable for intensive management for timber production because of the very low available water capacity and the shallowness to bedrock. Reforestation is difficult.

The capability subclass is VIIs.

20—Gralic-Grenadier families complex, 15 to 50 percent slopes. These deep and moderately deep, well drained soils formed in alluvium and colluvium derived from interbedded sandstone and shale. They are on hilly to steep mountain side slopes throughout the survey area. Elevation ranges from 8,400 to 9,900 feet. The slope dominantly is 15 to 35 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F. The unit is about 60 percent Gralic family fine sandy loam and 30 percent Grenadier family cobbly or stony fine sandy loam. Individual areas range from about 50 to several hundred acres in size.

The surface of the Gralic family is covered with a layer of partially decomposed needles, leaves, twigs, and roots about 2 inches thick. The surface layer is pinkish gray fine sandy loam about 5 inches thick. The upper 14 inches of the substratum is gravelly pink fine sandy loam. The lower part is pink extremely cobbly fine sandy loam. The depth to bedrock ranges from 40 to more than 60 inches.

Permeability is moderately rapid in the Gralic family. Available water capacity is very low to moderate. The effective rooting depth is 20 to more than 60 inches. Surface runoff is medium, and the hazard of water erosion is moderate.

Typically, the surface of the Grenadier family is

Figure 8.—A typical area of Falcon-Dough families-Rock outcrop complex, 1 to 10 percent slopes. The lighter, nonvegetated areas are exposures of Wingate sandstone.

covered with a layer of undecomposed needles, twigs, cones, and bark about 1 inch thick and a mat of decomposed forest litter about 3 inches thick. The surface layer is brown cobbly fine sandy loam about 4 inches thick. The subsurface layer is light brown stony sandy loam about 28 inches thick. The subsoil is reddish yellow very cobbly sandy loam about 18 inches thick. It is underlain by highly weathered Dakota sandstone. The depth to bedrock ranges from 20 to more than 60 inches.

Permeability is moderately rapid in the Grenadier family. Available water capacity is very low to moderate. The effective rooting depth is 20 to more than 60 inches. Surface runoff is medium, and the hazard of water erosion is moderate.

Included in this unit are small areas of soils in the Lamphier and Supervisor families, some soils that are more well developed than the major soils, some light-colored soils, and areas of rock outcrop. Included areas make up about 10 percent of the unit.

This unit supports a plant community of Engelmann spruce and subalpine fir. Aspen and Douglas-fir also are important species in some places. The major understory plants are elk sedge, nodding bromegrass, Thurber fescue, aspen peavine, and snowberry. As the overstory canopy closes in, understory production drops and species composition deteriorates. Understory production on this site varies, depending on the density of the trees. The potential understory vegetation includes elk sedge, slender wheatgrass, nodding

bromegrass, meadowrue, common juniper, snowberry, dwarf blueberry, and kinnikinnick.

The slope and the content of rock fragments limit management alternatives on this unit. Conventional methods of harvesting trees can be used in the more gently sloping areas but are difficult to use in the steeper areas. Proper design of road drainage systems and careful placement of culverts help to control erosion. The slope restricts the use of this unit for recreational purposes to a few paths and trails. The paths and trails should extend across the slope.

Elk, mule deer, blue grouse, snowshoe rabbits, and various squirrels inhabit areas of this unit.

The capability subclass is VIIs.

21—Hapgood-Lamphier families complex, 20 to 50 percent slopes. These deep or moderately deep, well drained soils formed in residuum and colluvium derived from interbedded sandstone and shale. They are on mountain side slopes and steep ridges, dominantly along the fault scarp and accompanying benches of the Uncompahgre Plateau throughout the survey area. The Hapgood family typically is on convex slopes, and the Lamphier family is on concave slopes. Elevation ranges from 8,400 to 10,000 feet. The lower elevations are generally on northern aspects. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 40 degrees F. The unit is about 45 percent Hapgood family cobbly loam, 25 to 50 percent slopes, and 40 percent Lamphier family loam, 20 to 35 percent slopes. Individual areas of these soils range from 40 to more than 1,000 acres in size. They have a hummocky appearance in some areas because of past slumping.

The Hapgood family is on mountain side slopes. The upper part of the surface layer is dark brown cobbly loam about 8 inches thick. The lower part is brown very cobbly loam about 9 inches thick. The next layer is yellowish brown extremely cobbly loam about 10 inches thick. The substratum is very pale brown extremely stony loam. The depth to bedrock ranges from 40 to more than 60 inches, but it is dominantly more than 60 inches.

Permeability is moderate in the Hapgood family. Available water capacity is low. The effective rooting depth is generally 60 inches or more. Surface runoff is medium, and the hazard of water erosion is slight or moderate.

The Lamphier family is on mountain ridges and the upper side slopes. The upper part of the surface layer is dark grayish brown loam about 20 inches thick. The lower part is grayish brown loam about 15 inches thick. The upper 10 inches of the substratum is variegated grayish brown and yellowish brown gravelly clay loam. The lower part is variegated brownish yellow and light gray gravelly sandy clay loam. The depth to bedrock ranges from 40 to more than 60 inches, but it is dominantly more than 60 inches.

Permeability is moderately slow in the Lamphier family. Available water capacity is generally high, but it is moderate in some areas. Surface runoff is medium, and the hazard of water erosion is moderate.

Included in this unit are small areas of soils that are lighter colored and contain more clay than the major soils. Included areas make up about 15 percent of the unit.

This unit is dominated by aspen. It is highly productive. The understory consists of Thurber fescue, elk sedge, needlegrasses, aspen peavine, and snowberry. Production varies from year to year, but in favorable years this unit can produce 3,000 pounds of air-dry forage per acre. The long-term potential vegetation is subalpine fir-Engelmann spruce. The potential understory vegetation includes bearded wheatgrass, Thurber fescue, slender wheatgrass, blue wildrye, elk sedge, Columbia needlegrass, aspen peavine, lupine, meadowrue, and snowberry.

A variety of wildlife species inhabit areas of this unit, including mule deer, elk, snowshoe rabbits, marmots, squirrels, and blue grouse.

The slope and the content of rock fragments are limitations affecting roads. The slope also limits access by livestock in some areas. This unit is well suited to the production of aspen, but the slope and the content of rock fragments hinder revegetation.

The capability subclass is VIIe.

22—Hoosan-Lamphier-Leaps families complex, 3 to 30 percent slopes. These deep and moderately deep, gently sloping to moderately steep, well drained soils formed in material weathered from interbedded sandstone and shale covered by various thicknesses of loess. They are on hilltops and hillsides. Elevation ranges from 8,800 to 9,500 feet. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F. The unit is about 40 percent Hoosan family loam, 30 percent Lamphier family loam, and 20 percent Leaps family clay loam.

The upper part of the surface layer of the Hoosan family is dark gray loam about 10 inches thick. The lower part is dark gray clay loam about 12 inches thick. The upper 16 inches of the substratum is very pale brown stony clay. The lower part to a depth of 60 inches or more is pale red clay. In places the surface layer is clay loam.

Permeability is slow in the Hoosan family. Available water capacity is moderate or high. Surface runoff is medium, and the hazard of water erosion is slight or moderate.

The upper part of the surface layer of the Lamphier family is dark grayish brown loam about 20 inches thick. The lower part is grayish brown loam about 15 inches thick. The upper 10 inches of the substratum is variegated light gray and light yellowish brown gravelly clay loam. The lower part to a depth of 60 inches or more is variegated brownish yellow and light gray gravelly sandy clay loam.

Permeability is moderately slow in the Lamphier family. Available water capacity typically is high, but it is moderate in some areas. Surface runoff is medium, and the hazard of water erosion is slight or moderate.

The surface layer of the Leaps family is grayish brown clay loam about 14 inches thick. The upper 9 inches of the substratum is very pale brown clay. The lower part to a depth of 60 inches or more is light gray clay.

Permeability is slow in the Leaps family. Available water capacity typically is high, but it is moderate in some areas. Surface runoff is medium, and the hazard of water erosion is slight or moderate.

Included in this unit are small areas of soils that are lighter colored than the major soils, are weakly developed, and have a stony surface. Also included, in rotational landslide areas, are some soils that have a higher content of clay than the major soils and scattered areas that have rounded, basaltic stones on the surface. Included areas make up about 10 percent of the unit.

The Hoosan and Leaps families support grasses. Thurber fescue, Columbia needlegrass, and Letterman needlegrass are the most important species. The important shrubs and forbs in this unit are big sagebrush, snowberry, western yarrow, lupine, and herbaceous cinquefoil. The vegetation on the Lamphier family is dominated by snowberry, big sagebrush, Columbia needlegrass, Thurber fescue, and scattered aspen. Columbia needlegrass and Thurber fescue are dominant in the potential plant community on the Hoosan and Leaps families. The potential vegetation on the Lamphier family includes aspen.

The shrink-swell potential and the potential for mass movement limit management alternatives for such uses as roads and campgrounds. A number of rotational landslides less than 10 acres in size are in areas of this unit.

This unit is grazed extensively by livestock and by elk and mule deer in the summer. Marmots and snowshoe rabbits also inhabit areas of this unit.

The capability subclass is VIe.

23—Jodero-Empedrado families complex, 2 to 20 percent slopes. These soils formed in alluvium derived from sandstone and shale. They are on valley bottoms at high elevations and on alluvial fan toe slopes and fan terraces at elevations between 7,800 and 8,400 feet. The Jodero family is on the valley bottoms and toe slopes, and the Empedrado family is on the fan terraces. The average annual precipitation is 16 to 18 inches, and the average annual soil temperature is about 46 degrees F. The unit is about 50 percent Jodero family loam and 30 percent Empedrado family loam.

The Jodero family is dominantly deep and well drained. Typically, the surface layer is dark brown loam about 27 inches thick. The substratum to a depth of 60 inches or more is reddish brown loam and clay loam.

Permeability is moderately slow in the Jodero family. Available water capacity is high. Surface runoff is very slow or slow, and the hazard of water erosion is slight.

The Empedrado family is moderately deep or deep and is well drained. Typically, the surface layer is brown loam and silt loam about 10 inches thick. The subsoil to a depth of 60 inches or more is yellowish red clay loam and sandy clay loam.

Permeability is moderately slow in the Empedrado family. Available water capacity is high. Surface runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Included in this unit are soils in the Falcon family. Included areas make up about 20 percent of the unit.

The vegetation on this unit is needleandthread, muttongrass, Sandberg bluegrass, and mountain big sagebrush. The potential vegetation is Arizona fescue-western wheatgrass.

This unit is well suited to summer grazing of cattle. Soil-moisture relationships are very good. Few limitations affect the use of these soils. The range should be managed for diversity of vegetation.

The capability subclass is VIc.

24—Kubler-Delson-Cerro families complex, 3 to 15 percent slopes. These gently sloping to gently rolling soils formed in alluvium and residuum derived mainly from interbedded sandstone and shale. They are on outwash fans and mountain foot slopes throughout the survey area. The Kubler family generally is on concave slopes, the Delson family is on convex slopes, and the Cerro family is in the more level areas. Elevation ranges from 7,700 to 8,600 feet. The average annual precipitation is about 18 inches, and the average annual soil temperature is about 45 degrees F. The unit is about 35 percent Kubler family loam, 30 percent Delson family gravelly loam, and 20 percent Cerro family loam.

Individual areas range from 300 to more than 800 acres in size.

The Kubler family is deep and well drained. Typically, the upper part of the surface layer is dark brown loam about 7 inches thick. The lower part is dark brown clay loam about 4 inches thick. The upper 11 inches of the subsoil is brown silty clay loam. The lower part is reddish brown clay. The depth to bedrock is generally more than 40 inches.

Permeability is slow in the Kubler family. Available water capacity is high. The effective rooting depth is 40 inches or more. Surface runoff is slow, and the hazard of water erosion is slight.

The Delson family is deep and well drained. Typically, the upper part of the surface layer is dark brown gravelly loam about 6 inches thick. The lower part is brown loam about 5 inches thick. The upper 8 inches of the subsoil is brown clay loam. The lower 26 inches is light brown clay grading to clay loam. The substratum is pinkish gray very gravelly clay loam. The depth to bedrock is generally 40 inches or more.

Permeability is slow in the Delson family. Available water capacity is high. The effective rooting depth is 40 inches or more. Surface runoff is slow, and the hazard of water erosion is slight.

The Cerro family is deep and well drained. Typically, the surface layer is dark grayish brown loam about 4 inches thick. The upper part of the subsoil is dark grayish brown clay loam about 10 inches thick. The lower part is light yellowish brown clay about 34 inches thick. The substratum to a depth of 60 inches or more is very pale brown, calcareous clay. Deep, wide cracks are common when the soil is dry.

Permeability is very slow in the Cerro family. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are small areas of soils that are similar to the soils in the Showalter and Trampas families, generally on the steeper slopes, and areas of shallow soils that have more clay than the major soils. Also included, in the northern part of the survey area, are soils in the Empedrado family. Included areas make up about 15 percent of the unit.

The vegetation on this unit generally is dominated by Gambel oak and perennial grasses. The vegetation on the Kubler and Delson families is dominated by shrubs. Serviceberry and Gambel oak are the major brush species. Letterman needlegrass, Columbia needlegrass, bottlebrush squirreltail, and junegrass are the major grass species. If the range condition deteriorates, Canada thistle and cheatgrass become dominant. The vegetation on the Cerro family is dominated by grasses. Needlegrasses, bottlebrush squirreltail, junegrass, western wheatgrass, and Kentucky bluegrass are the major species. Forbs, such as daisy fleabane, western yarrow, mulesear, and aspen peavine, also are important. The vegetation also includes big sagebrush, snowberry, and Gambel oak. The potential vegetation on the Kubler and Delson families is Gambel oak and elk sedge. The potential vegetation on the Cerro family is western wheatgrass and Letterman needlegrass.

A high shrink-well potential and the restricted permeability limit management alternatives on this unit. Reforestation is particularly difficult. The unit is well suited to the production of oak cordwood.

The wildlife species that inhabit areas of this unit include mule deer, elk, blue grouse, cottontail rabbits, and snowshoe rabbits.

The capability subclass is VIs.

25—Lamphier-Hapgood families complex, 5 to 20 percent slopes. These deep and moderately deep, well drained soils formed in residuum and colluvium derived from interbedded sandstone and shale. They are on mountain ridges and the upper side slopes throughout the survey area. The Lamphier family is on concave ridges, and the Hapgood family is on convex side slopes. Elevation ranges from 8,400 to 10,000 feet. The lower elevations generally are on northern aspects. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 40 degrees F. The unit is about 50 percent Lamphier family loam, 5 to 12 percent slopes, and 45 percent Hapgood family cobbly loam, 8 to 20 percent slopes.

The Lamphier family is on mountain ridges and the upper side slopes. Typically, the upper part of the surface layer is dark grayish brown loam about 20 inches thick. The lower part is grayish brown loam about 15 inches thick. The upper 10 inches of the substratum is variegated grayish brown and yellowish brown gravelly clay loam. The lower part is variegated brownish yellow and light gray gravelly sandy clay loam. Bedrock is generally at a depth of more than 40 inches, but it may be at a depth of only about 30 inches.

Permeability is moderately slow in the Lamphier family. Available water capacity typically is high, but it is moderate in some places. Surface runoff is medium, and the hazard of water erosion is slight or moderate.

The Hapgood family is on mountain side slopes. Typically, the upper part of the surface layer is dark brown cobbly loam about 8 inches thick. The lower part is brown very cobbly loam about 9 inches thick. The next layer is yellowish brown extremely cobbly loam about 10 inches thick. The substratum is very pale brown extremely stony loam. Bedrock is generally at a

depth of more than 60 inches, but it may be at a depth of only about 40 inches. In some areas the surface layer is loam.

Permeability is moderate in the Hapgood family. Available water capacity is low. The effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are small areas of soils that are similar to those in the Cebone and Overgaard families. These soils are moderately deep or deep over shale. Included areas make up about 5 percent of the unit.

The vegetation on this unit is dominated by aspen. The soils are highly productive. The understory is made up of Thurber fescue, elk sedge, needlegrasses, aspen peavine, and snowberry. The production varies from year to year, but in favorable years this unit can produce about 3,000 pounds of air-dry forage per acre. The long-term potential vegetation includes subalpine fir-Engelmann spruce and an understory of bearded wheatgrass, Thurber fescue, slender wheatgrass, blue wildrye, elk sedge, Columbia needlegrass, aspen peavine, lupine, meadowrue, and snowberry.

A variety of wildlife species inhabit areas of this unit, including deer, elk, snowshoe rabbits, marmots, squirrels, and blue grouse.

This unit is well suited to the production of aspen. Climatic factors and physical properties of the soils result in fairly good soil-moisture relationships. Although the hazard of erosion is slight, ground-disturbing activities should be undertaken with care. The content of rock fragments is a limitation on sites for roads.

The capability subclass is VIs.

26—Mirand-Callan families-Chilson Variant complex, 3 to 20 percent slopes. These gently sloping to rolling soils formed in mixed loess over alluvium and material weathered from interbedded sandstone and shale. They are on plateau tops and side slopes in the southwestern and northern parts of the survey area. Elevation ranges from 7,000 to 7,600 feet. The slope dominantly ranges from 3 to 8 percent. The average annual precipitation is about 16 inches, and the average annual soil temperature is about 52 degrees F. The unit is about 45 percent Mirand family loam, 3 to 10 percent slopes, 25 percent Callan family silt loam, 3 to 10 percent slopes, and 15 percent Chilson Variant sandy loam, 7 to 20 percent slopes. Individual areas range from 100 to more than 1,000 acres in size.

The Mirand family is moderately deep to very deep and is well drained. Typically, the surface layer is brown loam about 8 inches thick. The next layer is dark yellowish brown clay loam about 4 inches thick. The subsoil is brown clay loam about 25 inches thick. The substratum is calcareous, brown clay loam. The depth to bedrock ranges from 20 to more than 60 inches.

Permeability is moderately slow in the Mirand family. Available water capacity is low to high. The effective rooting depth ranges from 20 to more than 60 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Callan family is deep and well drained. Typically, the surface layer is brown silt loam about 7 inches thick. The upper part of the subsoil is brown clay loam about 3 inches thick. The lower part is reddish brown clay about 35 inches thick. The substratum is pink clay loam. The depth to bedrock is generally more than 40 inches.

Permeability is slow in the Callan family. Available water capacity is high. The effective rooting depth ranges from 40 to more than 60 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Chilson Variant is shallow and well drained. Typically, the surface layer is brown sandy loam about 5 inches thick. The upper part of the subsoil is reddish brown sandy clay loam about 3 inches thick. The next part is light reddish brown cobbly sandy clay loam about 4 inches thick. The lower part is light reddish brown cobbly clay about 5 inches thick. Bedrock is at a depth of 10 to 20 inches.

Permeability is slow in the Chilson Variant. Available water capacity is very low. The effective rooting depth is 7 to 20 inches. Surface runoff is medium, and the hazard of water erosion is slight.

Included in this unit are small areas of soils in the Showalter family and soils that have a lighter colored surface layer than the major soils. Included areas make up about 15 percent of the unit.

The vegetation on this unit consists of pinyon pine, Rocky Mountain juniper, Utah juniper, Gambel oak, serviceberry, and big sagebrush. Bottlebrush squirreltail and Indian ricegrass are the major grass species. The Callan family supports a grass-shrub community that includes mainly needlegrasses and big sagebrush. If the range condition deteriorates, pinyon pine and Utah juniper invade the site. The potential vegetation on the Chilson Variant and the Mirand family is pinyon pine and Rocky Mountain juniper and an understory of western wheatgrass, muttongrass, Sandberg bluegrass, bottlebrush squirreltail, serviceberry, true mountainmahogany, and Wyoming big sagebrush.

The depth to bedrock in the Chilson Variant is a minor limitation affecting some management alternatives.

Many wildlife species inhabit areas of this unit, including mule deer, elk, snowshoe rabbits, whitetail jackrabbits, chipmunks, and a variety of birds.

This unit is well suited to the production of pinyon pine and Utah juniper cordwood. It has a potential

Figure 9.—A typical area of Overgaard-Olathe families complex, 3 to 20 percent slopes. The woodland is mainly spruce and fir, and the vegetation in the foreground is mainly sedges and forbs.

production of 8 to 15 cords per acre. The unit has fairly good soil-moisture relationships.

The capability subclass is VIs.

27—Overgaard-Olathe families complex, 3 to 20 percent slopes. These gently sloping to rolling soils formed in material weathered from interbedded sandstone and shale. They are on the top of plateaus, at the higher elevations in the central part of the survey area (fig. 9). Elevation ranges from 9,000 to 10,000 feet. The slope dominantly ranges from 3 to 11 percent. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 38 degrees F. The unit is about 45 percent Overgaard family fine sandy loam and 35 percent Olathe family fine sandy loam. Individual areas range from a few hundred to several thousand acres in size.

The Overgaard family is moderately deep or deep and is well drained. Typically, the surface is covered with a mat of partially decomposed needles, bark, and twigs about 2 inches thick. The surface layer is light brown fine sandy loam about 3 inches thick. The subsurface layer is pink fine sandy loam about 6 inches thick. The subsoil is reddish yellow clay loam and cobbly clay loam about 17 inches thick. The depth to bedrock is dominantly 20 to 40 inches, but in some areas it is more than 60 inches.

Permeability is moderately slow in the Overgaard family. Available water capacity is low to high. The effective rooting depth is dominantly 20 to 40 inches. Surface runoff is slow, and the hazard of erosion is slight.

The Olathe family is shallow and well drained. Typically, the surface is covered with a layer of partially decomposed needles, bark, and twigs about 2 inches thick. The surface layer is pinkish gray fine sandy loam about 4 inches thick. The subsoil is light brown fine sandy loam and cobbly sandy loam about 11 inches thick. It is underlain by Dakota sandstone. The depth to bedrock ranges from 5 to 20 inches.

Permeability is moderately rapid in the Olathe family. Available water capacity is very low. The effective rooting depth is 7 to 20 inches. Surface runoff is slow, and the hazard of erosion is slight.

Included in this unit are small areas of soils in the Splitro family and some soils, mainly in open park areas, that are darker than the major soils. Included areas make up about 20 percent of the unit.

The vegetation on this unit consists of aspen, Engelmann spruce, subalpine fir, and grasses. Elk sedge and a variety of forbs make up the majority of the understory. The potential vegetation is Engelmann spruce and subalpine fir. The aspen may invade the grassed areas and eventually dominate the spruce-fir woodland. Understory vegetation includes elk sedge, slender wheatgrass, nodding bromegrass, meadowrue, common juniper, dogtooth violet, snowberry, dwarf blueberry, and kinnikinnick.

This unit is well suited to the production of Engelmann spruce and subalpine fir. Reforestation by mechanical means, road construction, and construction of recreational areas are difficult on the Olathe family because of the shallowness to bedrock. Also, trees in these areas are subject to windthrow because of the restricted rooting depth.

Mule deer, elk, blue grouse, marmots, snowshoe rabbits, and coyotes inhabit areas of this unit.

The capability subclass is VIs.

28—Sawcreek-Splitro families complex, 1 to 15 percent slopes. These moderately deep and shallow, well drained soils are on the top of gently sloping to gently rolling plateaus in the northern part of the survey area. They formed in residuum derived dominantly from sandstone. Elevation is 8,800 to 9,400 feet. The average annual precipitation is 20 to 22 inches, and the average annual soil temperature is about 41 degrees F. The unit is about 45 percent Sawcreek family sandy loam, 1 to 8 percent slopes, and 40 percent Splitro family cobbly sandy loam, 3 to 15 percent slopes.

Typically, the surface layer of the Sawcreek family is brown sandy loam about 9 inches thick. The subsoil is yellowish brown sandy loam about 14 inches thick. It is underlain by Wingate sandstone. Bedrock is generally at a depth of 20 to 40 inches.

Permeability is moderate in the Sawcreek family. Available water capacity is very low or low. Surface runoff is slow, and the hazard of water erosion is slight.

Typically, the surface layer of the Splitro family is dark grayish brown cobbly loam about 7 inches thick. The next layer also is dark grayish brown cobbly loam. It is about 8 inches thick. Bedrock is at a depth of 8 to 20 inches.

Permeability is moderate in the Splitro family. Available water capacity is very low or low. Surface runoff is slow, and the hazard of water erosion is slight or moderate.

Included in this unit are small areas of rock outcrop. The rock outcrop makes up about 10 percent of the unit. Also included are small areas of soils that have a thick, dark surface layer.

This map unit has an overstory of aspen. The understory includes Columbia needlegrass, bottlebrush squirreltail, hairy goldaster, and sandwort. The potential vegetation is an overstory of aspen and an understory of Arizona fescue, Parry oatgrass, snowberry, and kinnikinnick.

This unit is not suited to commercial production of timber because of the shallowness to bedrock and very poor soil-moisture relationships. Onsite investigation is needed prior to implementation of any planned land use.

The capability subclass is VIs.

29—Supervisor-Cebone families complex, 1 to 15 percent slopes. This map unit consists of nearly level to rolling soils on plateaus at elevations of 8,400 to 9,300 feet. The slope dominantly ranges from 3 to 10 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F. The unit is about 50 percent Supervisor family very cobbly loam and 30 percent Cebone family loam. Individual areas range from fewer than 100 to more than 1,000 acres in size. The largest area is along the upper reaches of Dave Wood Road.

The Supervisor family is moderately deep or deep and is well drained. Typically, the surface is covered with 1 inch of partially decomposed leaves, grasses, and twigs. The surface layer is brown very cobbly loam about 11 inches thick. The subsurface layer is pale brown very cobbly sandy loam about 5 inches thick. The underlying material is very pale brown extremely stony loam about 9 inches thick. It is underlain by Dakota sandstone. The depth to bedrock is dominantly 20 to 40 inches.

Permeability is moderately rapid in the Supervisor family. Available water capacity is very low. The effective rooting depth is dominantly 20 to 40 inches. Surface runoff is slow, and the hazard of water erosion is slight.

The Cebone family is moderately deep and deep and is well drained. Typically, the surface is covered with 1 inch of decomposed leaves, grasses, and roots. The surface layer is brown loam about 12 inches thick. The subsurface layer is pinkish gray fine sandy loam about 3 inches thick. The upper part of the subsoil is variegated pinkish gray and dark brown sandy clay loam about 6 inches thick. The next part is variegated strong brown and brown clay loam about 10 inches thick. The lower part is brown cobbly clay about 5 inches thick. It is underlain by fractured Dakota sandstone. The depth to bedrock ranges from 20 to more than 60 inches.

Permeability is slow in the Cebone family. Available water capacity is moderate or high. The effective rooting depth ranges from 20 to more than 60 inches. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are soils in the Hapgood and Splitro families. Included areas make up about 20 percent of the map unit.

The vegetation on this unit is dominated by subalpine fir, Engelmann spruce, Douglas-fir, and aspen. Where the spruce-fir forest canopy has not yet closed in completely, elk sedge, needlegrasses, and Gambel oak make up a large part of the understory. Where spruce-fir dominates, ground juniper, meadowrue, and kinnikinnick are the major understory species. The potential vegetation is Engelmann spruce and subalpine fir and scattered Douglas-fir.

This unit is suited to the production of Engelmann spruce and subalpine fir.

The content of rock fragments in the Supervisor family restricts the management potential of this unit. The placement and construction of roads may be limited by the shallowness to bedrock and the rock fragments.

The wildlife species that inhabit areas of this unit include elk, mule deer, snowshoe rabbits, and squirrels.

The capability subclass is VIs.

30—Trampas-Delson, moderately deep, families complex, 3 to 30 percent slopes. These gently sloping to rolling soils formed in residuum and in locally transported colluvial material derived from interbedded sandstone and shale. They are on mountain side slopes throughout the survey area. The Trampas family is on convex slopes, and the Delson family is on even slopes. Elevation ranges from 7,200 to 8,500 feet. The slope dominantly ranges from 6 to 20 percent. The average annual precipitation is about 18 inches, and the average annual soil temperature is about 45 degrees F. The unit is about 45 percent Trampas family cobbly loam and 35 percent moderately deep Delson family loam. Individual areas range from about 100 to more than 1,000 acres in size.

The Trampas family is generally deep and well drained. Typically, the surface is covered with a layer of undecomposed pine needles, grass, and twigs about 1 inch thick. The upper part of the surface layer is brown cobbly loam about 4 inches thick. The lower part is pink very cobbly loam about 7 inches thick. The next layer is pink and reddish brown very cobbly loam and clay loam about 16 inches thick. The subsoil is reddish brown extremely cobbly clay about 40 inches thick. The depth to bedrock generally is more than 60 inches.

Permeability is slow in the Trampas family. Available water capacity is low or moderate. The effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of water erosion is moderate.

The moderately deep Delson family is well drained. Typically, the surface layer is dark brown loam about 7 inches thick. The upper 4 inches of the subsoil is dark brown clay loam. The lower 13 inches is brown clay. The underlying material is pinkish gray cobbly clay loam about 6 inches thick. It is underlain by fractured Dakota sandstone. Bedrock is generally at a depth of 20 to 40 inches, but in some areas it is at a depth of about 60 inches.

Permeability is slow in the Delson family. Available water capacity is low or moderate. The effective rooting depth ranges from 20 to more than 40 inches. Surface runoff is medium, and the hazard of water erosion is slight or moderate.

Included in this unit are some soils in the Beenom family, small areas of weakly developed soils that are darker than the major soils, and a few wet areas. Included areas make up about 20 percent of the unit.

The vegetation on this map unit is dominated by an overstory of ponderosa pine and an understory of elk sedge, bottlebrush squirreltail, and mountain muhly. Gambel oak also makes up a part of the annual production. Tall rabbitbrush and Canada thistle invade this site when the range condition deteriorates. The potential vegetation is ponderosa pine. The potential understory on the Trampas family is Indian ricegrass, junegrass, mountain muhly, blue grama, muttongrass, bitterbrush, true mountainmahogany, manzanita, hairy goldaster, and Letterman needlegrass. The potential understory on the Delson family is Arizona fescue, Parry oatgrass, western wheatgrass, muttongrass, elk sedge, Gambel oak, lupine, and snowberry.

The main concerns in producing and harvesting timber are the cobbly surface and competition by

understory plants. Competition by Gambel oak limits the natural revegetation of ponderosa pine. Reforestation by mechanical methods is difficult because of the slope and the large content of rock fragments on or near the surface. Hand planting of nursery stock may be necessary.

The content of rock fragments on or near the surface is a limiting factor affecting recreational development. Erosion is a potential problem on the steeper slopes.

Turkeys, mule deer, and cottontail rabbits commonly inhabit areas of this unit.

The capability subclass is VIIs.

31—Ula-Agneston-Pendergrass families complex, 1 to 15 percent slopes. These shallow to deep, well drained soils formed in material weathered from sandstone or interbedded sandstone and shale. They are along the upper reaches of plateaus. The Ula and Agneston families are typically on nearly level slopes, and the Pendergrass family is on slope breaks. Elevation is 8,900 to 9,900 feet. The slope dominantly ranges from 3 to 10 percent. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 38 degrees F. The unit is about 30 percent Ula family loam, 25 percent Agneston family cobbly fine sandy loam, and 25 percent Pendergrass family very cobbly fine sandy loam. Individual areas are several hundred to more than 1,000 acres in size.

The Ula family is moderately deep or deep and is well drained. Typically, the surface is covered with undecomposed needles, grass, and twigs about 1 inch thick and a decomposed organic mat of needles, grass, and twigs about 2 inches thick. The surface layer is dark brown loam about 7 inches thick. The upper part of the subsurface layer is pinkish gray cobbly fine sandy loam about 10 inches thick. The lower part is variegated pinkish gray and strong brown cobbly sandy loam about 8 inches thick. The subsoil is reddish yellow cobbly sandy clay loam about 28 inches thick. It is underlain by partially weathered Dakota sandstone. The depth to bedrock is typically 30 to 55 inches but ranges from 20 to more than 60 inches.

Permeability is moderately slow in the Ula family. Available water capacity typically is low or moderate, but in some areas it ranges from very low to high. The effective rooting depth ranges from 20 to more than 60 inches. Surface runoff is slow, and the hazard of water erosion is slight or moderate.

The Agneston family is moderately deep or deep and is well drained. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 2 inches thick. The surface layer is brown cobbly fine sandy loam about 10 inches thick. The next layer is light brown cobbly fine sandy loam about 7 inches thick. The subsoil is light brown very cobbly clay loam about 19 inches thick. It is underlain by Dakota sandstone. The depth to bedrock is dominantly 20 to 40 inches but ranges to 60 inches in some areas. Tree roots penetrate cracks in the bedrock.

Permeability is moderately slow in the Agneston family. Available water capacity typically is low, but it is very low in some areas. The effective rooting depth ranges from 20 to more than 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight.

The Pendergrass family is shallow and well drained. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 2 inches thick. The surface layer is brown very cobbly fine sandy loam about 9 inches thick. The underlying material is light brown very cobbly fine sandy loam about 8 inches thick. The depth to sandstone bedrock ranges from 10 to 20 inches.

Permeability is moderately rapid in the Pendergrass family. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Surface runoff is slow, and the hazard of water erosion is slight.

Included in this unit are small areas of soils in the Leaps family, soils that have a dark surface layer, and soils that have a lighter colored surface layer than the major soils. Also included are small areas of rock outcrop and areas that are underlain by shale. Included areas make up about 20 percent of the unit.

The Agneston and Pendergrass families generally support dense stands of Engelmann spruce and subalpine fir and a few scattered aspen (fig. 10). The understory is elk sedge, nodding bromegrass, slender wheatgrass, and meadowrue. The Ula family generally supports open stands of Engelmann spruce and subalpine fir mixed with blue spruce and aspen. The understory is mostly meadowrue and bromegrass. A few open grass parks of slender wheatgrass and nodding bromegrass also occur in areas of the Ula family. The potential understory vegetation includes elk sedge, slender wheatgrass, nodding bromegrass, meadowrue, common juniper, dogtooth violet, snowberry, dwarf blueberry, and kinnikinnick. Understory production varies, depending on the density of the canopy cover.

This unit is well suited to the production of Engelmann spruce and subalpine fir. The main concerns in producing and harvesting timber are difficulties in reforestation, the windthrow hazard, and road construction and maintenance. Reforestation by mechanical means is difficult on the Pendergrass family because of the shallowness to bedrock and the large content of coarse fragments near the surface. Hand planting of nursery stock is usually necessary. Trees

Figure 10.—Aspen succeeding to spruce-fir in an area of Ula-Agneston-Pendergrass families complex, 1 to 15 percent slopes.

are subject to windthrow on the Pendergrass family because of the shallow rooting depth. Construction of access roads and recreational areas is difficult on the Pendergrass family because of the shallowness to bedrock and the content of coarse fragments.

Mule deer, elk, snowshoe rabbits, coyotes, and blue grouse inhabit areas of this unit.

The capability subclass is VIs.

32—Ustorthents-Ustochrepts-Rock outcrop complex, 40 to 150 percent slopes. This map unit consists of Rock outcrop and steep to extremely steep soils on plateau escarpments and canyon side slopes at the lower elevations throughout the survey area. Elevation ranges from 6,400 to 7,700 feet. The average annual precipitation is about 15 inches, and the average annual soil temperature is about 49 degrees F. The unit is about 40 percent Ustorthents, 30 percent Ustochrepts, and 20 percent Rock outcrop. Individual areas are generally several hundred acres in size.

Ustorthents are shallow to deep and are well drained. A reference pedon has a surface layer of brown very gravelly sandy loam about 13 inches thick. It is underlain by Dakota sandstone. The depth to bedrock ranges from 4 to more than 60 inches. The texture ranges from sandy loam to clay. The content of rock fragments ranges from 5 to 90 percent.

Permeability ranges from slow to very rapid in the Ustorthents. Available water capacity ranges from very low to high. The effective rooting depth ranges from 8 to more than 60 inches. Surface runoff is rapid or very rapid, and the hazard of water erosion is severe.

Ustochrepts are shallow to deep and are well drained. A reference pedon has a surface layer of brown gravelly loam about 4 inches thick, a subsoil of brown very cobbly sandy loam about 25 inches thick, and a substratum of calcareous, pale brown very cobbly sandy loam about 4 inches thick. It is underlain by Dakota sandstone. The depth to bedrock ranges from 12 to more than 60 inches. The texture ranges from sandy loam to clay loam. The content of rock fragments ranges from 5 to 70 percent.

Permeability ranges from slow to very rapid in the Ustochrepts. Available water capacity ranges from very low to high. The effective rooting depth ranges from 8 to more than 60 inches. Surface runoff is rapid or very rapid, and the hazard of water erosion is severe.

The Rock outcrop occurs as exposed areas of bare rock.

Included in this unit are areas of Borolls and Boralfs. Included areas make up about 10 percent of the unit.

The vegetation on this unit is a sparse coniferous woodland dominated by pinyon pine, Utah juniper, Rocky Mountain juniper, and perennial grasses.

The slope, the depth to bedrock, and the Rock outcrop greatly limit management alternatives on this unit. Onsite investigation is needed prior to implementation of any planned land use.

The capability subclass is VIIIe.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help 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 forestry, rangeland, watershed management, and transportation systems. Certain land uses, such as camp areas, picnic areas, and gravel pits, are site specific and require detailed onsite investigation. Other land uses, such as timber production and roads, can be planned on the basis of information in this survey, but project investigations are needed. 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.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The 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 woodland, and for engineering purposes.

In the capability system, soils generally are grouped at three levels—capability class, subclass, and unit *(11)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main 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 I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils

in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

Forage is an important resource in the survey area. Local ranchers are dependent on the use of more than 30 livestock allotments that produce summer forage for cattle, sheep, and horses. Approximately 78 percent of the area is classified as land suitable for grazing. The remaining acreage is too steep or rocky.

The climate, elevation, and slope greatly influence the kinds and amounts of forage produced. The lower elevations are generally drier and support blue grama, galleta, Indian ricegrass, western wheatgrass, and Wyoming big sagebrush. The mid and upper elevations are cooler and receive more moisture. Range vegetation at the mid elevations consists of Arizona fescue, Parry oatgrass, western wheatgrass, bluegrass, lupine, and snowberry. Range vegetation at the upper elevations consists of Thurber fescue, Columbia needlegrass, slender wheatgrass, bluegrass, nodding bromegrass, big sagebrush, snowberry, and herbaceous cinquefoil. In areas that have similar climate and topography, the amount of forage produced is closely related to the kind of soil. Effective management is based on the relationships between soils, vegetation, and water.

Table 5 shows present vegetation, potential natural vegetation, forage production potential, and revegetation limitations for the soils in the survey area. *Present vegetation* is the major vegetation species on the soil at the time the survey was made. *Potential natural vegetation* is the vegetation that is expected to grow on the site if the soils are not disturbed by wildfires, grazing, or insects. *Forage production potential* is the capacity of the soils, under the maximum level of management, to produce native forage without competition from nonforage plants. *Revegetation limitations* include any factor that may inhibit the ability of the soil to be revegetated with grasses and shrubs. Factors considered include natural fertility, available moisture, the hazard of erosion, the shrink-swell potential, coarse fragments, reaction, and slope. The most limiting factors are listed in the table.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimal production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major management concern on most rangeland in the survey area is control of grazing so that the kinds and amounts of plants that make up the potential natural plant community are reestablished. Forage production has declined in much of the survey area because of heavy grazing by wildlife and livestock.

Woodland Management and Productivity

About 68 percent of the survey area is forested. About 37 percent is commercial forest land that is capable of producing at least 20 cubic feet per acre per year. The primary forest cover types are pinyon-juniper, ponderosa pine, aspen, Engelmann spruce, and subalpine fir. The most important of the forest types are ponderosa pine, aspen, and Engelmann spruce.

Table 6 lists woodland management concerns and productivity classes. Interpretive ratings of slight, moderate, and severe indicate the degree of the soil limitations to be considered in management.

Ratings of *Timber harvest limitations* reflect the expected behavior of the soil following timber harvesting. The ratings are based on the hazard of erosion, natural fertility, the shrink-swell potential, coarse fragments, and the potential for frost action. A rating of moderate or severe indicates that careful examination of the map unit description or the soil morphology description is recommended.

The *reforestation limitations* rating is based on the capability of the soils to support the growth and survival of seedlings. The factors considered are natural fertility, the hazard of erosion, the shrink-swell potential, coarse fragments, the potential for frost action, and climatic zone. A rating of moderate or severe indicates that careful examination of the map unit description or the soil morphology description is recommended.

Ratings of the *windthrow hazard* relate to the anchoring ability of the soil. The ratings do not include consideration of aspect, the prevailing winds, or the

individual rooting characteristics of the different species. The soil properties and qualities considered include texture of the surface and subsurface layers, percentage of clay in the subsurface layer, the depth to root-restricting layers, and drainage characteristics.

Productivity is expressed as a range in *site indices*. A site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. In this table the site indices are ranges because of the variability of the soils at the level of mapping used in this survey. The site index data were taken in the field for specific soils in various map units.

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, roads, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale and the level of intensity at which the soils were mapped, 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 grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the 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

Table 7 shows the degree and kind of soil limitations that affect shallow excavations and dwellings with and without basements. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the

susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for dwellings with and without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Roads

Table 8 gives information about the soils as a source of roadfill and describes the limitations affecting unpaved roads.

Roadfill is soil material that is excavated in one place and used as road base material in another. The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Limitations affecting unpaved roads are based on the undisturbed soil profile after the removal of surface horizons. The ratings also are based on field observations of existing unpaved roads on various soils in the area. Ratings of *slight, moderate,* or *severe* are used to reflect the degree of limitation of a particular soil.

Sanitary Facilities

Table 9 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if

slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 10 gives information about the soils as a source of sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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 10, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the taxonomic unit descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is

as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 11 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect irrigation and terraces and diversions.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-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 shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 12 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil under the heading "Taxonomic Units and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*. Both systems are described in the "PCA Soil Primer" *(8)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, 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 in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an 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 millimeters, respectively. Estimates are based on

laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are 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 omitted in the table.

Physical and Chemical Properties

Table 13 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil under the heading "Taxonomic Units and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems 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 major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and

organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 13, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Table 14 lists the results of using the Universal Soil Loss Equation to estimate potential and current erosion under certain conditions. *Potential erosion* is the maximum expected soil loss in tons per acre per year based on estimated factors that represent the worst possible condition for any particular soil—for example, no overstory canopy, no vegetative cover, or the steepest slope. *Current erosion* is the product of using the USLE with factors that represent current conditions, such as ground cover, canopy cover, rainfall, and slope. The result is an estimate of soil loss in tons per acre per year.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly

impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding in any year is nearly 0 percent to 5 percent); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding in any year is 5 to 50 percent); and *frequent* that it occurs often under normal weather conditions (the chance of flooding in any year is more than 50 percent). If flooding is occasional or frequent, duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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 are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(12)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 16 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthent (*Orth*, meaning true or common, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Cryorthents (*Cry*, meaning cold, plus *orthents*).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Cryorthents.

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, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy-skeletal, mixed, nonacid Typic Cryorthents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Most of the soils in this survey were classified to the family level only. The soils are identified with a family name, for example, Belain family.

Taxonomic Units and Their Morphology

In this section, each soil recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each unit. A reference pedon, a small three-dimensional area of soil, is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(13)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(12)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the unit.

The map units of each taxonomic unit are described in the section "Detailed Soil Map Units."

Agneston Family

The Agneston family consists of moderately deep, well drained soils on plateau tops. These soils formed

in residuum derived from interbedded sandstone and shale. The slope ranges from 1 to 15 percent. The average annual precipitation is about 25 inches, and the average annual soil temperature is 38 degrees F.

Reference pedon of the Agneston family, in an area where the slope is 2 percent; 1 mile south of Highway 90 on States Draw Road, SE¼NW¼ sec. 23, T. 47 N., R. 12 W., in Montrose County:

Oi—2 inches to 0; partially decomposed mat of needles, leaves, twigs, and cones.
A—0 to 10 inches; brown (7.5YR 5/4) cobbly fine sandy loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; common coarse, medium, and fine roots; 10 percent gravel and 15 percent cobbles; strongly acid (pH 5.4); gradual smooth boundary.
A/B—10 to 17 inches; light brown (7.5YR 6/4) cobbly fine sandy loam, brown (7.5YR 4/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, nonsticky and nonplastic; common medium and fine and few coarse roots; 15 percent gravel and 15 percent cobbles; very strongly acid (pH 4.9); clear wavy boundary.
Bt—17 to 36 inches; light brown (7.5YR 6/4) very cobbly clay loam, brown (5YR 5/4) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few medium roots; 25 percent gravel and 25 percent cobbles; very strongly acid (pH 4.6); clear smooth boundary.
R—36 inches; sandstone bedrock.

The depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments in the control section ranges from 35 to 60 percent.

The A horizon has hue of 7.5YR or 10YR, value of 5 to 7 dry and 3 to 5 moist, and chroma of 2 to 6. It is dominantly fine sandy loam, but the range includes cobbly loam.

The Bt horizon has hue of 5YR to 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 to 8. It is very cobbly or very gravelly clay loam or sandy clay loam. Reaction is strongly acid or very strongly acid.

Arabrab Family

The Arabrab family consists of shallow, well drained soils on plateau uplands and benches. These soils formed in residuum derived from sandstone. The slope ranges from 3 to 15 percent. The average annual precipitation is about 14 inches, and the average annual soil temperature is about 53 degrees F.

Reference pedon of the Arabrab family, in an area where the slope is 5 percent; NE¼NE¼ sec. 14, T. 49 N., R. 12 W., in Montrose County:

A—0 to 6 inches; reddish brown (5YR 5/4) sandy loam, dark reddish brown (5YR 3/4) moist; weak very fine granular structure; loose; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; mildly alkaline (pH 7.8); clear smooth boundary.
Bt—6 to 14 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; moderately alkaline (pH 8.0); clear smooth boundary.
Bk—14 to 19 inches; light reddish brown (5YR 6/4) gravelly sandy clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; 15 percent gravel and 10 percent cobbles; moderately alkaline (pH 8.2); calcareous.
R—19 inches; fractured sandstone bedrock.

The depth to sandstone bedrock ranges from 10 to 20 inches. Reaction ranges from neutral to moderately alkaline.

The A horizon is 2 to 8 inches thick. It has hue of 5YR to 10YR. It is fine sandy loam or gravelly loam.

The Bt horizon is 6 to 12 inches thick. It has hue of 5YR to 10YR. It is sandy clay loam, loam, or clay loam. It is calcareous in some pedons. The content of clay ranges from 20 to 35 percent.

The Bk horizon is sandy clay loam, loam, or clay loam. It is calcareous in most pedons. The content of coarse fragments ranges from 5 to 35 percent.

Beenom Family

The Beenom family consists of shallow, well drained soils on mesa tops. These soils formed in material weathered from sandstone. The slope ranges from 1 to 20 percent. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Beenom family, in an area where the slope is 4 percent; SE¼NE¼ sec. 21, T. 49 N., R. 13 W., in Montrose County:

A1—0 to 2 inches; dark brown (7.5YR 4/2) sandy loam, very dark brown (7.5YR 2/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; 5 percent gravel; neutral (pH 6.8); clear smooth boundary.
A2—2 to 8 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak very fine and fine

subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots; 5 percent gravel; neutral (pH 6.8); clear wavy boundary.

Bt1—8 to 12 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) moist; moderate fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common moderately thick clay films on faces of peds; common very fine and fine roots; 5 percent gravel; neutral (pH 6.6); clear wavy boundary.

Bt2—12 to 16 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) moist; weak fine and medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; common moderately thick clay films on faces of peds; few very fine and fine roots; 5 percent gravel and 5 percent cobbles; neutral (pH 6.6).

R—16 inches; sandstone bedrock.

The depth to bedrock ranges from 10 to 20 inches. Reaction is neutral or mildly alkaline.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 moist and 3 to 5 dry and chroma of 0 to 3. It is sandy loam, loam, or sandy clay loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 3 or 4. It is sandy clay loam or clay loam.

Belain Family

The Belain family consists of moderately deep and deep, well drained soils on benches. These soils formed in alluvium and residuum derived from sandstone. The slope ranges from 1 to 15 percent. Elevation ranges from 8,000 to 8,800 feet. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Belain family, in an area where the slope is 10 percent; east of Casto Reservoir, NW¼NW¼ sec. 25, T. 15 S., R. 101 W., in Mesa County:

A1—0 to 2 inches; brown (10YR 5/3) loam, dark brown (7.5YR 3/2) moist; weak thick platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; neutral (pH 7.2); clear smooth boundary.

A2—2 to 5 inches; grayish brown (10YR 5/2) loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; common fine, medium, and coarse roots; neutral (pH 7.2); clear smooth boundary.

A3—5 to 7 inches; brown (10YR 5/3) sandy loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; neutral (pH 7.2); gradual smooth boundary.

Bw—7 to 13 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine and very fine roots; common medium and coarse roots; neutral (pH 7.2); clear smooth boundary.

C—13 to 22 inches; reddish yellow (7.5YR 7/6) sandy loam, strong brown (7.5YR 5/6) moist; massive; soft, very friable, nonsticky and nonplastic; few medium and coarse roots; mildly alkaline (pH 7.4); clear smooth boundary.

R—22 inches; hard sandstone bedrock.

Thickness of the mollic epipedon is 7 to 15 inches. The depth to bedrock ranges from 27 to 60 inches. The content of rock fragments ranges from 5 to 30 percent.

The A horizon has hue of 5YR to 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 1 to 3.

The Bw horizon has hue of 10YR to 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 to 4. It is loam or sandy loam. The content of clay ranges from 10 to 18 percent.

The C horizon has hue of 2.5YR to 7.5YR, value of 5 to 7 dry and 4 or 5 moist, and chroma of 4 to 6. It is sandy loam, loam, or gravelly sandy loam.

Callan Family

The Callan family consists of deep, well drained soils on fan terraces, benches, and plateau side slopes. These soils formed in alluvium and residuum derived from sandstone and shale. The slope ranges from 3 to 10 percent. Elevation ranges from 7,000 to 7,600 feet. The average annual precipitation is about 16 inches, and the average annual soil temperature is about 45 degrees F.

Reference pedon of the Callan family, SE¼SE¼ sec. 13, T. 15 N., R. 18 W., in Mesa County:

A—0 to 7 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; strong coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; neutral (pH 7.0); clear smooth boundary.

Bt1—7 to 10 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on faces of peds;

common fine and medium roots; neutral (pH 7.0); clear smooth boundary.
Bt2—10 to 32 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, sticky and very plastic; many moderately thick clay films on faces of peds; 5 percent gravel; common fine roots; neutral (pH 7.0); gradual smooth boundary.
Bt3—32 to 45 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; strong coarse prismatic structure parting to moderate coarse subangular blocky; extremely hard, extremely firm, sticky and very plastic; many thick clay films on faces of peds; 5 percent gravel; few fine roots; mildly alkaline (pH 7.4); calcareous; clear smooth boundary.
Bk—45 to 60 inches; pink (5YR 8/4) clay loam, reddish yellow (5YR 6/6) moist; massive; slightly hard, friable, sticky and plastic; 5 percent gravel; strongly calcareous; strongly alkaline (pH 8.6).

Thickness of the mollic epipedon ranges from 10 to 16 inches. The depth to lime, or depth to the base of the argillic horizon, is 30 inches or more.

The A horizon has hue of 7.5YR or 10YR. It is loam or silt loam.

The Bt horizon has hue of 5YR or 7.5YR. It is clay loam or clay. Reaction is neutral or mildly alkaline.

Cebone Family

The Cebone family consists of moderately deep or deep, well drained soils on plateau uplands. These soils formed in residuum and in locally transported sediments weathered from interbedded sandstone and shale. The slope ranges from 1 to 15 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is 40 degrees F.

Reference pedon of the Cebone family, in an area where the slope is 5 percent; NE¼ sec. 9, T. 46 N., R. 10 W., in Ouray County:

Oa—1 inch to 0; decomposed leaves, grass, and roots.
A1—0 to 6 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and medium roots; 10 percent gravel; neutral (pH 6.8); clear smooth boundary.
A2—6 to 12 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; soft, very friable, nonsticky and nonplastic; common fine roots; 10 percent gravel; neutral (pH 6.8); clear smooth boundary.
E—12 to 15 inches; pinkish gray (7.5YR 6/2) fine sandy loam, dark brown (7.5YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; few fine roots; 10 percent gravel; neutral (pH 6.8); clear wavy boundary.
BE—15 to 21 inches; variegated pinkish gray (7.5YR 6/2) and dark brown (7.5YR 4/4) sandy clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, sticky and plastic; few fine roots; common thin clay films; 10 percent gravel; neutral (pH 6.6); clear wavy boundary.
Bt1—21 to 31 inches; variegated strong brown (7.5YR 5/6) and brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; many moderately thick clay films; 10 percent gravel and 5 percent cobbles; neutral (pH 6.6); gradual smooth boundary.
Bt2—31 to 36 inches; brown (7.5YR 5/4) cobbly clay, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; many moderately thick clay films; 10 percent gravel and 15 percent cobbles; neutral (pH 6.6); abrupt wavy boundary.
R—36 inches; fractured Dakota sandstone.

Thickness of the mollic epipedon ranges from 10 to 20 inches. The content of gravel and cobbles on the surface ranges from 0 to 50 percent. The depth to sandstone bedrock ranges from 20 to more than 60 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is loam or gravelly loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6 dry and 4 to 6 moist, and chroma of 4 to 8. It is clay loam or clay. The content of clay ranges from 35 to 50 percent. The content of coarse fragments ranges from 5 to 30 percent.

Cerro Family

The Cerro family consists of deep, well drained soils on plateau uplands. These soils formed in material weathered from interbedded sandstone and shale. The slope ranges from 1 to 15 percent. The average annual precipitation is about 18 inches, and the average annual soil temperature is 45 degrees F.

Reference pedon of the Cerro family, in an area

where the slope is 6 percent; NW¼SE¼ sec. 31, T. 46 N., R. 11 W., in Montrose County:

A—0 to 4 inches; dark grayish brown (7.5YR 4/2) loam, very dark brown (7.5YR 2/2) moist; moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium and few coarse roots; 5 percent gravel and 5 percent cobbles; neutral (pH 6.6); clear smooth boundary.

BA—4 to 14 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; very few thin clay films; common fine and medium and few coarse roots; 5 percent gravel and 5 percent cobbles; neutral (pH 6.6); gradual smooth boundary.

Bt—14 to 30 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; common moderately thick clay films; dark organic stains on faces of many peds; cracks and slickensides; 5 percent gravel and 5 percent cobbles; neutral (pH 6.6); gradual wavy boundary.

Btk—30 to 48 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; common moderately thick clay films on faces of peds and lining pores; pressure faces; few medium roots commonly flattened on faces of peds; 5 percent gravel and 5 percent cobbles; mildly alkaline (pH 7.4); calcareous; gradual wavy boundary.

Ck—48 to 60 inches; very pale brown (10YR 7/4) clay, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; 10 percent gravel and 5 percent cobbles; mildly alkaline (pH 7.6); calcareous.

The depth to uniformly calcareous material ranges from 20 to 40 inches. Depth to the base of the argillic horizon ranges from 24 to 50 inches. Thickness of the mollic epipedon ranges from 8 to 16 inches. Cracks as large as one-half inch are common in dry soils.

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

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 3 or 4. It is clay loam or clay. The content of coarse fragments ranges from 5 to 35 percent.

The C horizon is clay loam, clay, or silty clay in the fine-earth fraction.

Chilson Family

The Chilson family consists of shallow, well drained soils on plateau tops. These soils formed in material weathered from sandstone. The slope ranges from 1 to 20 percent. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Chilson family, in an area where the slope is 2 percent; north of Craig Point Road, SE¼SW¼ sec. 10, T. 45 N., R. 12 W., in Montrose County:

Oe—1 inch to 0; decomposed and undecomposed needles and grass.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium and coarse roots; neutral (pH 6.9); clear smooth boundary.

BA—4 to 8 inches; dark brown (7.5YR 4/3) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; 15 percent gravel; neutral (pH 6.9); clear smooth boundary.

Bt—8 to 15 inches; brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate medium and fine angular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films on faces of peds; many very fine and few fine, medium, and coarse roots; 30 percent gravel; neutral (pH 6.7); clear wavy boundary.

Cr—15 to 17 inches; variegated strong brown (7.5YR 5/8 and 5/6) and grayish brown (10YR 5/2), weathered sandstone bedrock.

R—17 inches; hard sandstone bedrock.

The depth to bedrock ranges from 10 to 20 inches. Thickness of the mollic epipedon ranges from 7 to 11 inches. The content of coarse fragments, mainly gravel-sized, angular sandstone, ranges from 0 to 30 percent and increases with increasing depth.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 or 3. It is loam or fine sandy loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 to 6. It is clay loam or clay. The content of clay ranges from 35 to 45 percent.

The C horizon, if it occurs, is weathered sandstone.

Chilson Variant

The Chilson Variant consists of shallow, well drained soils on benches, mesa tops, and side slopes. These soils formed in residuum derived from interbedded sandstone and shale. The slope ranges from 1 to 40 percent. The average annual precipitation is about 16 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of Chilson Variant, in an area where the slope is 4 percent; NW¼NW¼ sec. 35, T. 49 N., R. 12 W., in Montrose County:

A—0 to 5 inches; brown (7.5YR 5/2) sandy loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; 5 percent gravel and 5 percent cobbles; mildly alkaline (pH 7.4); clear smooth boundary.

BA—5 to 8 inches; reddish brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; common very fine and fine roots; 5 percent gravel and 5 percent cobbles; neutral (pH 7.2); clear wavy boundary.

Bt1—8 to 14 inches; light reddish brown (5YR 6/4) cobbly sandy clay loam, reddish brown (5YR 4/4) moist; strong medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few moderately thick clay films on faces of peds; common very fine and fine roots; 10 percent gravel and 15 percent cobbles; neutral (pH 7.0); gradual wavy boundary.

Bt2—14 to 19 inches; light reddish brown (5YR 6/4) cobbly clay, reddish brown (5YR 4/4) moist; strong medium subangular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films on faces of peds; few very fine and fine roots; 10 percent gravel and 15 percent cobbles; neutral (pH 7.0); abrupt smooth boundary.

R—19 inches; sandstone bedrock.

Thickness of the ochric epipedon ranges from 4 to 7 inches. Reaction is neutral or mildly alkaline throughout the profile. The depth to bedrock ranges from 7 to 20 inches.

The A horizon has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 moist and 3 to 5 dry and chroma of 0 to 3.

The Bt horizon has hue of 5YR or 7.5YR, value of 3 or 4 moist and 4 to 6 dry, and chroma of 2 to 4. It is cobbly sandy clay loam, cobbly clay, or clay. The content of clay ranges from 35 to 50 percent, by weighted average. The content of coarse fragments ranges from 5 to 30 percent.

Dalhart Family

The Dalhart family consists of moderately deep and deep, well drained soils on plateau tops. These soils formed in material weathered from sandstone. The slope ranges from 3 to 15 percent. The average annual precipitation is about 14 inches, and the average annual soil temperature is about 53 degrees F.

Reference pedon of the Dalhart family, in an area where the slope is 7 percent; SE¼SW¼ sec. 11, T. 49 N., R. 12 W., in Montrose County:

A—0 to 4 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) moist; weak medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; neutral (pH 7.2); clear smooth boundary.

Bt—4 to 8 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; mildly alkaline (pH 7.4); clear wavy boundary.

Btk1—8 to 13 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common thin clay films on faces of peds; common fine and medium roots; calcareous (10 percent calcium carbonate equivalent); mildly alkaline (pH 7.8); clear wavy boundary.

Btk2—13 to 30 inches; pink (7.5YR 7/4) sandy clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; few very fine and fine roots; calcareous (30 percent calcium carbonate equivalent); moderately alkaline (pH 8.0); gradual wavy boundary.

Ck—30 to 37 inches; pink (7.5YR 8/4) sandy clay loam, reddish yellow (7.5YR 6/6) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; calcareous (35 percent calcium carbonate equivalent); moderately alkaline (pH 8.2).

R—37 inches; sandstone bedrock.

Depth to bedrock ranges from 20 to more than 60 inches. Reaction ranges from neutral to moderately alkaline. The content of coarse fragments ranges from 0 to 30 percent in any one horizon, but it is less than 15 percent on a weighted average.

The A horizon is 2 to 8 inches thick. It has hue of 5YR to 10YR. It is loamy sand, sandy loam, or loam.

The Bt horizon has hue of 5YR to 10YR. It is sandy clay loam, loam, or clay loam. The content of clay ranges from 18 to 35 percent. The horizon is calcareous in the lower part.

The C horizon is sandy clay loam, loam, or clay loam.

Delson Family

The Delson family consists of deep and moderately deep, well drained soils on benches and valley side slopes. These soils formed in material weathered from interbedded sandstone and shale and in locally transported sediments. The slope ranges from 1 to 45 percent. The average annual precipitation is about 18 inches, and the average annual soil temperature is about 45 degrees F.

Reference pedon of the Delson family, in an area where the slope is 8 percent; 300 feet east of 25 Mesa Road at the junction with Lee Reservoir Road, SW¼NW¼ sec. 10, T. 49 N., R. 13 W., in Montrose County:

A1—0 to 6 inches; dark brown (7.5YR 4/2) gravelly loam, very dark brown (7.5YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; 15 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

A2—6 to 11 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; 5 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

Bt1—11 to 19 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on faces of peds; few fine and medium roots; 5 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

Bt2—19 to 30 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; many moderately thick clay films on faces of peds; few fine and medium roots; 5 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

Bt3—30 to 40 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films on faces of peds; few fine and medium roots; 10 percent gravel; slightly acid (pH 6.4); gradual wavy boundary.

BC—40 to 45 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak medium and fine subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on faces of peds; few fine and medium roots; 10 percent gravel; neutral (pH 6.8); gradual wavy boundary.

C—45 to 60 inches; pinkish gray (7.5YR 7/2) and brown (7.5YR 5/4) very gravelly clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular structure; very hard, firm, very sticky and very plastic; 35 percent gravel; few fine roots; neutral (pH 6.8).

Thickness of the mollic epipedon ranges from 7 to 14 inches. The content of gravel and cobbles ranges from 0 to 35 percent in the A horizon. The content of coarse fragments ranges from 10 to 30 percent in the control section. The depth to bedrock ranges from 20 to more than 60 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 moist, and chroma of 1 to 3. It is gravelly loam or loam.

The Bt horizon has hue of 5YR to 10YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 3 or 4. It is clay or clay loam. The content of clay ranges from 35 to 45 percent.

The C horizon is gravelly clay loam, clay loam, or very gravelly or very cobbly clay loam. It is calcareous in some pedons. The content of rock fragments ranges from 5 to 50 percent.

Dough Family

The Dough family consists of shallow, well drained soils on nearly level to gently sloping plateau tops and benches. These soils formed in residuum and alluvium derived from sandstone. The slope ranges from 1 to 10 percent. The average annual precipitation is about 15 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Dough family, SE¼NE¼NW¼ sec. 13, T. 15 S., R. 101 W., in Mesa County:

A—0 to 3 inches; brown (7.5YR 4/4) sandy loam, dark brown (7.5YR 3/4) moist; weak very fine granular structure; soft, very friable; neutral (pH 7.2); clear smooth boundary.

Bw—3 to 11 inches; brown (7.5YR 4/4) sandy loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral (pH 7.2); abrupt smooth boundary.

R—11 inches; sandstone bedrock.

The depth to bedrock ranges from 7 to 20 inches. The texture is sandy loam or loam in the control section. The content of clay in the control section ranges from 18 to 22 percent. Reaction is neutral or mildly alkaline throughout the profile.

The A horizon has hue of 5YR to 10YR, value of 3 moist and 4 or 5 dry, and chroma of 2 to 4.

The Bw horizon has hue of 5YR to 10YR, value of 3 moist and 4 or 5 dry, and chroma of 4 or 5.

Durango Family

The Durango family consists of moderately deep or deep, well drained soils on pediments. These soils formed in place in residuum and locally transported alluvium. The slope ranges from 3 to 15 percent. The average annual precipitation is about 15 inches, and the average annual soil temperature is about 52 degrees F.

Reference pedon of the Durango family, in an area where the slope is 3 percent; SE¼SW¼ sec. 13, T. 50 N., R. 14 W., in Mesa County:

A—0 to 4 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; neutral (pH 7.0); clear smooth boundary.

BAt—4 to 10 inches; reddish brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; very few thin clay films on faces of peds; common fine and medium roots; neutral (pH 7.2); clear smooth boundary.

Bt1—10 to 18 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few moderately thick clay films on faces of peds; common very fine and fine roots; neutral (pH 7.2); clear wavy boundary.

Bt2—18 to 25 inches; reddish brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films; few fine roots; mildly alkaline (pH 7.6); clear wavy boundary.

Btk—25 to 42 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few thin clay films on faces of peds; few fine roots; moderately alkaline (pH 8.0); calcareous; gradual wavy boundary.

BCk—42 to 60 inches; light reddish brown (5YR 6/4) clay, reddish brown (5YR 4/4) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; moderately alkaline (pH 8.0); calcareous.

Reaction ranges from neutral to moderately alkaline. The depth to bedrock ranges from 20 to more than 60 inches. The content of coarse fragments on the surface and in the profile ranges dominantly from 0 to 15 percent, but it ranges from 0 to 25 percent in some pedons.

The A horizon is 2 to 10 inches thick. It has hue of 5YR to 10YR. It is loamy sand, sandy loam, or loam.

The Bt horizon has hue of 5YR to 10YR. It is clay loam or clay. The content of clay ranges from 35 to 45 percent. The horizon generally is calcareous in the lower part.

The C horizon, if it occurs, is clay loam or clay. It is generally strongly calcareous.

Empedrado Family

The Empedrado family consists of deep, well drained soils on broad alluvial fans, toe slopes, and fan terraces. These soils formed in alluvium and residuum derived dominantly from sandstone and shale. The slope ranges from 2 to 15 percent. Elevation ranges from 8,000 to 8,400 feet. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Empedrado family, about one-fourth mile south of Casto Reservoir, NW¼NW¼ sec. 27, T. 15 S., R. 101 W., in Mesa County:

A1—0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; neutral (pH 7.2); clear smooth boundary.

A2—2 to 10 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine to coarse roots; neutral (pH 7.2); clear smooth boundary.

Bt1—10 to 15 inches; brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/3) moist; strong fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; common thin clay films on faces of peds; few very fine and fine and common medium roots; neutral (pH 7.2); clear wavy boundary.

Bt2—15 to 28 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; common moderately thick clay films on faces of peds; few very fine and fine

and common medium roots; neutral (pH 7.3); clear wavy boundary.

Bt3—28 to 42 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 5/6) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common thin clay films on faces of peds; few very fine and fine roots; neutral (pH 7.5); clear wavy boundary.

BCk—42 to 60 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/8) moist; massive; very hard, firm, sticky and plastic; few thin clay films on faces of peds; few very fine and fine roots; moderately alkaline (pH 8.2).

Thickness of the mollic epipedon ranges from 7 to 15 inches. The depth to lime ranges from 25 to 45 inches. The content of coarse fragments ranges from 0 to 5 percent in the control section.

The A horizon has hue of 10YR to 5YR, value of 4 or 5 dry, and chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 3 to 6. It is clay loam, sandy clay loam, or loam. The content of clay ranges from 25 to 35 percent. Reaction is neutral or mildly alkaline.

The BCk horizon has hue of 5YR or 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 6 to 8. It is sandy clay loam or clay loam. The content of clay ranges from 25 to 35 percent.

Falcon Family

The Falcon family consists of shallow, well drained soils on pediments and plateau tops. These soils formed in residuum derived from sandstone. The slope ranges from 1 to 15 percent. Elevation ranges from 8,000 to 8,800 feet. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Falcon family, in an area where the slope is 2 percent; NW¼NE¼ sec. 13, T. 15 S., R. 101 W., in Mesa County:

Oe—2 inches to 0; partially decomposed and undecomposed needles and leaves.

A1—0 to 3 inches; brown (10YR 5/3) stony sandy loam, dark brown (7.5YR 3/2) moist; weak medium granular structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; 5 percent gravel and 5 percent stones; neutral (pH 7.4); clear smooth boundary.

A2—3 to 10 inches; brown (10YR 5/3) sandy loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 5 percent gravel; neutral (pH 7.4); abrupt smooth boundary.

R—10 inches; sandstone bedrock.

Thickness of the mollic epipedon ranges from 7 to 15 inches. The depth to bedrock ranges from 7 to 20 inches. The content of clay in the control section ranges from 10 to 20 percent.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5 dry and 2 or 3 moist, and chroma of 1 to 3. It is sandy loam, sandy clay loam, or gravelly sandy loam.

Gralic Family

The Gralic family consists of deep, well drained, cobbly soils on mountain side slopes. These soils formed in alluvium and colluvium derived from interbedded sandstone and shale. The slope ranges from 15 to 50 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F.

Reference pedon of the Gralic family, in an area where the slope is 18 percent; east of Long Creek Road, NE¼NW¼ sec. 18, T. 48 N., R. 12 W., in Montrose County:

Oi—2 inches to 0; partially decomposed needles, leaves, twigs, and roots.

A—0 to 5 inches; pinkish gray (7.5YR 6/2) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine roots; 5 percent gravel and 5 percent cobbles; medium acid (pH 5.6); clear smooth boundary.

C1—5 to 19 inches; pink (7.5YR 7/4) gravelly fine sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots; 10 percent gravel and 5 percent cobbles; medium acid (pH 5.6); gradual wavy boundary.

C2—19 to 60 inches; pink (7.5YR 7/4) extremely cobbly fine sandy loam, strong brown (7.5YR 5/6) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few medium roots; 30 percent gravel, 30 percent cobbles, and 5 percent stones; medium acid (pH 5.5).

The A horizon is 5 to 8 inches thick. It has hue of 7.5YR or 10YR, value of 4 or 5 moist and 5 to 7 dry, and chroma of 3 to 6. It is fine sandy loam or gravelly or cobbly fine sandy loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5 moist and 5 to 7 dry, and chroma of 3 to 6. It is

generally the very gravelly, extremely gravelly, or extremely cobbly analogs of fine sandy loam or sandy loam, but it is gravelly fine sandy loam in the upper part and has less than 18 percent clay. The content of coarse fragments ranges from 35 to 80 percent. Strata of shale are common below a depth of 40 inches. Reaction is medium acid or slightly acid.

Grenadier Family

The Grenadier family consists of deep, well drained, cobbly soils on moderately steep or steep side slopes of valleys, commonly on north aspects. These soils formed in material weathered from sandstone. The slope ranges from 15 to 50 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F.

Reference pedon of the Grenadier family, along a logging road northeast of Iron Spring Campground, SW¼SW¼ sec. 13, T. 47 N., R. 12 W., in Montrose County:

Oi—3 to 2 inches; undecomposed needles, twigs, and bark.
Oe—2 inches to 0; decomposed forest litter.
A—0 to 4 inches; brown (7.5YR 5/2) cobbly fine sandy loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; 10 percent gravel, 10 percent cobbles, and 5 percent stones; medium acid (pH 5.6); clear wavy boundary.
Bw1—4 to 32 inches; light brown (7.5YR 6/4) stony sandy loam, brown (7.5YR 4/4) moist; weak medium granular structure; slightly hard, very friable, nonsticky and nonplastic; 10 percent gravel, 10 percent cobbles, and 10 percent stones; medium acid (pH 5.2); gradual wavy boundary.
Bw2—32 to 50 inches; reddish yellow (7.5YR 6/6) very cobbly sandy loam, strong brown (7.5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; 15 percent gravel, 25 percent cobbles, and 10 percent stones; medium acid (pH 5.8).
Cr—50 inches; highly weathered sandstone bedrock.

Thickness of the solum and the depth to bedrock range from 40 to more than 60 inches. The content of rock fragments ranges from 20 to 30 percent in the A horizon and from 25 to 75 percent in the B horizon, but it ranges from 35 to 60 percent on a weighted average basis. Reaction is medium acid or slightly acid in the solum.

The A horizon has hue of 7.5YR or 10YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 to 4. It is gravelly loam, cobbly fine sandy loam, or stony fine sandy loam.

The Bw horizon is 3 to 20 inches thick. It has hue of 7.5YR or 10YR, value of 6 or 7 dry and 4 to 6 moist, and chroma of 4 to 6. It is the very cobbly or very stony analogs of fine sandy loam or sandy loam. Interbedded sandstone and shale bedrock generally is below a depth of 60 inches, but in some pedons it is between depths of 40 and 60 inches.

Hapgood Family

The Hapgood family consists of deep, well drained, cobbly soils on mountain side slopes. These soils formed in residuum and colluvium derived from interbedded sandstone and shale. The slope ranges from 5 to 50 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F.

Reference pedon of the Hapgood family, in an area where the slope is 15 percent; on States Draw Road, SE¼SW¼ sec. 23, T. 47 N., R. 12 W., in Montrose County:

A1—0 to 8 inches; dark brown (10YR 3/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable, nonsticky and slightly plastic; common fine, medium, and coarse roots; 10 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.
A2—8 to 17 inches; brown (10YR 4/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; 25 percent gravel and 20 percent cobbles; slightly acid (pH 6.2); clear smooth boundary.
AC—17 to 27 inches; yellowish brown (10YR 5/4) extremely cobbly loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; few fine and medium roots; 20 percent gravel, 40 percent cobbles, and 15 percent stones; slightly acid (pH 6.2); clear wavy boundary.
C—27 to 60 inches; very pale brown (10YR 7/3) extremely stony loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; 15 percent gravel, 30 percent cobbles, and 30 percent stones; medium acid (pH 6.0).

Thickness of the mollic epipedon ranges from 16 to

36 inches. Reaction is medium acid or slightly acid in the control section. The content of coarse fragments in the control section ranges from 35 to 75 percent. The depth to bedrock is more than 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is loam or cobbly loam in the upper part and very cobbly loam or very cobbly sandy clay loam in the lower part.

The C horizon has hue of 7.5YR or 10YR, value of 6 or 7 dry and 4 to 6 moist, and chroma of 3 or 4. The texture of the control section is loam or sandy clay loam on a weighted average basis. The content of clay ranges from 18 to 25 percent. The content of rock fragments ranges from 35 to 75 percent.

Hoosan Family

The Hoosan family consists of deep, well drained soils on hilltops and hillsides. These soils formed in loess over slope alluvium and residuum derived from interbedded sandstone and shale. The slope ranges from 3 to 30 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is 40 degrees F.

Reference pedon of the Hoosan family, in an area where the slope is 11 percent; NW¼SE¼ sec. 35, T. 50 N., R. 16 W., in Mesa County:

A1—0 to 10 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; neutral (pH 7.2); clear smooth boundary.

A2—10 to 22 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; few fine roots; 5 percent gravel and 5 percent cobbles; neutral (pH 7.2); clear wavy boundary.

2C1—22 to 38 inches; very pale brown (10YR 7/4) stony clay, yellowish brown (10YR 5/4) moist; strong medium angular blocky structure; very hard, very firm, sticky and very plastic; few very fine roots; 5 percent gravel, 5 percent cobbles, and 15 percent stones; neutral (pH 7.4); clear wavy boundary.

2C2—38 to 60 inches; pale red (2.5YR 6/2) clay, pale red (2.5YR 6/2) moist; massive; very hard, very firm, sticky and very plastic; mildly alkaline (pH 7.4).

Thickness of the mollic epipedon ranges from 16 to 30 inches. The A horizon is loam or clay loam. The C horizon has hue of 2.5YR to 10YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 2 to 4. In some pedons a stone line is in the upper part of the C horizon.

Jodero Family

The Jodero family consists of deep, well drained soils on broad alluvial valley bottoms, toe slopes, and benches. These soils formed in alluvium and residuum derived dominantly from sandstone and shale. The slope ranges from 1 to 8 percent. Elevation ranges from 8,000 to 8,400 feet. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Jodero family, about one-fourth mile south of Casto Reservoir, NW¼NW¼ sec. 27, T. 15 S., in Mesa County:

A1—0 to 3 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; neutral (pH 7.0); clear smooth boundary.

A2—3 to 18 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; hard, firm, nonsticky and nonplastic; common fine roots; neutral (pH 7.2); clear wavy boundary.

Bw—18 to 27 inches; brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) moist; weak medium subangular blocky structure; very hard, friable, nonsticky and slightly plastic; few fine roots; neutral (pH 7.1); gradual wavy boundary.

BC—27 to 37 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few fine roots; neutral (pH 7.3); gradual wavy boundary.

C1—37 to 51 inches; reddish brown (5YR 5/4) clay loam, strong brown (7.5YR 4/6) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; neutral (pH 7.3); gradual wavy boundary.

C2—51 to 60 inches; reddish brown (5YR 5/4) clay loam, strong brown (7.5YR 4/6) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; mildly alkaline (pH 7.5).

Thickness of the mollic epipedon ranges from 16 to 30 inches. The content of coarse fragments, mainly gravel-sized fragments, ranges from 0 to 10 percent in the control section. The texture of the control section is sandy clay loam or loam. The content of clay in the control section ranges from 18 to 28 percent.

The A horizon has hue of 10YR to 5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is loam or sandy loam. The content of clay ranges from 16 to 26 percent.

The Bw horizon has hue of 10YR to 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 to 4. It is loam or sandy clay loam.

The C horizon has hue of 5YR or 7.5YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 3 to 6. It is clay loam or sandy clay loam. Reaction is neutral or mildly alkaline.

Kubler Family

The Kubler family consists of deep, well drained soils on outwash fans and mountain foot slopes. These soils formed in alluvium weathered from shale and sandstone. The slope ranges from 1 to 45 percent. The average annual precipitation is about 18 inches, and the average annual soil temperature is about 45 degrees F.

Reference pedon of the Kubler family, in an area where the slope is 5 percent; along Craig Point Road, SE¼ sec. 2, T. 45 N., R. 12 W., in Montrose County:

A—0 to 7 inches; dark brown (10YR 3/3) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; mildly alkaline (pH 7.4); clear smooth boundary.

BA—7 to 11 inches; dark brown (10YR 3/3) clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; common fine and medium roots; neutral (pH 7.0); clear smooth boundary.

Bt1—11 to 22 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine angular blocky; hard, firm, sticky and plastic; few fine and medium roots; common thin clay films on faces of peds; neutral (pH 7.0); gradual smooth boundary.

Bt2—22 to 33 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; few very dark brown (10YR 2/2) organic stains on faces of peds; moderate medium prismatic structure parting to strong fine and medium angular blocky; very hard, firm, very sticky and very plastic; few fine roots; common thin clay films on faces of peds; neutral (pH 7.2); clear smooth boundary.

Bt3—33 to 44 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak coarse angular blocky; very hard, firm, very sticky and very plastic; common thin clay films on faces of peds; neutral (pH 7.3); gradual smooth boundary.

Btk—44 to 50 inches; reddish brown (5YR 5/4) clay, yellowish red (5YR 4/6) moist; weak coarse subangular blocky structure; very hard, firm, very sticky and very plastic; glossy pressure coatings on faces of peds; calcareous (soft masses of calcium carbonate concentrated as streaks); moderately alkaline (pH 8.0); gradual smooth boundary.

BCk—50 to 60 inches; reddish brown (5YR 5/4) clay, yellowish red (5YR 4/6) moist; weak coarse subangular blocky structure; very hard, firm, very sticky and very plastic; glossy pressure coatings on faces of peds; calcareous (soft masses of calcium carbonate concentrated as streaks); moderately alkaline (pH 7.9).

Thickness of the mollic epipedon ranges from 16 to 27 inches. The depth to calcareous material ranges from 30 to 45 inches. Some pedons do not contain lime. The content of coarse fragments ranges from 0 to 30 percent. The depth to bedrock is 40 inches or more.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 or 3.

The Bt horizon has hue of 7.5YR or 5YR, value of 4 to 6 dry and 3 to 6 moist, and chroma of 4 to 6. It is clay or clay loam. The content of clay ranges from 35 to 50 percent.

The BC horizon has hue of 10YR to 5YR. It is clay loam, clay, or gravelly clay loam.

Lamphier Family

The Lamphier family consists of deep, well drained soils on mountain side slopes and ridges. These soils formed in material weathered from interbedded sandstone and shale. The slope ranges from 5 to 50 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F.

Reference pedon of the Lamphier family, in an area where the slope is 10 percent; NW¼SW¼ sec. 16, T. 50 N., R. 16 W., in Mesa County:

A1—0 to 20 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; 5 percent gravel and 5 percent cobbles; neutral (pH 7.2); gradual wavy boundary.

A2—20 to 35 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; 5 percent gravel and 5 percent cobbles and stones; neutral (pH 7.2); gradual wavy boundary.

C1—35 to 45 inches; variegated light gray and light yellowish brown (10YR 6/3, 6/4, and 7/2) gravelly

clay loam, yellowish brown (10YR 5/6, mixed) moist; massive; very hard, firm, slightly sticky and slightly plastic; few fine roots; 10 percent gravel and 5 percent cobbles; neutral (pH 6.8); gradual wavy boundary.

C2—45 to 60 inches; variegated brownish yellow to light gray (10YR 6/6 and 7/2) gravelly sandy clay loam, yellowish brown (10YR 5/6, mixed) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; 15 percent gravel and 5 percent cobbles; neutral (pH 7.0).

Thickness of the mollic epipedon ranges from 16 to 35 inches. The content of rock fragments typically ranges from 5 to 15 percent, but in some pedons it ranges from 5 to 35 percent. Bedrock is generally at a depth of more than 60 inches, but in some pedons it is at a depth of only 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is loam or sandy clay loam. The content of clay ranges from 18 to 26 percent.

The C horizon has hue of 2.5YR to 10YR, value of 5 to 7 dry and 3 to 6 moist, and chroma of 2 to 7. It is sandy clay loam, clay loam, or clay. The content of clay ranges from 25 to 35 percent in the control section.

Leaps Family

The Leaps family consists of deep, well drained soils on plateau side slopes. These soils formed in residuum and alluvium derived from interbedded sandstone and shale. They are covered by varying thicknesses of loess. The slope ranges from 3 to 30 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is 40 degrees F.

Reference pedon of the Leaps family, in an area where the slope is 10 percent; NW¼SE¼ sec. 35, T. 50 N., R. 16 W., in Mesa County:

A1—0 to 10 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; neutral (pH 7.2); clear wavy boundary.

A2—10 to 14 inches; grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong medium subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few fine roots; neutral (pH 7.2); clear wavy boundary.

2C1—14 to 23 inches; very pale brown (10YR 7/3) clay, brown (10YR 5/3) moist; strong coarse prismatic structure; very hard, very firm, sticky and very plastic; neutral (pH 7.0); gradual wavy boundary.

2C2—23 to 60 inches; light gray (10YR 7/2) clay, grayish brown (10YR 5/2) moist; massive; very hard, very friable, sticky and very plastic; neutral (pH 7.0).

Thickness of the mollic epipedon ranges from 7 to 15 inches.

The A horizon has hue of 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is loam or clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 2 or 3. It is clay or silty clay.

Mirand Family

The Mirand family consists of moderately deep to very deep, well drained soils on benches and on side slopes in breaks. These soils formed in loess mixed with alluvium and residuum derived from interbedded sandstone and shale. The slope ranges from 3 to 20 percent. The average annual precipitation is about 16 inches, and the average annual soil temperature is about 52 degrees F.

Reference pedon of the Mirand family, in an area where the slope is 8 percent; SE¼NW¼ sec. 17, T. 46 N., R. 13 W., in Montrose County:

A—0 to 8 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; neutral (pH 7.2); clear wavy boundary.

BA—8 to 12 inches; dark yellowish brown (10YR 4/4) clay loam, dark yellowish brown (10YR 3/4) moist; strong fine subangular blocky structure; hard, friable, sticky and slightly plastic; common thin clay films on faces of peds; few fine roots; neutral (pH 7.2); clear wavy boundary.

Bt—12 to 28 inches; brown (10YR 4/3) clay loam, dark yellowish brown (10YR 3/4) moist; strong medium subangular blocky structure; hard, friable, slightly sticky and plastic; common thin clay films on faces of peds; neutral (pH 7.2); gradual wavy boundary.

BCt—28 to 37 inches; brown (10YR 4/3) clay loam, dark yellowish brown (10YR 3/4) moist; strong fine subangular blocky structure; very hard, friable, sticky and plastic; common thin clay films on faces of peds; mildly alkaline (pH 7.4); clear wavy boundary.

BCtk—37 to 60 inches; brown (10YR 4/3) clay loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, sticky and plastic; mildly alkaline (pH 7.8); strongly calcareous (segregated lime in filaments).

Thickness of the mollic epipedon ranges from 4 to 8 inches; the upper 6 inches mixes to mollic. Reaction is neutral or mildly alkaline throughout the profile. The content of coarse fragments ranges from a trace to 15 percent. The depth to bedrock ranges from 20 to more than 60 inches.

The A horizon has hue of 5YR to 10YR or is neutral in hue. It has value of 3 to 5 dry and 2 or 3 moist and chroma of 0 to 3. It is loam or cobbly loam.

The upper part of the argillic horizon is clay loam or clay. The content of clay typically ranges from 35 to 45 percent, but the range includes sandy clay loam in the lower part.

Olathe Family

The Olathe family consists of shallow, well drained soils on plateau uplands. These soils formed in material weathered from sandstone. The slope ranges from 3 to 20 percent. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 38 degrees F.

Reference pedon of the Olathe family, in an area where the slope is 3 percent; along a logging road from the Raspberry microwave site, SW¼NW¼ sec. 20, T. 47 N., R. 12 W., in Montrose County:

Oi—2 inches to 0; partially decomposed needles, bark, and twigs.

A—0 to 4 inches; pinkish gray (7.5YR 6/2) fine sandy loam, dark brown (7.5YR 4/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

Bw1—4 to 10 inches; light brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure parting to weak fine and very fine granular; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); clear wavy boundary.

Bw2—10 to 15 inches; pink (7.5YR 7/4) cobbly sandy loam, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; 5 percent gravel and 10 percent cobbles; medium acid (pH 5.8); clear wavy boundary.

Cr—15 to 17 inches; strongly weathered sandstone; abrupt wavy boundary.

R—17 inches; sandstone bedrock.

The depth to bedrock ranges from 7 to 20 inches. The content of coarse fragments ranges from 5 to 25 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 6 dry and 3 or 4 moist, and chroma of 2 to 4. It is fine sandy loam, gravelly sandy loam, or loam.

The Bw horizon has hue of 7.5YR or 10YR, value of 6 or 7 dry and 3 to 6 moist, and chroma of 4 to 6. It is cobbly fine sandy loam, sandy loam, gravelly sandy loam, or cobbly sandy loam.

Overgaard Family

The Overgaard family consists of moderately deep and deep, well drained soils on plateaus. These soils formed in material weathered from interbedded sandstone and shale. The slope ranges from 3 to 20 percent. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 38 degrees F.

Reference pedon of the Overgaard family, in an area where the slope is 3 percent; at the Raspberry microwave site, SE¼NE¼ sec. 20, T. 47 N., R. 12 W., in Montrose County:

Oi—2 inches to 0; partially decomposed needles, bark, and twigs.

A—0 to 3 inches; light brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

E—3 to 9 inches; pink (7.5YR 7/4) fine sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure parting to moderate fine granular; soft, very friable, nonsticky and nonplastic; common fine and medium roots; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); gradual wavy boundary.

Bt1—9 to 14 inches; reddish yellow (7.5YR 7/6) cobbly clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; few medium roots; 5 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); gradual wavy boundary.

Bt2—14 to 26 inches; reddish yellow (7.5YR 7/8) cobbly clay loam, strong brown (7.5YR 5/8) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films on faces of peds; few medium roots; 5 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); clear smooth boundary.

R—26 inches; sandstone bedrock.

Reaction ranges from strongly acid to neutral. Bedrock typically is at a depth of 20 to 40 inches, but in

some pedons it is at a depth of more than 60 inches.

The A horizon has hue of 7.5YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 3 or 4. It is loamy sand, fine sandy loam, or loam. In some pedons the E horizon is albic.

The Bt horizon has hue of 7.5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 6 to 8. It is clay loam or clay. The content of clay ranges from 35 to 45 percent.

Pendergrass Family

The Pendergrass family consists of shallow, well drained soils on gently sloping plateau tops. These soils formed in residuum derived from sandstone. The slope ranges from 1 to 15 percent. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 38 degrees F.

Reference pedon of the Pendergrass family, in an area where the slope is 1 percent; along States Draw Road, one-half mile south of Highway 90, SE¼NW¼ sec. 23, T. 47 N., R. 12 W., in Montrose County:

Oi—2 inches to 0; partially decomposed needles and twigs.
A—0 to 9 inches; brown (7.5YR 5/4) very cobbly fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure parting to weak fine granular; soft, friable, nonsticky and nonplastic; many coarse and medium roots; 20 percent gravel and 20 percent cobbles; very strongly acid (pH 4.8); clear wavy boundary.
C—9 to 17 inches; light brown (7.5YR 6/4) very cobbly fine sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; soft, friable, slightly sticky and slightly plastic; many coarse and medium roots; 20 percent gravel and 25 percent cobbles; very strongly acid (pH 4.8); abrupt wavy boundary.
R—17 inches; fractured sandstone bedrock.

The depth to bedrock ranges from 10 to 20 inches. The texture of the control section is typically very cobbly fine sandy loam or very cobbly sandy loam. The content of rock fragments ranges from 35 to 60 percent. Reaction ranges from very strongly acid to medium acid.

The A horizon has hue of 7.5YR or 5YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 3 to 6.

Sawcreek Family

The Sawcreek family consists of moderately deep, well drained soils on mesa tops and benches. These soils formed in residuum and alluvium derived from sandstone. The slope ranges from 1 to 15 percent. The average annual precipitation is about 21 inches, and the average annual soil temperature is 41 degrees F.

Reference pedon of the Sawcreek family, in an area where the slope is 5 percent; NW¼NW¼ sec. 34, T. 15 S., R. 102 W., in Mesa County:

A—0 to 9 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; neutral (pH 7.0); clear smooth boundary.
Bw1—9 to 19 inches; yellowish brown (10YR 5/4) sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; neutral (pH 6.9); clear smooth boundary.
Bw2—19 to 23 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; neutral (pH 6.8); abrupt smooth boundary.
Cr—23 to 26 inches; weathered sandstone.
R—26 inches; Wingate sandstone.

The depth to hard bedrock ranges from 20 to 40 inches. Thickness of the mollic epipedon ranges from 7 to 16 inches. The control section is typically loam or sandy loam and has 10 to 18 percent clay. Reaction ranges from neutral to medium acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is sandy loam or loam.

The B horizon has hue of 7.5YR or 10YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 to 4.

Sharrott Family

The Sharrott family consists of shallow, well drained soils on plateau tops. These soils formed in material weathered from sandstone. The slope ranges from 1 to 7 percent. The average annual precipitation is about 17 inches, and the average annual soil temperature is about 46 degrees F.

Reference pedon of the Sharrott family, in an area where the slope is 3 percent; along Sanborn Park Road, NE¼ sec. 32, T. 46 N., R. 11 W., in Montrose County:

A—0 to 4 inches; brown (10YR 4/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; 15 percent

gravel and 15 percent cobbles; neutral (pH 6.6); clear smooth boundary.

Bw1—4 to 12 inches; brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 4/4) moist; weak moderate subangular blocky structure parting to moderate fine granular; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; 20 percent gravel and 10 percent cobbles; neutral (pH 6.6); clear wavy boundary.

Bw2—12 to 15 inches; yellowish brown (10YR 5/6) extremely gravelly sandy loam, dark brown (7.5YR 4/4) moist; moderate fine granular structure; slightly hard, friable, nonsticky and nonplastic; very few fine roots; 50 percent gravel and 10 percent cobbles; slightly acid (pH 6.4); abrupt wavy boundary.

R—15 inches; sandstone bedrock.

The depth to bedrock ranges from 8 to 20 inches. Reaction ranges from medium acid to neutral. The content of rock fragments ranges from 35 to 70 percent in the control section.

The A horizon has hue of 10YR, value of 4 dry and 2 or 3 moist, and chroma of 1 to 3. It is cobbly loam, fine sandy loam, gravelly fine sandy loam, or gravelly loam.

The B horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 to 6. It is the very gravelly or extremely gravelly analogs of fine sandy loam or sandy loam. The content of clay ranges from 5 to 18 percent.

Showalter Family

The Showalter family consists of deep, well drained, cobbly soils on alluvial fans and mountain side slopes. These soils formed in alluvium derived from shale and sandstone. The slope ranges from 15 to 45 percent. The average annual precipitation is about 18 inches, and the average annual soil temperature is about 45 degrees F.

Reference pedon of the Showalter family, in an area where the slope is 15 percent; SW¼SE¼ sec. 3, T. 46 N., R. 10 W., in Montrose County:

A1—0 to 11 inches; dark brown (7.5YR 4/2) gravelly loam, very dark brown (7.5YR 2/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; 10 percent gravel and 5 percent cobbles; neutral (pH 6.8); clear wavy boundary.

A2—11 to 16 inches; brown (7.5YR 5/2) gravelly clay loam, dark brown (7.5YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; 10 percent gravel and 5 percent cobbles; neutral (pH 6.8); clear wavy boundary.

Bt1—16 to 24 inches; light brown (7.5YR 6/4) very cobbly clay loam, dark brown (7.5YR 4/4) moist; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few thin clay films on faces of peds; 20 percent gravel, 30 percent cobbles, and 5 percent stones; neutral (pH 6.6); clear wavy boundary.

Bt2—24 to 32 inches; light brown (7.5YR 6/4) very cobbly clay, dark brown (7.5YR 4/4) moist; moderate medium and fine angular and subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common thin clay films on faces of peds; 30 percent gravel, 20 percent cobbles, and 10 percent stones; diffuse wavy boundary.

BCt—32 to 60 inches; light brown (7.5YR 6/4) extremely cobbly clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, slightly sticky and slightly plastic; few fine roots; few thin clay films on faces of peds; 50 percent gravel, 30 percent cobbles, and 10 percent stones.

Thickness of the mollic epipedon ranges from 7 to 16 inches. The content of coarse fragments ranges from 35 to 90 percent, by volume, in the B horizon and from 10 to 35 percent, by volume, in the rest of the profile.

The A horizon has hue of 5YR to 10YR, value of 3 to 5 dry and 2 or 3 moist, and chroma of 1 or 2. It is loam, clay loam, or cobbly clay loam.

The Bt horizon has hue of 5YR to 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 to 6. It is very cobbly clay or very cobbly clay loam. The content of clay ranges from 35 to 55 percent in the fine-earth fraction.

Splitro Family

The Splitro family consists of shallow, well drained soils on benches and tops of mesas. These soils formed in material weathered from sandstone. The slope ranges from 1 to 15 percent. The average annual precipitation is about 21 inches, and the average annual soil temperature is about 41 degrees F.

Reference pedon of the Splitro family, in an area where the slope is 3 percent; SW¼SW¼ sec. 27, T. 15 S., R. 102 W., in Mesa County:

A1—0 to 7 inches; dark grayish brown (10YR 4/2) cobbly loam, black (10YR 2/1) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; 10 percent gravel, 10

percent cobbles, and 5 percent stones; many fine and common medium roots; slightly acid (pH 6.3); clear smooth boundary.

A2—7 to 15 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; many fine and common medium roots; 10 percent gravel, 10 percent cobbles, and 5 percent stones; slightly acid (pH 6.3); abrupt wavy boundary.

R—15 inches; sandstone bedrock.

The depth to bedrock ranges from 5 to 20 inches. Thickness of the mollic epipedon dominantly ranges from 6 to 16 inches, but in some pedons it ranges from 6 to 18 inches. The control section is typically loam or sandy loam and has 10 to 18 percent clay and 10 to 30 percent rock fragments. Reaction is neutral or slightly acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 1 to 3. It is cobbly or stony loam or sandy loam. The content of rock fragments ranges from 10 to 30 percent.

The Bw horizon, if it occurs, has hue of 7.5YR or 10YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 to 4.

Supervisor Family

The Supervisor family consists of moderately deep and deep, well drained soils on plateau tops. These soils formed in residuum and local alluvium derived from interbedded sandstone and shale. The slope ranges from 1 to 15 percent. The average annual precipitation is about 23 inches, and the average annual soil temperature is about 40 degrees F.

Reference pedon of the Supervisor family, in an area where the slope is 4 percent; along Dave Wood Road, one-fourth mile north of the Ouray-Montrose County line, SE¼ sec. 17, T. 46 N., R. 10 W., in Montrose County:

Oi—1 inch to 0; partially decomposed leaves, grass, and twigs.

A—0 to 11 inches; brown (10YR 4/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; 10 percent gravel, 30 percent cobbles, and 10 percent stones; slightly acid (pH 6.2); clear smooth boundary.

AC—11 to 16 inches; pale brown (10YR 6/3) very cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; 10 percent gravel, 30 percent cobbles, and 15 percent stones; slightly acid (pH 6.2); clear smooth boundary.

C—16 to 25 inches; very pale brown (10YR 7/4) extremely stony loam, yellowish brown (10YR 5/6) moist; massive; soft, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; 20 percent gravel, 30 percent cobbles, and 30 percent stones; slightly acid (pH 6.2); abrupt wavy boundary.

R—25 inches; fractured Dakota sandstone.

The depth to bedrock ranges from 20 to 40 inches. Thickness of the mollic epipedon ranges from 8 to 15 inches. The content of rock fragments ranges from 35 to 80 percent throughout the profile and increases with increasing depth. Reaction ranges from medium acid to neutral. The content of clay ranges from 7 to 18 percent in the control section.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is very cobbly sandy loam or loam.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 3 to 6. It is extremely stony or cobbly sandy loam or loam.

Trampas Family

The Trampas family consists of deep, well drained soils on gently sloping to steep benches and valley side slopes. These soils formed in material weathered from interbedded sandstone and shale. The slope ranges from 5 to 30 percent. The average annual precipitation is about 18 inches, and the average annual soil temperature is about 45 degrees F.

Reference pedon of the Trampas family, in an area where the slope is 8 percent; along Hanks Valley Road, one-fourth mile east of the Jutton turnoff, SE¼SE¼ sec. 18, T. 46 N., R. 11 W., in Montrose County:

Oi—1 inch to 0; undecomposed pine needles, grass, and twigs.

A—0 to 4 inches; brown (7.5YR 5/2) cobbly loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; 5 percent gravel, 15 percent cobbles, and 5 percent stones; slightly acid (pH 6.4); clear wavy boundary.

E—4 to 11 inches; pink (7.5YR 7/4) cobbly loam, brown (7.5YR 5/4) moist; weak fine and very fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; 10 percent gravel, 15 percent cobbles, and 5

percent stones; slightly acid (pH 6.2); gradual wavy boundary.

B/E—11 to 20 inches; mixed pink (7.5YR 7/4) and reddish brown (5YR 5/4) very cobbly clay loam; reddish brown (5YR 5/4) moist on faces of peds and reddish brown (5YR 4/4) moist, crushed; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few thin clay films on faces of peds and lining pores; 20 percent gravel, 30 percent cobbles, and 10 percent stones; slightly acid (pH 6.2); gradual wavy boundary.

Bt1—20 to 45 inches; reddish brown (5YR 5/4) extremely cobbly clay, reddish brown (5YR 4/4) moist; moderate fine angular blocky structure; extremely hard, firm, sticky and plastic; few fine roots in cracks; 20 percent gravel, 35 percent cobbles, and 10 percent stones; slightly acid (pH 6.2); gradual wavy boundary.

Bt2—45 to 60 inches; reddish brown (5YR 5/4) extremely stony clay, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; few fine roots in cracks; common thin clay films; dark organic stains on faces of some peds; 20 percent gravel, 20 percent cobbles, and 40 percent stones; slightly acid (pH 6.2).

Thickness of the solum is more than 40 inches. Reaction is slightly acid or neutral in the solum.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is loam or fine sandy loam. The content of coarse fragments, mainly stones and cobbles, ranges from 15 to 35 percent.

The E horizon has hue of 7.5YR, value of 6 or 7 dry and 3 to 5 moist, and chroma of 2 to 4. It is loam or fine sandy loam. The content of coarse fragments ranges from 25 to 55 percent.

The Bt horizon has hue of 5YR or 7.5YR, value of 5 to 7 dry and 4 or 5 moist, and chroma of 4 to 6. It is clay or clay loam. The content of coarse fragments ranges from 35 to 80 percent.

Ula Family

The Ula family consists of deep and moderately deep, well drained soils on plateau tops. These soils formed in material weathered from sandstone and shale. The slope ranges from 1 to 15 percent. The average annual precipitation is about 25 inches, and the average annual soil temperature is about 38 degrees F.

Reference pedon of the Ula family, in an area where the slope is 7 percent; NE¼NE¼ sec. 18, T. 47 N., R. 11 W., in Montrose County:

Oi—3 to 2 inches; undecomposed needles, grass, and twigs.

Oe—2 inches to 0; decomposed organic mat of needles, grass, and twigs.

A1—0 to 2 inches; dark brown (7.5YR 4/2) loam, very dark brown (7.5YR 2/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; common fine roots; 5 percent gravel and 5 percent cobbles; neutral (pH 6.8); clear smooth boundary.

A2—2 to 7 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; common fine roots; 5 percent gravel and 5 percent cobbles; neutral (pH 6.6); clear smooth boundary.

E—7 to 17 inches; pinkish gray (7.5YR 6/2) cobbly fine sandy loam, dark brown (7.5YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; few fine roots; 5 percent gravel and 15 percent cobbles; neutral (pH 6.6); clear wavy boundary.

B/E—17 to 25 inches; variegated pinkish gray (7.5YR 7/2) and strong brown (7.5YR 5/6) cobbly sandy loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; common fine roots; 5 percent gravel and 15 percent cobbles; medium acid (pH 6.0); clear wavy boundary.

Bt1—25 to 45 inches; reddish yellow (7.5YR 6/6) cobbly sandy clay loam, strong brown (7.5YR 5/6) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; few fine and very fine roots; 10 percent gravel and 20 percent cobbles; strongly acid (pH 5.2); clear wavy boundary.

Bt2—45 to 53 inches; reddish yellow (7.5YR 6/6) cobbly sandy clay loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; 5 percent gravel and 20 percent cobbles; very strongly acid (pH 4.6); clear wavy boundary.

R—53 inches; sandstone bedrock.

Thickness of the mollic epipedon ranges from 4 to 10 inches. Bedrock is typically at a depth of 30 to 55

inches, but in some pedons it is at a depth of 20 to more than 60 inches. The content of coarse fragments ranges from 10 to 35 percent in the control section and from 10 to 60 percent in the substratum, if it occurs.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 6 dry and 2 to 5 moist, and chroma of 2 or 3. It is loam or fine sandy loam.

The Bt horizon has hue of 5YR to 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 to 8. It is cobbly sandy clay loam or cobbly clay loam.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

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.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle

pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suitable for crop production unless irrigated.
Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.
Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.
Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.
Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.
Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.
Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

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.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

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. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil.

The soil is not a source of gravel or sand for construction purposes.

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.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

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. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

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, any plowed or disturbed surface layer.

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 O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon 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) granular, 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 horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but 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-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil may be assigned to two hydrologic groups.

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.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long,

continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

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. An area 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.

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. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

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.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

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.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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 downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 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.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland area with a relatively flat summit that is considerably elevated (more than 100 meters) above adjacent lowlands.

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.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

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 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

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.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's

surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, 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 substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

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).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or a very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

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.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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 and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Windthrow. The uprooting and tipping over of trees by the wind.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Norwood, Colorado)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	36.2	9.0	22.6	51	-18	0	1.03	0.42	1.53	4	14.0
February	40.6	13.7	27.2	57	-12	20	.79	.31	1.18	4	10.4
March	46.8	20.3	33.6	66	-7	35	1.01	.30	1.57	4	11.0
April	57.1	27.0	42.1	73	7	130	1.04	.53	1.47	4	6.3
May	67.6	35.2	51.4	83	18	357	1.02	.32	1.59	4	.6
June	78.4	43.0	60.7	90	28	621	.72	.22	1.13	3	.0
July	83.7	49.0	66.4	93	38	818	1.68	.83	2.40	6	.0
August	80.4	47.6	64.0	91	34	744	1.70	.87	2.44	6	.0
September	73.2	40.6	56.9	86	24	507	1.44	.25	2.37	4	.0
October	61.9	31.2	46.6	77	10	221	1.54	.42	2.45	3	2.7
November	46.5	19.7	33.1	64	-4	26	1.03	.53	1.46	3	8.1
December	37.5	10.9	24.2	54	-15	6	.94	.44	1.36	4	12.8
Yearly:											
Average	59.2	28.9	44.1	---	---	---	---	---	---	---	---
Extreme	---	---	---	93	-20	---	---	---	---	---	---
Total	---	---	---	---	---	3,485	13.94	11.18	16.65	49	65.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-80 at Norwood, Colorado)

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--	May 28	June 11	June 26
2 years in 10 later than--	May 21	June 5	June 20
5 years in 10 later than--	May 8	May 24	June 8
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 21	Sept. 14	Aug. 15
2 years in 10 earlier than--	Sept. 27	Sept. 19	Aug. 25
5 years in 10 earlier than--	Oct. 8	Sept. 29	Sept. 12

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Norwood, Colorado)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	124	100	62
8 years in 10	133	110	73
5 years in 10	152	128	95
2 years in 10	171	145	116
1 year in 10	181	155	127

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Mesa County	Montrose County	San Miguel County	Ouray County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Acres	Acres	Pct
10	Arabrab-Dalhart families complex, 3 to 15 percent slopes	10,797	5,770	0	0	16,567	2.9
11	Belain-Falcon families complex, 1 to 15 percent slopes	17,778	0	0	0	17,778	3.1
12	Borolls-Boralfs-Rock outcrop complex, 40 to 150 percent slopes	34,770	25,512	922	1,060	62,264	10.7
13	Chilson-Delson, moderately deep-Beenom families complex, 1 to 20 percent slopes	1,780	36,141	10,046	3,418	51,385	8.9
14	Chilson Variant-Rock outcrop complex, 3 to 20 percent slopes	0	2,266	0	0	2,266	0.4
15	Delson-Kubler-Showalter families complex, 15 to 45 percent slopes	12,358	12,421	713	0	25,492	4.4
16	Delson, moderately deep-Sharrott families complex, 1 to 15 percent slopes	8,401	14,994	750	2,662	26,807	4.6
17	Dough family, dry-Rock outcrop complex, 1 to 15 percent slopes	2,074	0	0	0	2,074	0.4
18	Durango-Arabrab families complex, 3 to 15 percent slopes	2,021	9,876	0	0	11,897	2.1
19	Falcon-Dough families-Rock outcrop complex, 1 to 10 percent slopes	5,519	0	0	0	5,519	0.9
20	Gralic-Grenadier families complex, 15 to 50 percent slopes	6,454	13,711	0	2,449	22,614	3.9
21	Hapgood-Lamphier families complex, 20 to 50 percent slopes	14,021	17,873	33	1,823	33,750	5.8
22	Hoosan-Lamphier-Leaps families complex, 3 to 30 percent slopes	22,999	2,177	0	6	25,182	4.4
23	Jodero-Empedrado families complex, 2 to 20 percent slopes	8,681	0	0	0	8,681	1.5
24	Kubler-Delson-Cerro families complex, 3 to 15 percent slopes	15,473	36,383	6,390	68	58,314	10.1
25	Lamphier-Hapgood families complex, 5 to 20 percent slopes	17,666	20,229	115	2,396	40,406	7.0
26	Mirand-Callan families-Chilson Variant complex, 3 to 20 percent slopes	12,404	16,193	0	0	28,597	4.9
27	Overgaard-Olathe families complex, 3 to 20 percent slopes	0	15,323	0	0	15,323	2.6
28	Sawcreek-Splitro families complex, 1 to 15 percent slopes	7,055	0	0	0	7,055	1.2
29	Supervisor-Cebone families complex, 1 to 15 percent slopes	1,142	15,616	0	4,818	21,576	3.7
30	Trampas-Delson, moderately deep, families complex, 3 to 30 percent slopes	443	14,958	2,849	0	18,250	3.2
31	Ula-Agneston-Pendergrass families complex, 1 to 15 percent slopes	932	24,891	0	6,624	32,447	5.6
32	Ustorthents-Ustochrepts-Rock outcrop complex, 40 to 150 percent slopes	14,232	27,866	1,782	476	44,356	7.7
	Total	217,000	312,200	23,600	25,800	578,600	100.0

TABLE 5.--RANGELAND

Soil name and map symbol	Present vegetation	Potential natural vegetation	Forage production potential	Revegetation limitations
			lbs/acre	
10*:				
Arabrab	Pinyon pine, Utah juniper.	Pinyon pine, Utah juniper.	300-500	Low available moisture, shallow to bedrock, natural fertility.
Dalhart	Galleta, blue grama, big sagebrush.	Galleta, needleandthread.	1,100-1,500	Natural fertility.
11:				
Belain	Ponderosa pine, manzanita.	Ponderosa pine, Arizona fescue.	1,500-1,800	Natural fertility.
Falcon	Ponderosa pine, manzanita.	Ponderosa pine, Arizona fescue.	850-1,000	Shallow to bedrock, natural fertility.
12:				
Borolls	Coniferous forest	Coniferous forest	**	Slope.
Boralfs	Coniferous forest	Coniferous forest	**	---
Rock outcrop.				
13*:				
Chilson	Ponderosa pine, Gambel oak.	Ponderosa pine----	600-800	Shallow to bedrock.
Delson, moderately deep	Ponderosa pine, Gambel oak.	Ponderosa pine----	2,000-2,500	Shrink-swell.
Beenom	Ponderosa pine, Gambel oak.	Ponderosa pine----	600-800	Shrink-swell.
14*:				
Chilson Variant-	Pinyon pine, Utah juniper.	Pinyon pine, Utah juniper.	300-500	Shallow to bedrock.
Rock outcrop.				
15*:				
Delson-Kubler---	Gambel oak, Letterman needlegrass.	Gambel oak, elk sedge.	2,000-3,000	Slope.
Showalter	Gambel oak, Letterman needlegrass.	Gambel oak, mountain bromegrass.	1,800-2,300	Slope, coarse fragments.
16*:				
Delson, moderately deep	Ponderosa pine, Gambel oak.	Ponderosa pine, Arizona fescue.	2,000-2,500	Shrink-swell.
Sharrott	Ponderosa pine, elk sedge.	Ponderosa pine, Arizona fescue.	850-1,000	Shallow to bedrock.

See footnotes at end of table.

TABLE 5.--RANGELAND--Continued

Soil name and map symbol	Present vegetation	Potential natural vegetation	Forage production potential	Revegetation limitations
			lbs/acre	
17:				
Dough, dry	Pinyon pine, Rocky Mountain juniper.	Pinyon pine, Rocky Mountain juniper.	500-800	Shallow to bedrock.
Rock outcrop.				
18*:				
Durango	Serviceberry, big sagebrush, junegrass.	Muttongrass, western wheatgrass.	1,100-1,500	Shrink-swell.
Arabrab	Pinyon pine, Utah juniper.	Pinyon pine, Utah juniper.	300-500	Shallow to bedrock, low available moisture.
19:				
Falcon	Ponderosa pine, big sagebrush.	Ponderosa pine, muttongrass.	850-1,000	Shallow to bedrock.
Dough	Ponderosa pine, big sagebrush.	Ponderosa pine, muttongrass.	800-1,000	Shallow to bedrock.
Rock outcrop.				
20*:				
Gralic	Engelmann spruce, subalpine fir, aspen, Douglas-fir.	Engelmann spruce, subalpine fir.	100-500	Coarse fragments, slope.
Grenadier	Engelmann spruce, subalpine fir, aspen, Douglas-fir.	Engelmann spruce, subalpine fir.	100-500	Coarse fragments, slope.
21:				
Hapgood	Aspen woodland	Aspen woodland	1,500-2,000	Slope, coarse fragments.
Lamphier	Aspen woodland	Aspen woodland	1,500-2,000	Slope.
22:				
Hoosan	Columbia needlegrass, Thurber fescue.	Columbia needlegrass, Thurber fescue.	1,500-1,800	Shrink-swell.
Lamphier	Columbia needlegrass, Thurber fescue.	Aspen, Columbia needlegrass.	1,500-2,000	Shrink-swell.
Leaps	Columbia needlegrass, Thurber fescue.	Columbia needlegrass, Thurber fescue.	1,500-1,800	Shrink-swell.
23:				
Jodero	Big sagebrush, needleandthread, muttongrass.	Arizona fescue, western wheatgrass.	1,500-1,800	---

See footnotes at end of table.

TABLE 5.--RANGELAND--Continued

Soil name and map symbol	Present vegetation	Potential natural vegetation	Forage production potential	Revegetation limitations
			lbs/acre	
23:				
Empedrado	Needleandthread, big sagebrush.	Arizona fescue, western wheatgrass.	1,500-1,800	---
24:				
Kubler	Gambel oak, Letterman needlegrass.	Gambel oak, elk sedge.	2,000-3,000	Shrink-swell.
Delson	Gambel oak, Kentucky bluegrass.	Gambel oak, elk sedge.	2,000-3,000	Shrink-swell.
Cerro	Letterman needlegrass, western wheatgrass.	Western wheatgrass, Letterman needlegrass.	2,000-2,500	Shrink-swell.
25:				
Lamphier	Aspen woodland	Aspen woodland	2,000-2,500	Coarse fragments.
Hapgood	Aspen woodland	Aspen woodland	2,000-2,500	Coarse fragments.
26*:				
Mirand	Pinyon pine, big sagebrush.	Pinyon pine, Rocky Mountain juniper.	1,100-1,500	---
Callan	Pinyon pine, Rocky Mountain juniper, big sagebrush.	Big sagebrush, Indian ricegrass.	1,100-1,500	Shrink-swell.
Chilson Variant	Pinyon pine, Rocky Mountain juniper.	Pinyon pine, Rocky Mountain juniper.	300-500	Shallow to bedrock.
27*:				
Overgaard	Engelmann spruce, subalpine fir.	Engelmann spruce, subalpine fir.	100-500	Shrink-swell.
Olathe	Engelmann spruce, subalpine fir.	Engelmann spruce, subalpine fir.	100-500	Shallow to bedrock.
28***:				
Sawcreek	Aspen, Columbia needlegrass.	Aspen, Arizona fescue.	900-1,200	---
Splitro	Aspen, Columbia needlegrass.	Aspen, Arizona fescue.	900-1,200	Shallow to bedrock.
29*:				
Supervisor	Engelmann spruce, aspen, Douglas-fir, blue spruce, subalpine fir.	Engelmann spruce, subalpine fir, Douglas-fir.	100-500	Coarse fragments.

See footnotes at end of table.

TABLE 5.--RANGELAND--Continued

Soil name and map symbol	Present vegetation	Potential natural vegetation	Forage production potential	Revegetation limitations
			lbs/acre	
29*:				
Cebone	Engelmann spruce, aspen, Douglas-fir, blue spruce, subalpine fir.	Engelmann spruce, subalpine fir, Douglas-fir, blue spruce.	100-500	Shrink-swell.
30*:				
Trampas	Ponderosa pine, bottlebrush squirreltail.	Ponderosa pine, Indian ricegrass.	1,500-1,800	Coarse fragments.
Delson, moderately deep	Ponderosa pine, Gambel oak.	Ponderosa pine, Arizona fescue.	2,000-2,500	Shrink-swell.
31*:				
Ula	Engelmann spruce, subalpine fir.	Engelmann spruce, subalpine fir.	100-500	---
Agneston	Engelmann spruce, subalpine fir.	Engelmann spruce, subalpine fir.	100-500	Coarse fragments.
Pendergrass	Engelmann spruce, subalpine fir.	Engelmann spruce, subalpine fir.	100-500	Shallow to bedrock.
32:				
Ustorthents	Lower coniferous forest.	Lower coniferous forest.	**	Slope.
Ustochrepts	Lower coniferous forest.	Lower coniferous forest.	**	Slope.
Rock outcrop.				

* Forage production potential is highly variable, depending upon the density and species of of the canopy cover.

** Too broad for interpretation.

*** Not a true aspen woodland; marginal site conditions.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for commercial production of trees are listed. Absence of an entry means that information was not available. See text for definitions of "slight," "moderate," and "severe." NS means that the soil is not suited to that species)

Soil name and map symbol	Management concerns			Productivity				
				Range of site indices				
	Timber harvest limitations	Reforestation limitations	Windthrow hazard	Ponderosa pine[1]	Engelmann spruce[2]	Subalpine fir[2]	Aspen[3]	Pinyon-juniper[4]
10:								
Arabrab----	Moderate or severe.	Severe---	Severe---	NS	NS	NS	NS	70-100
Dalhart----	Moderate---	Moderate---	Moderate---	NS	NS	NS	NS	70-100
11:								
Belain-----	Moderate---	Moderate---	Severe---	45-60	NS	NS	NS	NS
Falcon-----	Severe---	Severe---	Severe---	45-55	NS	NS	NS	NS
13:								
Chilson----	Moderate or severe.	Severe---	Severe---	55-75	NS	NS	(5)	NS
Delson, moderately deep------	Moderate or severe.	Moderate---	Severe---	60-85	NS	NS	(5)	NS
Beenom-----	Moderate---	Severe---	Severe---	50-80	NS	NS	(5)	NS
14:								
Chilson Variant---	Severe---	Severe---	Severe---	NS	NS	NS	NS	70-80
Rock outcrop.								
15:								
Delson-----	---	---	---	(5)	NS	NS	NS	NS
Kubler-----	---	---	---	(5)	NS	NS	NS	NS
Showalter--	---	---	---	NS	NS	NS	NS	NS
16:								
Delson, moderately deep------	Moderate or severe.	Severe---	Severe---	60-85	NS	NS	(5)	NS
Sharrott---	Moderate or severe.	Severe---	Severe---	65-80	NS	NS	(5)	NS
17:								
Dough, dry-	Moderate---	Severe---	Severe---	NS	NS	NS	NS	50-90
Rock outcrop.								

See footnotes at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns			Productivity				
				Range of site indices				
	Timber harvest limitations	Reforestation limitations	Windthrow hazard	Ponderosa pine[1]	Engelmann spruce[2]	Subalpine fir[2]	Aspen[3]	Pinyon-juniper[4]
18:								
Durango	Moderate	Moderate	Moderate or severe.	NS	NS	NS	NS	90-120
Arabrab	Severe	Severe	Severe	NS	NS	NS	NS	65-90
19:								
Falcon	Moderate or severe.	Severe	Severe	50-70	NS	NS	NS	NS
Dough	Moderate or severe.	Severe	Severe	50-70	NS	NS	NS	NS
Rock outcrop.								
20:								
Gralic	Moderate or severe.	Moderate or severe.	Moderate	NS	65-75	60-70	NS	NS
Grenadier	Moderate or severe.	Moderate or severe.	Moderate	NS	70-80	70-80	NS	NS
21:								
Hapgood	Moderate or severe.	Moderate or severe.	Moderate	NS	(5)	(5)	(6)	NS
Lamphier	Moderate or severe.	Slight	Slight	NS	(5)	(5)	(6)	NS
22:								
Hoosan	---	---	---	NS	NS	NS	(6)	NS
Lamphier	---	---	---	NS	NS	NS	(5)	NS
Leaps	---	---	---	NS	NS	NS	(5)	NS
23:								
Jodero	---	---	---	NS	NS	NS	NS	NS
Empedrado	---	---	---	NS	NS	NS	NS	NS
24:								
Kubler	---	---	---	(5)	NS	NS	NS	NS
Delson	---	---	---	(5)	NS	NS	NS	NS
Cerro	---	---	---	NS	NS	NS	NS	NS
25:								
Lamphier	Slight	Slight	Slight	NS	(5)	(5)	(6)	NS
Hapgood	Severe	Severe	Moderate	NS	(5)	(5)	45-55	NS
26:								
Mirand	Severe	Severe	Severe	NS	NS	NS	NS	70-100

See footnotes at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns			Productivity				
				Range of site indices				
	Timber harvest limitations	Reforestation limitations	Windthrow hazard	Ponderosa pine[1]	Engelmann spruce[2]	Subalpine fir[2]	Aspen[3]	Pinyon-juniper[4]
26:								
Callan	Severe	Severe	Severe	NS	NS	NS	NS	100-150
Chilson Variant	Severe	Severe	Severe	NS	NS	NS	NS	65-75
27:								
Overgaard	Severe	Severe	Severe	NS	65-75	60-70	NS	NS
Olathe	Severe	Severe	Severe	NS	(6)	(6)	NS	NS
28:								
Sawcreek	Moderate	Moderate	Moderate	NS	NS	NS	(6)	NS
Splitro	Moderate or severe.	Moderate	Moderate	NS	NS	NS	(6)	NS
29:								
Supervisor	Moderate or severe.	Moderate or severe.	Moderate	NS	75-85	(6)	(5)	NS
Cebone	Severe	Severe	Severe	NS	70-80	(6)	(5)	NS
30:								
Trampas	Moderate or severe.	Moderate or severe.	Severe	55-80	NS	NS	NS	NS
Delson, moderately deep	Severe	Severe	Severe	60-75	NS	NS	NS	NS
31:								
Ula	Moderate	Moderate	Slight	NS	80-95	70-95	NS	NS
Agneston	Moderate	Moderate or severe.	Moderate	NS	75-90	80-90	NS	NS
Pendergrass	Severe	Severe	Severe	NS	55-75	40-70	NS	NS

[1] Based on U.S. Department of Agriculture Technical Bulletin 630.
[2] Based on Soil Conservation Service Woodland Technical Guide, expanded to fit local conditions. Base age of 100 years.
[3] Based on U.S. Department of Agriculture Bulletin 1291. Base age of 80 years.
[4] Data based on basal area. Source: Howell, J., Jr. 1940. Pinyon and juniper: A preliminary study of volume, growth, and yield. U.S. Dep. Agric., Soil Conserv. Serv. Reg. Bull. 71.
[5] The soil is suitable for production of this species, but the species is not part of the potential natural vegetation.
[6] The soil is suitable for production of this species, but no site index data are available.

TABLE 7.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements
10:			
Arabrab	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Dalhart	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
11:			
Belain	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.
Falcon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
12:			
Borolls.			
Boralfs.			
Rock outcrop	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
13:			
Chilson	Severe: depth to rock.	Severe: shrink-swell, depth to rock.	Severe: depth to rock, shrink-swell.
Delson, moderately deep-	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
Beenom	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
14:			
Chilson Variant--	Severe: depth to rock.	Severe: shrink-swell, depth to rock.	Severe: depth to rock, shrink-swell.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
15:			
Delson	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements
15:			
Kubler	Severe: slope.	Severe: slope.	Severe: slope.
Showalter	Severe: slope.	Severe: slope.	Severe: slope.
16:			
Delson, moderately deep-	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
Sharrott	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
17:			
Dough, dry	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
18:			
Durango	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.
Arabrab	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
19:			
Falcon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Dough	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
20:			
Gralic	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.
Grenadier	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.
21:			
Hapgood	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.
Lamphier	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements
22:			
Hoosan	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.
Lamphier	Severe: slope.	Severe: slope.	Severe: slope.
Leaps.			
23:			
Jodero	Slight	Severe: flooding.	Severe: flooding.
Empedrado	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.
24:			
Kubler	Moderate: depth to rock, too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.
Delson	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
Cerro	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.
25:			
Lamphier	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.
Hapgood	Severe: large stones.	Severe: large stones.	Severe: large stones.
26:			
Mirand	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.
Callan	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.
Chilson Variant	Severe: depth to rock.	Severe: shrink-swell, depth to rock.	Severe: depth to rock, shrink-swell.
27:			
Overgaard	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
Olathe	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements
28:			
Sawcreek	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.
Splitro	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
29:			
Supervisor	Severe: depth to rock, large stones.	Severe: large stones.	Severe: depth to rock, large stones.
Cebone	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.
30:			
Trampas	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.
Delson, moderately deep-	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
31:			
Ula	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
Agneston	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.
Pendergrass	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
32:			
Ustorthents.			
Ustochrepts.			
Rock outcrop	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.

TABLE 8.--ROADS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "fair," "slight," and other terms)

Soil name and map symbol	Suitability as a source of roadfill	Limitations affecting unpaved roads
10:		
Arabrab	Poor: thin layer.	Severe: depth to rock.
Dalhart	Fair: texture.	Moderate: texture.
11:		
Belain	Fair: texture.	Moderate: texture.
Falcon	Poor: thin layer.	Severe: depth to rock.
12:		
Borolls	Poor: rock outcrop, slope.	Severe: slope.
Boralfs	Poor: rock outcrop, slope.	Severe: slope.
Rock outcrop.		
13:		
Chilson	Poor: thin layer.	Severe: depth to rock.
Delson, moderately deep	Fair: low strength.	Moderate: low strength.
Beenom	Poor: thin layer.	Severe: depth to rock.
14:		
Chilson Variant	Poor: thin layer, large stones.	Severe: depth to rock.
Rock outcrop.		
15:		
Delson	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
Kubler	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
Showalter	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
16:		
Delson, moderately deep	Fair: texture.	Moderate: texture.

TABLE 8.--ROADS--Continued

Soil name and map symbol	Suitability as a source of roadfill	Limitations affecting unpaved roads
16:		
Sharrott	Poor: thin layer.	Severe: depth to rock.
17:		
Dough, dry	Poor: thin layer.	Severe: depth to rock.
Rock outcrop.		
18:		
Durango	Fair: texture.	Moderate: texture.
Arabrab	Poor: thin layer.	Severe: depth to rock.
19:		
Falcon	Poor: thin layer.	Severe: depth to rock.
Dough	Poor: thin layer.	Severe: depth to rock.
Rock outcrop.		
20:		
Gralic	Fair or poor: large stones, area reclaim.	Moderate or severe: large stones, slope.
Grenadier	Fair or poor: large stones, area reclaim.	Moderate or severe: slope, large stones.
21:		
Hapgood	Poor: slope, large stones.	Moderate or severe: large stones.
Lamphier	Fair: slope.	Moderate: slope.
22:		
Hoosan	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
Lamphier	Fair: slope.	Moderate: texture, slope.
Leaps	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
23:		
Jodero	Fair: texture.	Moderate: texture.
Empedrado	Fair: texture.	Moderate: texture.

TABLE 8.--ROADS--Continued

Soil name and map symbol	Suitability as a source of roadfill	Limitations affecting unpaved roads
24:		
Kubler	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
Delson	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
Cerro	Poor: texture, shrink-swell.	Severe: texture, shrink-swell.
25:		
Lamphier	Fair: texture.	Moderate: texture.
Hapgood	Fair: large stones.	Moderate: large stones.
26:		
Mirand	Fair: texture.	Moderate: texture.
Callan	Fair: low strength.	Moderate: low strength.
Chilson Variant	Poor: area reclaim, thin layer.	Severe: depth to rock.
27:		
Overgaard	Fair: area reclaim, texture.	Moderate: texture.
Olathe	Poor: thin layer.	Severe: depth to rock.
28:		
Sawcreek	Good	Moderate: texture.
Splitro	Poor: thin layer.	Severe: depth to rock.
29:		
Supervisor	Poor: large stones, area reclaim.	Moderate: depth to rock, large stones.
Cebone	Poor: shrink-swell.	Severe: shrink-swell.
30:		
Trampas	Fair: slope.	Moderate: slope, large stones.
Delson, moderately deep	Fair: slope, texture.	Moderate: texture.

TABLE 8.--ROADS--Continued

Soil name and map symbol	Suitability as a source of roadfill	Limitations affecting unpaved roads
31:		
Ula	Fair: area reclaim.	Slight or moderate: depth to rock.
Agneston	Poor: area reclaim.	Moderate: depth to rock.
Pendergrass	Poor: thin layer.	Severe: depth to rock.
32:		
Ustorthents	Poor: rock outcrop, slope.	Severe: slope.
Ustochrepts	Poor: rock outcrop, slope.	Severe: slope.
Rock outcrop.		

TABLE 9.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10:					
Arabrab	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
Dalhart	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
11:					
Belain	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, small stones.
Falcon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: depth to rock.
12:					
Borolls.					
Boralfs.					
Rock outcrop	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, slope.
13:					
Chilson	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
Delson, moderately deep	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Beenom	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
14:					
Chilson Variant	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, small stones.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
15:					
Delson	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Kubler	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Showalter	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.
16:					
Delson, moderately deep	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Sharrott	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, small stones.
17:					
Dough, dry	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: depth to rock.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
18:					
Durango	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Arabrab	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
19:					
Falcon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: depth to rock.
Dough	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: depth to rock.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
20:					
Gralic	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Grenadier	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: large stones, slope.
21:					
Hapgood	Severe: slope, large stones.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope.	Poor: large stones, slope.
Lamphier	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
22:					
Hoosan	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Lamphier	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Leaps.					
23:					
Jodero	Severe: percs slowly.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Empedrado	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
24:					
Kubler	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
Delson	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Cerro	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
25:					
Lamphier	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope, thin layer.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
25:					
Hapgood	Severe: large stones.	Severe: slope, large stones.	Severe: depth to rock, large stones.	Moderate: depth to rock, slope.	Poor: large stones.
26:					
Mirand	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey.
Callan	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Chilson Variant	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, small stones.
27:					
Overgaard	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey.
Olathe	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
28:					
Sawcreek	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
Splitro	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, large stones.
29:					
Supervisor	Severe: depth to rock, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, large stones.	Severe: depth to rock, seepage.	Poor: area reclaim, large stones.
Cebone	Severe: depth to rock, percs slowly.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock, seepage.	Poor: area reclaim, too clayey, hard to pack.
30:					
Trampas	Severe: percs slowly, slope, large stones.	Severe: slope, large stones.	Severe: depth to rock, slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, hard to pack, large stones.
Delson, moderately deep	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
31:					
Ula	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, large stones.
Agneston	Severe: depth to rock, percs slowly.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, large stones.	Severe: depth to rock, seepage.	Poor: area reclaim, large stones.
Pendergrass	Severe: depth to rock, large stones.	Severe: seepage, depth to rock, large stones.	Severe: depth to rock, seepage, large stones.	Severe: depth to rock, seepage.	Poor: area reclaim, large stones.
32:					
Ustorthents.					
Ustochrepts.					
Rock outcrop	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, slope.

TABLE 10.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "fair," "poor," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Sand	Gravel	Topsoil
10:			
Arabrab	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Dalhart	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
11:			
Belain	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Falcon	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
12:			
Borolls.			
Boralfs.			
Rock outcrop	---	---	Poor: depth to rock, slope.
13:			
Chilson	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, small stones.
Delson, moderately deep	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Beenom	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
14:			
Chilson Variant	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Rock outcrop	---	---	Poor: depth to rock.
15:			
Delson	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Sand	Gravel	Topsoil
15:			
Kubler	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Showalter	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
16:			
Delson, moderately deep	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Sharrott	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
17:			
Dough, dry	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Rock outcrop	---	---	Poor: depth to rock.
18:			
Durango	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Arabrab	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
19:			
Falcon	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Dough	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Rock outcrop	---	---	Poor: depth to rock.
20:			
Gralic	Improbable: large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
Grenadier	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Sand	Gravel	Topsoil
21:			
Hapgood	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Lamphier	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
22:			
Hoosan	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Lamphier	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Leaps.			
23:			
Jodero	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Empedrado	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
24:			
Kubler	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
Delson	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Cerro	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
25:			
Lamphier	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Hapgood	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
26:			
Mirand	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Callan	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Chilson Variant	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Sand	Gravel	Topsoil
27:			
Overgaard	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Olathe	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
28:			
Sawcreek	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Splitro	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
29:			
Supervisor	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones.
Cebone	Improbable: excess fines,	Improbable: excess fines,	Poor: small stones.
30:			
Trampas	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Delson, moderately deep	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
31:			
Ula	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
Agneston	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Pendergrass	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones.
32:			
Ustorthents.			
Ustochrepts.			
Rock outcrop	---	---	Poor: depth to rock, slope.

TABLE 11.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--	
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions
10:				
Arabrab	Severe: depth to rock, slope.	Severe: piping.	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.
Dalhart	Severe: slope.	Severe: piping.	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.
11:				
Belain	Severe: seepage, slope.	Severe: piping.	Slope, depth to rock.	Slope, depth to rock.
Falcon	Severe: depth to rock, slope.	Severe: thin layer.	Slope, depth to rock.	Slope, depth to rock.
12:				
Borolls.				
Boralfs.				
Rock outcrop	Severe: depth to rock, slope.	---	Slope, depth to rock.	Slope, depth to rock.
13:				
Chilson	Severe: depth to rock.	Severe: thin layer.	Slope, percs slowly.	Large stones, depth to rock, soil blowing.
Delson, moderately deep-	Severe: slope.	Moderate: thin layer, hard to pack.	Percs slowly, depth to rock, slope.	Slope, large stones, depth to rock.
Beenom	Severe: depth to rock.	Severe: piping.	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.
14:				
Chilson Variant	Severe: depth to rock, slope.	Severe: thin layer.	Slope, percs slowly, depth to rock.	Slope, large stones, depth to rock.
Rock outcrop	Severe: depth to rock, slope.	---	Slope, depth to rock.	Slope, depth to rock.
15:				
Delson	Severe: slope.	Moderate: thin layer, hard to pack.	Percs slowly, depth to rock, slope.	Slope, large stones, depth to rock.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions
15:				
Kubler	Severe: slope.	Moderate: hard to pack.	Percs slowly, slope.	Slope, percs slowly.
Showalter	Severe: slope.	Severe: large stones.	Slope, large stones, droughty.	Slope, large stones, percs slowly.
16:				
Delson, moderately deep	Severe: slope.	Moderate: thin layer, hard to pack.	Percs slowly, depth to rock, slope.	Slope, large stones, depth to rock.
Sharrott	Severe: depth to rock.	Severe: seepage.	Large stones, droughty, depth to rock.	Large stones, depth to rock.
17:				
Dough, dry	Severe: depth to rock, slope.	Severe: piping.	Slope, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.
Rock outcrop	Severe: depth to rock, slope.	---	Slope, depth to rock.	Slope, depth to rock.
18:				
Durango	Moderate: depth to rock, slope.	Moderate: hard to pack.	Soil blowing, percs slowly, depth to rock.	Depth to rock, soil blowing.
Arabrab	Severe: depth to rock, slope.	Severe: piping.	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.
19:				
Falcon	Severe: depth to rock.	Severe: thin layer.	Slope, soil blowing, depth to rock.	Depth to rock, soil blowing.
Dough	Severe: depth to rock.	Severe: piping.	Slope, soil blowing, depth to rock.	Depth to rock, soil blowing.
Rock outcrop	Severe: depth to rock.	---	Slope, depth to rock.	Depth to rock.
20:				
Gralic	Severe: seepage, slope.	Severe: seepage, large stones.	Large stones, droughty, soil blowing.	Slope, large stones, soil blowing.
Grenadier	Severe: seepage, slope.	Severe: piping, large stones.	Large stones, droughty, slope.	Slope, large stones.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--	
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions
21:				
Hapgood	Severe: slope.	Severe: large stones.	Large stones, droughty, slope.	Slope, large stones,
Lamphier	Severe: slope.	Severe: piping.	Slope	Slope.
22:				
Hoosan	Severe: slope.	Severe: hard to pack.	Percs slowly, slope.	Slope, percs slowly.
Lamphier	Severe: slope.	Severe: piping.	Slope	Slope.
Leaps.				
23:				
Jodero	Moderate: slope.	Slight	Slope	Erodes easily.
Empedrado	Severe: slope.	Moderate: piping.	Slope	Slope.
24:				
Kubler	Severe: slope.	Moderate: hard to pack.	Percs slowly, slope.	Slope, percs slowly.
Delson	Severe: slope.	Moderate: thin layer, hard to pack.	Percs slowly, depth to rock, slope.	Slope, large stones, depth to rock.
Cerro	Severe: slope.	Moderate: hard to pack.	Percs slowly, slope.	Slope, percs slowly.
25:				
Lamphier	Severe: slope.	Severe: piping.	Slope	Slope.
Hapgood	Severe: slope.	Severe: large stones.	Large stones, droughty, slope.	Slope, large stones.
26:				
Mirand	Moderate: depth to rock, slope.	Slight	Percs slowly, depth to rock, slope.	Depth to rock, percs slowly.
Callan	Moderate: slope.	Moderate: hard to pack.	Percs slowly, slope.	Percs slowly.
Chilson Variant	Severe: depth to rock, slope.	Severe: thin layer.	Slope, percs slowly, depth to rock.	Slope, large stones, depth to rock.
27:				
Overgaard	Severe: slope.	Severe: thin layer.	Soil blowing, depth to rock, slope.	Slope, large stones, depth to rock.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions
27:				
Olathe	Severe: depth to rock, slope.	Severe: thin layer.	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.
28:				
Sawcreek	Severe: seepage, slope.	Severe: piping.	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.
Splitro	Severe: depth to rock, slope.	Severe: piping.	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.
29:				
Supervisor	Severe: seepage, slope.	Severe: seepage, large stones.	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.
Cebone	Severe: slope.	Severe: thin layer.	Percs slowly, depth to rock, slope.	Slope, large stones, depth to rock.
30:				
Trampas	Severe: slope.	Severe: large stones.	Large stones, droughty, percs slowly.	Slope, large stones, percs slowly.
Delson, moderately deep-	Severe: slope.	Moderate: thin layer, hard to pack.	Percs slowly, depth to rock, slope.	Slope, large stones, depth to rock.
31:				
Ula	Severe: slope.	Severe: thin layer.	Large stones, droughty.	Slope, large stones, depth to rock.
Agneston	Severe: slope.	Severe: large stones.	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.
Pendergrass	Severe: depth to rock.	Severe: large stones.	Large stones, droughty, depth to rock.	Large stones, depth to rock.
32:				
Ustorthents.				
Ustochrepts.				
Rock outcrop	Severe: depth to rock, slope.	---	Slope, depth to rock.	Slope, depth to rock.

TABLE 12.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10:											
Arabrab	0-6	Sandy loam	SM, ML	A-4, A-2	0-5	95-100	90-100	65-90	30-55	20-25	NP-5
	6-14	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-100	80-100	75-95	50-75	30-40	5-15
	14-19	Gravelly sandy clay loam, gravelly loam, gravelly clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-2	0-15	60-85	50-75	45-70	30-55	30-40	5-15
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Dalhart	0-4	Sandy loam	SM	A-4	0	100	100	65-75	35-50	20-25	NP-5
	4-13	Sandy clay loam, loam, clay loam.	CL	A-6	0	100	100	75-90	50-75	30-40	10-20
	13-37	Sandy clay loam, loam, clay loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0	80-100	75-100	70-85	40-70	25-35	5-15
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
11:											
Belain	0-5	Loam	SM	A-4	0-10	95-100	90-100	65-75	35-50	20-30	NP-5
	5-13	Sandy loam, gravelly sandy loam.	SM	A-2, A-4	0-10	65-95	55-90	40-70	25-45	20-30	NP-5
	13-22	Sandy loam, loam, gravelly sandy loam.	SM, ML	A-1, A-2, A-4	0-10	65-95	55-90	40-80	20-60	20-30	NP-5
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Falcon	0-3	Stony sandy loam	SM	A-2, A-4	5-15	95-100	90-100	60-75	30-50	20-30	NP-5
	3-10	Sandy clay loam, gravelly sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	75-100	70-100	50-75	25-50	20-30	NP-10
	10	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
12:											
Borolls.											
Boralfs.											
Rock outcrop	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
13:											
Chilson	0-4	Fine sandy loam	SM, SM-SC	A-4	0-10	90-100	85-100	65-85	35-50	20-30	NP-10
	4-8	Gravelly clay loam, cobbly clay loam, sandy clay loam.	CL, SC	A-6, A-7	5-25	75-95	70-90	50-80	35-70	35-45	15-25
	8-15	Gravelly clay loam, cobbly clay loam, clay.	GC, CL, CH	A-7	0-30	60-90	55-85	45-80	35-65	45-55	25-35
	15-17	Weathered bedrock	---	---	---	---	---	---	---	---	---
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
13:											
Delson, moderately deep	0-7	Loam	CL-ML, ML	A-4	0-5	85-100	75-100	60-90	50-75	25-35	5-10
	7-24	Clay loam, clay, gravelly clay loam.	CL, CH, GC	A-7	0-10	60-90	55-85	45-80	40-75	40-55	15-30
	24-30	Very gravelly clay loam, very cobbly clay loam.	GM, GC	A-2, A-6, A-7	10-45	45-60	40-55	35-50	30-40	35-50	10-25
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Beenom	0-2	Sandy loam	ML, SM	A-4	0-5	95-100	90-100	60-75	40-60	20-25	NP-5
	2-8	Loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	70-90	50-75	25-35	5-15
	8-16	Sandy clay loam, clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-5	95-100	85-100	75-90	45-75	25-40	5-20
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
14:											
Chilson Variant	0-5	Sandy loam	SM, SM-SC	A-4	0-15	85-100	80-95	60-70	35-50	20-30	NP-10
	5-14	Sandy clay loam, cobbly sandy clay loam.	SC	A-2, A-6	0-25	80-100	75-95	55-75	30-50	30-40	10-20
	14-19	Cobbly clay, clay	SC	A-2, A-7	0-25	75-100	70-90	50-70	30-50	40-55	20-35
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
15:											
Delson	0-11	Gravelly loam	GM-GC, GM, SM-SC, SM	A-2, A-4	0-10	55-80	50-75	45-70	30-50	25-35	5-10
	11-45	Clay loam, clay, gravelly clay loam.	CL, CH, GC	A-7	0-10	60-90	55-85	45-80	40-75	40-55	15-30
	45-60	Very gravelly clay loam, very cobbly clay loam.	GM, GC	A-2, A-6, A-7	10-45	45-60	40-55	35-50	30-40	35-50	10-25
Kubler	0-7	Loam	CL-ML, CL	A-4, A-6	0	85-100	75-100	65-95	55-75	25-35	5-15
	7-22	Clay loam, silty clay loam.	CL	A-6, A-7	0	85-100	75-100	70-100	60-90	35-45	15-25
	22-44	Clay, clay loam	CL, CH	A-7	0	85-100	75-100	65-100	55-90	45-55	25-35
	44-60	Clay, clay loam, gravelly clay loam.	CL, GC	A-6, A-7	0	60-85	55-80	50-75	40-70	35-50	15-30
Showalter	0-11	Gravelly loam	ML, SM	A-4	5-15	50-75	45-70	40-60	35-55	30-35	5-10
	11-24	Very cobbly clay loam.	GC, SC	A-6	30-50	55-75	50-70	40-65	35-50	35-40	15-20
	24-32	Very cobbly clay	GC, CH	A-7	30-50	55-75	50-70	45-65	40-60	40-60	20-40
	32-60	Extremely cobbly clay, extremely cobbly clay loam.	GC	A-2	50-70	20-50	15-45	15-40	10-35	35-50	15-30

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>3 inches	4	10	40	200		
	In				Pct					Pct	
16:											
Delson, moderately deep	0-7	Loam	CL-ML, ML	A-4	0-5	85-100	75-100	60-90	50-75	25-35	5-10
	7-24	Clay loam, clay, gravelly clay loam.	CL, CH, GC	A-7	0-10	60-90	55-85	45-80	40-75	40-55	15-30
	24-30	Clay loam, gravelly clay loam, cobbly clay loam.	ML, CL, GM, GC	A-6, A-7	0-25	60-90	55-85	45-80	35-70	35-50	10-25
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Sharrott	0-4	Cobbly loam	SM, ML	A-4	25-40	85-95	80-90	70-85	45-60	20-30	NP-5
	4-15	Very gravelly fine sandy loam, extremely gravelly fine sandy loam.	GM, SM, GP-GM, SP-SM	A-1, A-2	15-25	25-70	20-65	10-40	5-30	20-30	NP-5
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
17:											
Dough, dry	0-3	Sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	100	90-100	40-60	20-30	NP-10
	3-16	Sandy loam, fine sandy loam, loam.	ML, SM, CL-ML, SM-SC	A-4	0	100	100	90-100	40-70	20-30	NP-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
18:											
Durango	0-4	Sandy loam	SM, SM-SC	A-2, A-4	0	75-100	75-100	50-70	25-45	20-30	NP-10
	4-10	Sandy clay loam	SC	A-2, A-6	0	75-100	75-100	50-80	30-50	30-40	10-20
	10-25	Clay loam, clay	CH, CL	A-7	0	95-100	85-95	70-90	60-80	45-60	25-35
	25-60	Clay, clay loam, gravelly clay loam.	GC, CH, SC, CL	A-7	0	65-95	60-90	55-85	45-75	45-55	25-30
Arabrab	0-6	Sandy loam	SM, ML	A-4, A-2	0-5	95-100	90-100	65-90	30-55	20-25	NP-5
	6-14	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-100	80-100	75-95	50-75	30-40	5-15
	14-19	Gravelly sandy clay loam, gravelly loam, gravelly clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-2	0-15	60-85	50-75	45-70	30-55	30-40	5-15
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
19:											
Falcon	0-3	Fine sandy loam	SM	A-2, A-4	0-10	95-100	90-100	60-75	30-50	20-30	NP-5
	3-10	Sandy clay loam, gravelly sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	75-100	70-100	50-75	25-50	20-30	NP-10
	10	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	>3 inches	4	10	40	200		
	In				Pct					Pct	
19:											
Dough	0-3	Sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	100	90-100	40-60	20-30	NP-10
	3-11	Sandy loam, fine sandy loam, loam.	ML, SM, CL-ML, SM-SC	A-4	0	100	100	90-100	40-70	20-30	NP-10
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
20:											
Gralic	0-5	Fine sandy loam	SM, ML	A-4	0-10	95-100	90-100	80-100	40-60	20-25	NP-5
	5-19	Gravelly fine sandy loam, extremely gravelly fine sandy loam, very cobbly sandy loam.	GM, SM	A-2, A-1	5-55	35-80	30-75	20-60	15-35	15-25	NP-5
	19-60	Extremely cobbly fine sandy loam, very gravelly fine sandy loam.	GM-GC, GM, SM, SM-SC	A-2, A-1	25-60	50-65	35-50	25-40	15-30	15-25	NP-5
Grenadier	0-4	Very stony fine sandy loam.	SM	A-4	15-30	90-95	85-90	70-90	40-50	15-25	NP-5
	4-32	Stony sandy loam, very cobbly fine sandy loam, very cobbly sandy loam.	SM	A-4, A-2	25-50	80-90	75-85	50-75	25-45	15-25	NP-5
	32-50	Very cobbly sandy loam, extremely cobbly sandy loam, very stony fine sandy loam.	SM, GM	A-2, A-1	40-65	60-80	55-75	35-60	20-35	15-25	NP-5
	50	Weathered bedrock	---	---	---	---	---	---	---	---	---
21:											
Hapgood	0-8	Cobbly loam	SM-SC, CL-ML	A-4	15-35	80-90	70-90	60-85	40-65	25-30	5-10
	8-17	Very cobbly loam, very cobbly sandy clay loam.	GC	A-6, A-2	30-55	55-70	50-70	40-65	25-45	30-35	10-15
	17-60	Extremely cobbly loam, extremely stony sandy clay loam, very cobbly loam.	GC	A-6, A-2	30-80	55-70	50-70	40-65	25-45	30-35	10-15
Lamphier	0-35	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	90-100	75-90	45-75	25-35	5-15
	35-45	Clay loam, sandy clay loam.	CL, SC	A-6, A-7	0-10	85-100	80-100	70-90	45-75	35-45	15-25
	45-60	Gravelly sandy clay loam, clay loam, clay.	CL, CH, SC	A-6, A-7	0-10	60-95	55-90	45-85	35-70	35-60	15-40

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
22:											
Hoosan	0-10	Loam	CL-ML, CL	A-4, A-6	0-10	95-100	90-100	80-100	60-75	25-35	5-15
	10-22	Loam, clay loam	CL	A-6	0-10	95-100	90-100	80-100	60-75	30-40	10-20
	22-38	Stony clay, clay	ML, MH	A-7	5-25	75-85	70-85	65-80	50-70	45-55	15-25
	38-60	Clay	ML, MH	A-7	0-10	95-100	90-100	85-95	65-80	45-55	15-25
Lamphier	0-35	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	90-100	75-90	45-75	25-35	5-15
	35-45	Clay loam, sandy clay loam.	CL, SC	A-6, A-7	0-10	85-100	80-100	70-90	45-75	35-45	15-25
	45-60	Gravelly sandy clay loam, clay loam, clay.	CL, CH, SC	A-6, A-7	0-10	60-95	55-90	45-85	35-70	35-60	15-40
Leaps	0-14	Clay loam	CL, CH	A-7, A-6	0	100	100	90-100	65-80	35-45	15-25
	14-60	Clay, silty clay	CH	A-7	0-10	100	90-100	85-95	70-90	55-70	30-40
23:											
Jodero	0-3	Loam	ML, CL-ML	A-4	0-5	90-100	85-100	75-90	60-75	25-35	5-10
	3-18	Loam, sandy loam, sandy clay loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0-5	90-100	85-100	60-85	40-70	20-35	5-15
	18-37	Loam, sandy clay loam.	SC, CL	A-6	0-5	90-100	85-100	60-80	40-60	25-35	10-15
	37-60	Clay loam, sandy clay loam.	CL, SC	A-6, A-7	0	95-100	90-100	65-90	40-70	35-50	15-25
Empedrado	0-3	Loam	CL-ML	A-4	0	95-100	90-100	80-95	60-75	25-30	5-10
	3-10	Silt loam, loam	CL-ML	A-4	0	95-100	90-100	80-95	60-85	25-30	5-10
	10-28	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0	95-100	90-100	60-80	45-70	30-50	10-25
	28-60	Sandy clay loam, clay loam.	CL	A-6, A-7	0	95-100	90-100	60-80	45-70	30-50	10-25
24:											
Kubler	0-7	Loam	CL-ML, CL	A-4, A-6	0	85-100	75-100	65-95	55-75	25-35	5-15
	7-22	Clay loam, silty clay loam.	CL	A-6, A-7	0	85-100	75-100	70-100	60-90	35-45	15-25
	22-44	Clay, clay loam	CL, CH	A-7	0	85-100	75-100	65-100	55-90	45-55	25-35
	44-60	Clay, clay loam, gravelly clay loam.	CL, GC	A-6, A-7	0	60-85	55-80	50-75	40-70	35-50	15-30
Delson	0-11	Gravelly loam	GM-GC, GM, SM-SC, SM	A-2, A-4	0-10	55-80	50-75	45-70	30-50	25-35	5-10
	11-39	Clay loam, clay, gravelly clay loam.	CL, CH, GC	A-7	0-10	60-90	55-85	45-80	40-75	40-55	15-30
	39-60	Clay loam, gravelly clay loam, cobbly clay loam.	ML, CL, GM, GC	A-6, A-7	0-25	60-90	55-85	45-80	35-70	35-50	10-25
Cerro	0-4	Loam	CL-ML, CL	A-4, A-6	0-15	90-100	85-95	75-85	50-70	25-35	5-15
	4-14	Clay loam	CL	A-6, A-7	0-15	90-100	85-95	75-85	60-75	35-45	15-25
	14-48	Clay, clay loam	CL, CH	A-7	0-5	95-100	90-100	85-95	70-85	45-55	25-35
	48-60	Clay, clay loam, silty clay.	CH	A-7	0-5	95-100	90-100	85-100	75-95	50-55	30-35

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>3 inches	4	10	40	200		
	In				Pct					Pct	
25:											
Lamphier	0-35	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	90-100	75-90	45-75	25-35	5-15
	35-45	Clay loam, sandy clay loam.	CL, SC	A-6, A-7	0-10	85-100	80-100	70-90	45-75	35-45	15-25
	45-60	Gravelly sandy clay loam, clay loam, clay.	CL, CH, SC	A-6, A-7	0-10	60-95	55-90	45-85	35-70	35-60	15-40
Hapgood	0-8	Cobbly loam	SM-SC, CL-ML	A-4	15-35	80-90	70-90	60-85	40-65	25-30	5-10
	8-17	Very cobbly loam, very cobbly sandy clay loam.	GC	A-6, A-2	30-55	55-70	50-70	40-65	25-45	30-35	10-15
	17-60	Extremely cobbly loam, extremely stony sandy clay loam, very cobbly loam.	GC	A-6, A-2	30-80	55-70	50-70	40-65	25-45	30-35	10-15
26:											
Mirand	0-8	Sandy loam	ML, CL-ML	A-4	0-5	85-100	80-95	65-80	50-65	20-30	NP-10
	8-37	Clay loam, clay	CL, CH	A-7	0-5	90-100	85-95	75-95	65-85	45-55	20-30
	37-60	Clay loam, sandy clay loam.	CL, SC	A-6	0-5	85-100	80-95	65-80	40-65	35-40	15-20
Callan	0-7	Silt loam	CL-ML	A-4	0-5	95-100	90-100	90-100	70-95	25-30	5-10
	7-10	Clay loam, loam	CL	A-6	0	90-100	90-100	85-100	65-90	30-40	10-15
	10-45	Clay, clay loam	CL, CH	A-7	0	90-100	90-100	85-100	65-100	40-65	15-35
	45-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	85-100	65-90	30-45	10-20
Chilson Variant	0-5	Sandy loam	SM, SM-SC	A-4	0-15	85-100	80-95	60-70	35-50	20-30	NP-10
	5-14	Sandy clay loam, cobbly sandy clay loam.	SC	A-2, A-6	0-25	80-100	75-95	55-75	30-50	30-40	10-20
	14-19	Cobbly clay, clay	SC	A-2, A-7	0-25	75-100	70-90	50-70	30-50	40-55	20-35
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
27:											
Overgaard	0-9	Fine sandy loam	ML, SM	A-4	0-15	90-100	80-100	80-90	40-55	20-25	NP-5
	9-26	Cobbly clay loam, cobbly clay.	CL	A-7	15-30	90-100	80-100	75-100	60-75	40-50	15-25
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Olathe	0-4	Fine sandy loam	SM, ML	A-4	0-10	95-100	90-100	70-90	35-55	20-25	NP-5
	4-10	Fine sandy loam, sandy loam, gravelly sandy loam.	ML, SM	A-2, A-4	0-10	70-100	65-100	60-90	25-60	20-25	NP-5
	10-15	Cobbly fine sandy loam, sandy loam, cobbly sandy loam.	---	---	15-25	85-95	80-95	55-75	25-45	---	---
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>3 inches	4	10	40	200		
	In				Pct					Pct	
28:											
Sawcreek	0-9	Sandy loam	SM	A-4	0	95-100	85-100	60-75	35-50	20-30	NP-5
	9-23	Loam, sandy loam	SM, ML	A-4	0	95-100	85-100	60-85	40-60	20-30	NP-5
	23-26	Weathered bedrock	---	---	---	---	---	---	---	---	---
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Splitro	0-7	Stony loam	GM, ML	A-4	10-30	70-90	70-85	60-80	45-60	20-30	NP-5
	7-15	Cobbly sandy loam, cobbly loam, stony loam.	GM, SM, ML	A-2, A-4	15-30	70-95	70-90	50-80	30-60	20-30	NP-5
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
29:											
Supervisor	0-11	Very cobbly loam	GM, SM	A-2, A-4	30-45	55-75	55-70	45-60	30-45	20-30	NP-5
	11-16	Very cobbly loam, very cobbly sandy loam.	GM, SM	A-1, A-2, A-4	45-55	50-70	50-65	35-55	20-40	20-30	NP-5
	16-25	Extremely stony loam, extremely stony sandy loam, extremely cobbly loam.	GM	A-2, A-1	50-70	30-50	30-45	20-40	10-30	20-30	NP-5
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cebone	0-12	Loam	ML, CL-ML	A-4	0-10	80-95	75-90	65-80	50-65	20-30	NP-10
	12-15	Fine sandy loam, sandy loam, gravelly fine sandy loam.	SM	A-1, A-2, A-4	0-10	70-90	65-85	40-75	20-40	15-25	NP-5
	15-21	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A-6, A-7	0-10	70-90	65-85	55-80	35-65	35-50	15-25
	21-36	Cobbly clay loam, cobbly clay, gravelly clay loam.	GC, CH, CL	A-7	15-45	60-95	60-90	50-85	40-75	45-60	20-35
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
30:											
Trampas	0-4	Cobbly loam	SM-SC, CL-ML	A-4	10-45	80-95	75-90	50-85	40-70	25-30	5-10
	4-11	Cobbly loam, very cobbly loam, stony fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4	25-55	75-80	75-80	60-75	35-60	20-30	NP-10
	11-20	Very cobbly clay loam, very stony clay loam, very cobbly sandy clay loam.	SC, CL	A-6, A-7	30-55	70-85	70-80	55-75	35-65	35-45	15-25
	20-45	Extremely cobbly clay, very stony clay, very cobbly clay.	GC, CL, CH	A-7	45-60	60-95	60-90	50-85	40-80	45-55	25-35
	45-60	Extremely cobbly clay, extremely stony clay, very stony clay.	GC, CL, CH	A-7	45-75	50-95	45-90	40-85	35-80	45-60	25-40

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>3 inches	4	10	40	200		
	In				Pct					Pct	
30:											
Delson, moderately deep	0-7	Loam	CL-ML, ML	A-4	0-5	85-100	75-100	60-90	50-75	25-35	5-10
	7-24	Clay loam, clay, gravelly clay loam.	CL, CH, GC	A-7	0-10	60-90	55-85	45-80	40-75	40-55	15-30
	24-30	Clay loam, gravelly clay loam, cobbly clay loam.	ML, CL, GM, GC	A-6, A-7	0-25	60-90	55-85	45-80	35-70	35-50	10-25
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
31:											
Ula	0-7	Loam	ML	A-4	0-15	85-100	75-100	65-90	50-75	20-30	NP-5
	7-25	Cobbly fine sandy loam, cobbly sandy loam.	SM-SC, SC, CL-ML, CL	A-2, A-4, A-6	15-35	85-100	75-100	50-90	30-55	25-35	5-15
	25-53	Cobbly sandy clay loam, cobbly clay loam.	SC, CL	A-2, A-6, A-7	15-35	75-100	70-100	50-90	30-70	35-50	15-25
	53	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Agneston	0-17	Cobbly fine sandy loam.	SM	A-2, A-4	25-35	85-95	80-90	65-80	30-45	20-25	NP-5
	17-36	Very cobbly clay loam, very gravelly clay loam, very cobbly sandy clay loam.	GC	A-2, A-6, A-7	25-55	55-70	50-65	40-60	25-50	35-45	15-25
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Pendergrass	0-9	Very cobbly fine sandy loam.	GM, SM	A-1, A-2	30-55	55-75	50-70	40-60	20-35	20-25	NP-5
	9-17	Very cobbly fine sandy loam, very cobbly sandy loam.	GM, SM	A-1, A-2	30-55	55-75	50-70	35-60	20-35	20-25	NP-5
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
32:											
Ustorthents.											
Ustochrepts.											
Rock outcrop	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
10:											
Arabrab	0-6	15-20	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	0.28	1	3	1-3
	6-14	20-35	0.6-2.0	0.14-0.20	7.4-8.4	<2	Low	0.28			
	14-19	20-35	0.6-2.0	0.10-0.15	7.4-8.4	<2	Low	0.20			
	19	---	---	---	---	---	---	---			
Dalhart	0-4	7-15	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	0.32	2	3	1-4
	4-13	18-35	0.2-0.6	0.15-0.17	7.4-7.8	<2	Moderate	0.20			
	13-37	15-30	0.2-0.6	0.13-0.15	7.9-8.4	<4	Moderate	0.20			
	37	---	---	---	---	---	---	---			
11:											
Belain	0-5	10-18	2.0-6.0	0.13-0.15	6.6-7.3	<2	Low	0.28	2	5	2-4
	5-13	10-18	2.0-6.0	0.11-0.15	6.6-7.3	<2	Low	0.20			
	13-22	10-18	2.0-6.0	0.11-0.16	7.4-7.8	<2	Low	0.20			
	22	---	---	---	---	---	---	---			
Falcon	0-3	10-20	2.0-6.0	0.11-0.18	6.6-7.3	<2	Low	0.24	1	5	1-4
	3-10	10-23	2.0-6.0	0.10-0.18	6.6-7.3	<2	Low	0.28			
	10	---	---	---	---	---	---	---			
12:											
Borolls.											
Boralfs.											
Rock outcrop	0-60	---	---	---	---	<2	---	---	---	---	---
13:											
Chilson	0-4	10-20	2.0-6.0	0.14-0.16	6.1-7.3	<2	Low	0.32	1	3	2-4
	4-8	25-37	0.2-0.6	0.12-0.16	6.1-7.3	<2	Moderate	0.24			
	8-15	35-45	0.06-0.2	0.12-0.15	6.1-7.3	<2	High	0.24			
	15-17	---	---	---	---	---	---	---			
	17	---	---	---	---	---	---	---			
Delson, moderately deep	0-7	18-27	0.6-2.0	0.14-0.18	6.1-7.3	<2	Low	0.32	5	4	3-6
	7-24	35-45	0.06-0.2	0.14-0.21	6.1-7.3	<2	Moderate	0.28			
	24-30	28-40	0.2-0.6	0.15-0.19	6.6-8.4	<2	Moderate	0.24			
	30	---	---	---	---	---	---	---			
Beenom	0-2	10-20	2.0-6.0	0.12-0.14	6.6-7.8	<2	Low	0.20	1	3	1-3
	2-8	15-24	0.6-2.0	0.13-0.16	6.6-7.8	<2	Moderate	0.32			
	8-16	20-35	0.2-0.6	0.14-0.21	6.6-7.8	<2	Moderate	0.28			
	16	---	---	---	---	---	---	---			
14:											
Chilson Variant	0-5	10-20	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.24	1	4	2-4
	5-14	25-35	0.2-0.6	0.12-0.16	6.6-7.8	<2	Moderate	0.20			
	14-19	40-55	0.06-0.2	0.12-0.16	6.6-7.8	<2	High	0.20			
	19	---	---	---	---	---	---	---			
Rock outcrop	0-60	---	---	---	---	<2	---	---	---	---	---
15:											
Delson	0-11	18-27	0.6-2.0	0.12-0.16	6.1-7.3	<2	Low	0.24	5	6	3-6
	11-45	35-45	0.06-0.2	0.14-0.21	6.1-7.3	<2	Moderate	0.28			
	45-60	28-40	0.2-0.6	0.15-0.19	6.6-8.4	<2	Moderate	0.24			

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
15:											
Kubler	0-7	18-27	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.32	3	6	2-5
	7-22	28-40	0.2-0.6	0.17-0.20	6.6-7.8	<2	Low	0.32			
	22-44	35-50	0.06-0.2	0.14-0.16	6.6-7.3	<2	Moderate	0.24			
	44-60	28-45	0.06-0.2	0.13-0.16	7.9-8.4	<2	Moderate	0.24			
Showalter	0-11	18-28	0.6-2.0	0.14-0.17	6.6-7.3	<2	Low	0.20	3	7	1-4
	11-24	35-40	0.2-0.6	0.08-0.11	6.6-7.3	<2	Moderate	0.17			
	24-32	40-55	0.06-0.2	0.06-0.08	6.6-7.3	<2	High	0.15			
	32-60	28-45	0.06-0.2	0.04-0.06	6.6-7.3	<2	Moderate	0.15			
16:											
Delson, moderately deep	0-7	18-27	0.6-2.0	0.14-0.18	6.1-7.3	<2	Low	0.32	5	4	3-6
	7-24	35-45	0.06-0.2	0.14-0.21	6.1-7.3	<2	Moderate	0.28			
	24-30	28-40	0.2-0.6	0.17-0.21	6.1-7.3	<2	Moderate	0.28			
	30	---	---	---	---	---					
Sharrott	0-4	5-18	0.6-2.0	0.10-0.12	5.6-7.3	<2	Low	0.20	1	6	2-4
	4-15	5-18	2.0-6.0	0.04-0.06	5.6-7.3	<2	Low	0.10			
	15	---	---	---	---	---					
17:											
Dough, dry	0-3	10-20	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low	0.28	1	3	.5-1
	3-16	10-22	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low	0.28			
	16	---	---	---	---	---					
Rock outcrop	0-60	---	---	---	---	<2				---	---
18:											
Durango	0-4	5-20	2.0-6.0	0.06-0.15	6.6-7.3	<2	Low	0.20	5	3	1-3
	4-10	20-30	0.2-0.6	0.16-0.18	6.6-7.3	<2	Moderate	0.28			
	10-25	35-55	0.06-0.2	0.14-0.17	6.6-7.8	<2	High	0.24			
	25-60	35-45	0.06-0.2	0.11-0.15	7.9-8.4	<2	High	0.24			
Arabrab	0-6	15-20	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	0.28	1	3	1-4
	6-14	20-35	0.6-2.0	0.14-0.20	7.4-8.4	<2	Low	0.28			
	14-19	20-35	0.6-2.0	0.10-0.15	7.4-8.4	<2	Low	0.20			
	19	---	---	---	---	---					
19:											
Falcon	0-3	10-20	2.0-6.0	0.11-0.18	6.6-7.3	<2	Low	0.28	1	3	1-4
	3-10	10-23	2.0-6.0	0.10-0.18	6.6-7.3	<2	Low	0.28			
	10	---	---	---	---	---					
Dough	0-3	10-20	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low	0.28	1	3	.5-1
	3-11	10-22	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low	0.28			
	11	---	---	---	---	---					
Rock outcrop	0-60	---	---	---	---	<2				---	---
20:											
Gralic	0-5	10-15	2.0-6.0	0.12-0.15	5.6-6.5	<2	Low	0.32	5	3	1-3
	5-19	8-18	2.0-6.0	0.06-0.14	5.6-6.5	<2	Low	0.15			
	19-60	7-18	2.0-6.0	0.05-0.08	5.6-6.5	<2	Low	0.10			

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm		K	T		Pct
20:											
Grenadier	0-4	5-15	2.0-6.0	0.10-0.12	5.6-6.0	<2	Low	0.20	3	8	1-3
	4-32	5-15	2.0-6.0	0.06-0.13	5.6-6.5	<2	Low	0.15			
	32-50	5-15	2.0-6.0	0.05-0.09	5.6-6.5	<2	Low	0.10			
	50	---	---	---	---	---					
21:											
Hapgood	0-8	15-22	0.6-2.0	0.13-0.15	5.6-6.5	<2	Low	0.20	4	8	2-5
	8-17	18-25	0.6-2.0	0.08-0.13	5.6-6.5	<2	Low	0.15			
	17-60	18-25	0.6-2.0	0.05-0.08	5.6-6.5	<2	Low	0.10			
Lamphier	0-35	18-26	0.6-2.0	0.16-0.19	6.6-7.3	<2	Moderate	0.28	5	6	2-5
	35-45	25-35	0.2-0.6	0.14-0.17	6.6-7.3	<2	Moderate	0.24			
	45-60	25-50	0.2-0.6	0.11-0.17	6.6-7.3	<2	High	0.20			
22:											
Hoosan	0-10	15-25	0.6-2.0	0.16-0.18	6.6-7.3	<2	Moderate	0.32	5	6	2-5
	10-22	20-35	0.2-0.6	0.15-0.18	6.6-7.3	<2	Moderate	0.28			
	22-38	40-50	0.06-0.2	0.10-0.12	6.6-7.3	<2	High	0.20			
	38-60	40-50	0.06-0.2	0.10-0.12	6.6-7.3	<2	High	0.20			
Lamphier	0-35	18-26	0.6-2.0	0.16-0.19	6.6-7.3	<2	Moderate	0.28	5	6	2-5
	35-45	25-35	0.2-0.6	0.14-0.17	6.6-7.3	<2	Moderate	0.24			
	45-60	25-50	0.2-0.6	0.11-0.17	6.6-7.3	<2	High	0.20			
Leaps	0-14	28-35	0.2-0.6	0.17-0.19	6.6-7.3	<2	Moderate	0.20	5	6	2-4
	14-60	40-55	0.06-0.2	0.10-0.13	6.6-7.3	<2	High	0.20			
23:											
Jodero	0-3	15-27	0.6-2.0	0.15-0.18	6.6-7.3	<2	Low	0.32	5	5	2-5
	3-18	15-28	0.2-0.6	0.14-0.18	6.6-7.3	<2	Moderate	0.37			
	18-37	18-28	0.2-0.6	0.17-0.20	6.6-7.8	<2	Moderate	0.28			
	37-60	25-35	0.2-0.6	0.17-0.20	6.6-7.8	<2	Moderate	0.28			
Empedrado	0-3	15-22	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.32	5	6	1-4
	3-10	15-22	0.6-2.0	0.17-0.20	6.6-7.8	<2	Low	0.32			
	10-28	25-35	0.2-0.6	0.18-0.20	6.6-7.8	<2	Moderate	0.28			
	28-60	25-35	0.2-0.6	0.18-0.20	7.4-8.4	<2	Low	0.28			
24:											
Kubler	0-7	18-27	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.32	3	6	2-5
	7-22	28-40	0.2-0.6	0.17-0.20	6.6-7.8	<2	Low	0.32			
	22-44	35-50	0.06-0.2	0.14-0.16	6.6-7.3	<2	Moderate	0.24			
	44-60	28-45	0.06-0.2	0.13-0.16	7.9-8.4	<2	Moderate	0.24			
Delson	0-11	18-27	0.6-2.0	0.12-0.16	6.1-7.3	<2	Low	0.24	5	6	3-6
	11-39	35-45	0.06-0.2	0.14-0.21	6.1-7.3	<2	Moderate	0.28			
	39-60	28-40	0.2-0.6	0.17-0.21	6.1-7.3	<2	Moderate	0.28			
Cerro	0-4	15-27	0.6-2.0	0.16-0.18	6.1-7.3	<2	Low	0.24	5	4	1-4
	4-14	28-35	0.06-0.2	0.17-0.21	6.1-7.3	<2	Low	0.24			
	14-48	35-45	<0.06	0.10-0.12	6.1-7.8	<2	Moderate	0.28			
	48-60	38-45	0.06-0.2	0.11-0.13	7.4-8.4	<2	Moderate	0.28			
25:											
Lamphier	0-35	18-26	0.6-2.0	0.16-0.19	6.6-7.3	<2	Moderate	0.28	5	6	2-5
	35-45	25-35	0.2-0.6	0.14-0.17	6.6-7.3	<2	Moderate	0.24			
	45-60	25-50	0.2-0.6	0.11-0.17	6.6-7.3	<2	High	0.20			

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
25:											
Hapgood---	0-8	15-22	0.6-2.0	0.13-0.15	5.6-6.5	<2	Low---	0.20	4	8	2-5
	8-17	18-25	0.6-2.0	0.08-0.13	5.6-6.5	<2	Low---	0.15			
	17-60	18-25	0.6-2.0	0.05-0.08	5.6-6.5	<2	Low---	0.10			
26:											
Mirand---	0-8	10-20	0.6-2.0	0.15-0.18	6.6-7.3	<2	Low---	0.32	5	6	2-4
	8-37	35-45	0.06-0.2	0.12-0.14	6.6-7.3	<2	Moderate--	0.28			
	37-60	28-40	0.06-0.2	0.15-0.17	7.4-8.4	<2	Moderate--	0.32			
Callan---	0-7	20-28	0.6-2.0	0.18-0.21	6.6-7.3	<2	Low---	0.32	5	6	2-4
	7-10	25-35	0.2-0.6	0.16-0.20	6.6-7.3	<2	Moderate--	0.28			
	10-45	35-60	0.06-0.2	0.14-0.16	6.6-7.8	<2	High---	0.24			
	45-60	25-40	0.2-0.6	0.16-0.18	7.9-9.0	<2	Moderate--	0.28			
Chilson Variant-	0-5	10-20	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low---	0.24	1	4	2-4
	5-14	25-35	0.2-0.6	0.12-0.16	6.6-7.8	<2	Moderate--	0.20			
	14-19	40-55	0.06-0.2	0.12-0.16	6.6-7.8	<2	High---	0.20			
	19	---	---	---	---	---	---	---			
27:											
Overgaard---	0-9	5-15	2.0-6.0	0.12-0.15	5.6-7.3	<2	Low---	0.37	2	3	<1
	9-26	35-45	0.2-0.6	0.15-0.15	5.6-7.3	<2	Moderate--	0.28			
	26	---	---	---	---	---	---	---			
Olathe---	0-4	5-18	2.0-6.0	0.12-0.14	6.1-7.3	<2	Low---	0.20	1	3	2-4
	4-10	5-18	2.0-6.0	0.12-0.14	6.1-7.3	<2	Low---	0.24			
	10-15	5-18	2.0-6.0	0.09-0.11	6.1-7.3	<2	Low---	0.17			
	15	---	---	---	---	---	---	---			
28:											
Sawcreek---	0-9	10-18	2.0-6.0	0.12-0.15	5.6-7.3	<2	Low---	0.20	2	3	2-4
	9-23	10-18	2.0-6.0	0.14-0.16	5.6-7.3	<2	Low---	0.28			
	23-26	---	---	---	---	---	---	---			
	26	---	---	---	---	---	---	---			
Splitro---	0-7	10-18	0.6-2.0	0.12-0.14	6.1-7.3	<2	Low---	0.20	1	8	1-4
	7-15	10-18	0.6-2.0	0.12-0.14	6.1-7.3	<2	Low---	0.24			
	15	---	---	---	---	---	---	---			
29:											
Supervisor---	0-11	7-18	0.6-2.0	0.06-0.09	5.6-7.3	<2	Low---	0.17	2	8	2-4
	11-16	7-18	2.0-6.0	0.05-0.09	5.6-7.3	<2	Low---	0.15			
	16-25	7-18	2.0-6.0	0.05-0.09	5.6-7.3	<2	Low---	0.10			
	25	---	---	---	---	---	---	---			
Cebone---	0-12	10-18	0.6-2.0	0.15-0.18	6.1-7.3	<2	Low---	0.32	2	6	1-4
	12-15	5-15	2.0-6.0	0.09-0.12	6.1-7.3	<2	Low---	0.20			
	15-21	25-40	0.2-0.6	0.14-0.18	6.1-7.3	<2	Moderate--	0.20			
	21-36	35-50	0.06-0.2	0.12-0.15	6.1-7.3	<2	High---	0.17			
	36	---	---	---	---	---	---	---			
30:											
Trampas---	0-4	15-22	0.6-2.0	0.13-0.16	6.1-7.3	<2	Low---	0.20	1	6	2-5
	4-11	10-22	0.2-6.0	0.10-0.14	6.1-7.3	<2	Low---	0.17			
	11-20	30-38	0.2-0.6	0.06-0.08	6.1-7.3	<2	Moderate--	0.15			
	20-45	40-50	0.06-0.2	0.05-0.07	6.1-7.3	<2	Moderate--	0.15			
	45-60	40-55	0.06-0.2	0.03-0.05	6.1-7.3	<2	High---	0.10			

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
30:											
Delson, moderately deep	0-7	18-27	0.6-2.0	0.14-0.18	6.1-7.3	<2	Low	0.32	5	4	3-6
	7-24	35-45	0.06-0.2	0.14-0.21	6.1-7.3	<2	Moderate	0.28			
	24-30	28-40	0.2-0.6	0.17-0.21	6.1-7.3	<2	Moderate	0.28			
	30	---	---	---	---	---	---	---			
31:											
Ula	0-7	8-15	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.32	2	5	2-5
	7-25	13-20	0.6-2.0	0.07-0.09	5.6-6.5	<2	Moderate	0.15			
	25-53	20-35	0.2-0.6	0.09-0.11	4.5-5.5	<2	Moderate	0.15			
	53	---	---	---	---	---	---	---			
Agneston	0-17	5-15	2.0-6.0	0.09-0.11	5.1-5.5	<2	Low	0.15	2	5	1-2
	17-36	25-35	0.2-0.6	0.06-0.09	4.5-5.5	<2	Moderate	0.10			
	36	---	---	---	---	---	---	---			
Pendergrass	0-9	8-16	2.0-6.0	0.07-0.09	4.5-5.5	<2	Low	0.15	1	8	1-3
	9-17	8-16	2.0-6.0	0.07-0.09	4.5-5.5	<2	Low	0.10			
	17	---	---	---	---	---	---	---			
32:											
Ustorthents.											
Ustochrepts.											
Rock outcrop	0-60	---	---	---	---	<2	---	---	---	---	---

TABLE 14.--EROSION FACTORS

Soil name and map symbol	Potential erosion	Current erosion
	Tons/acre/year	Tons/acre/year
10:		
Arabrab	3.4-7.3	0.14-0.31[1, 2]
Dalhart	3.9-7.3	0.10-0.18[3]
11:		
Belain	4.6-7.3	0.33-0.52[1, 2] 0.28-0.45[4, 2]
Falcon	4.6-7.3	0.33-0.52[1, 2] 0.28-0.45[4, 2]
13:		
Chilson	6.4-7.3	0.19-.021[1, 2] 0.41-.047[4, 2]
Delson, moderately deep	5.5-8.4	0.16-0.35[1, 2] 0.25-0.39[4, 2]
Beenom	3.9-4.6	0.11-0.13[4, 2]
14:		
Chilson Variant	6.2	0.28[5, 6] 0.60[5, 2]
Rock outcrop.		
15:		
Delson	37.6-42.9	2.60-2.98[5, 7]
Kubler	32.2-37.6	1.59-1.86[5, 7]
Showalter	26.8-32.2	1.86-2.23[5, 7]
16:		
Delson, moderately deep	5.5-8.4	0.16-0.35[1, 2] 0.25-0.39[4, 2]
Sharrott	5.5-8.4	0.16-0.25[1, 2] 0.35-0.55[4, 2]
17:		
Dough, dry	3.9-4.6	0.12-0.14[4, 2]
Rock outcrop.		
18:		
Durango	12.0-22.6	0.22-0.41[1, 2] 0.59-1.10[4, 2]
Arabrab	10.6-22.6	0.52-1.10[4, 2]
19:		
Falcon	3.7-7.9	0.13-0.27[4, 2] 0.13-0.27[5, 2]
Dough	2.8-7.9	0.15-0.44[4, 2] 0.15-0.42[5, 2]
Rock outcrop.		

See footnotes at end of table.

TABLE 14.--EROSION FACTORS--Continued

Soil name and map symbol	Potential erosion	Current erosion
	Tons/acre/year	Tons/acre/year
20:		
Gralic	66.0-87.2	2.00-2.64[5, 2]
Grenadier	47.1-66.0	1.43-2.00[5, 2]
21:		
Hapgood	47.1-56.6	1.20-1.44[5, 2]
Lamphier	23.6-66.0	0.60-1.68[5, 2]
22:		
Hoosan	21.2-25.4	0.18-0.22[3]
Lamphier	21.2-25.4	0.38-0.46[5, 2]
Leaps	25.4-29.6	0.22-0.26[3]
23:		
Jodero	4.7-11.2	0.12-0.29[3]
Empedrado	13.1-15.2	0.33-0.39[3]
24:		
Kubler	5.5-6.4	0.22-0.26[5, 7]
Delson	6.4-7.3	0.37-0.42[5, 7]
Cerro	5.5-6.4	0.09-0.11[3]
25:		
Lamphier	5.4-15.2	0.11-0.30[5, 2]
Hapgood	5.4-10.9	0.11-0.22[5, 2]
26:		
Mirand	7.3-10.2	0.19-0.26[1, 2] 0.40-0.57[4, 2]
Callan	8.7-13.4	0.22-0.34[1, 7] 0.62-0.96[4, 2]
Chilson Variant	6.2-11.6	0.16-0.30[1, 7] 0.44-0.83[4, 2]
27:		
Overgaard	13.1-17.4	0.63-0.83[5, 2]
Olathe	11.0-14.7	0.49-0.66[5, 2]
28:		
Sawcreek	6.8-11.0	0.11-0.17[4, 2] 0.10-0.17[5, 2]
Splitro	6.8-11.0	0.11-0.17[4, 2] 0.10-0.17[5, 2]
29:		
Supervisor	3.4-8.2	0.10-0.24[4, 2] 0.32-0.77[5, 2]
Cebone	5.8-8.2	0.54-0.77[5, 2]

See footnotes at end of table.

TABLE 14.--EROSION FACTORS--Continued

Soil name and map symbol	Potential erosion	Current erosion
	Tons/acre/year	Tons/acre/year
30:		
Trampas	31.3-35.8	0.54-0.62[1, 2] 1.45-1.65[4, 2]
Delson, moderately deep	26.8-41.4	0.75-1.22[1, 2] 1.24-1.91[4, 2]
31:		
Ula	11.0-12.7	0.33-0.38[3]
Agneston	6.8-9.6	0.52-0.72[5, 2]
Pendergrass	5.8-6.8	0.77-0.91[5, 2]

[1] 25 percent canopy cover
[2] Trees
[3] 0 percent canopy cover
[4] 50 percent canopy cover
[5] 75 percent canopy cover
[6] Tall weeds or short brush
[7] Brush or bushes

TABLE 15.--SOIL AND WATER FEATURES

("Hydrologic group" and other terms are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
10:									
Arabrab	D	None	---	---	10-20	Hard	Moderate	High	Low.
Dalhart	C	None	---	---	>20	Hard	Moderate	High	Low.
11:									
Belain	C	None	---	---	20-60	Hard	Moderate	Moderate	Low.
Falcon	D	None	---	---	7-20	Hard	Moderate	Moderate	Low.
12:									
Borolls.									
Boralfs.									
Rock outcrop	D	None	---	---	0	Hard	---	---	---
13:									
Chilson	D	None	---	---	10-20	Hard	Low	Moderate	Low.
Delson, moderately deep-	C	None	---	---	>60	---	Low	High	Low.
Beenom	D	None	---	---	10-20	Hard	Moderate	Moderate	Low.
14:									
Chilson Variant--	D	None	---	---	7-20	Hard	Low	Moderate	Low.
Rock outcrop	D	None	---	---	0	Hard	---	---	---
15:									
Delson	C	None	---	---	>60	---	Low	High	Low.
Kubler	C	None	---	---	>60	---	Low	High	Low.
Showalter	C	None	---	---	40-60	Hard	Low	Moderate	Low.
16:									
Delson, moderately deep-	C	None	---	---	>60	---	Low	High	Low.
Sharrott	D	None	---	---	8-20	Hard	Moderate	Moderate	Moderate.
17:									
Dough, dry	D	None	---	---	7-20	Hard	Moderate	Moderate	Low.
Rock outcrop	D	None	---	---	0	Hard	---	---	---
18:									
Durango	C	None	---	---	>20	Hard	Low	High	Low.
Arabrab	D	None	---	---	10-20	Hard	Moderate	High	Low.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
19:									
Falcon	D	None	---	---	7-20	Hard	Moderate	Moderate	Low.
Dough	D	None	---	---	7-20	Hard	Moderate	Moderate	Low.
Rock outcrop	D	None	---	---	0	Hard	---	---	---
20:									
Gralic	B	None	---	---	>40	Soft	Moderate	Moderate	Moderate.
Grenadier	B	None	---	---	40-60	Soft	Moderate	Moderate	Moderate.
21:									
Hapgood	B	None	---	---	>40	---	Moderate	Moderate	Moderate.
Lamphier	B	None	---	---	>60	---	Moderate	Moderate	Low.
22:									
Hoosan	C	None	---	---	>60	---	Moderate	Moderate	Low.
Lamphier	B	None	---	---	>60	---	Moderate	Moderate	Low.
Leaps	C	None	---	---	>60	---	Moderate	Moderate	Low.
23:									
Jodero	B	Rare	---	---	>60	---	Moderate	Moderate	Low.
Empedrado	B	None	---	---	>60	---	Moderate	High	Low.
24:									
Kubler	C	None	---	---	>60	---	Low	High	Low.
Delson	C	None	---	---	>60	---	Low	High	Low.
Cerro	D	None	---	---	>60	---	Low	High	Low.
25:									
Lamphier	B	None	---	---	>60	---	Moderate	Moderate	Low.
Hapgood	B	None	---	---	>40	---	Moderate	Moderate	Moderate.
26:									
Mirand	C	None	---	---	>20	Hard	Low	High	Low.
Callan	C	None	---	---	>60	---	Low	High	Low.
Chilson Variant	D	None	---	---	7-20	Hard	Low	Moderate	Low.
27:									
Overgaard	C	None	---	---	>20	Hard	Moderate	Moderate	Moderate.
Olathe	D	None	---	---	6-20	Hard	Low	Moderate	Low.
28:									
Sawcreek	C	None	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Splitro	D	None	---	---	5-20	Hard	Moderate	Moderate	Low.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
29:									
Supervisor	C	None	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Cebone	B	None	---	---	>20	Hard	Moderate	Moderate	Low.
30:									
Trampas	C	None	---	---	>40	Hard	Low	Moderate	Low.
Delson, moderately deep	C	None	---	---	>60	---	Low	High	Low.
31:									
Ula	C	None	---	---	>20	Hard	Moderate	High	High.
Agneston	B	None	---	---	20-40	Hard	Moderate	High	High.
Pendergrass	B	None	---	---	10-20	Hard	Moderate	High	High.
32:									
Ustorthents.									
Ustochrepts.									
Rock outcrop	D	None	---	---	0	Hard	---	---	---

TABLE 16.--CLASSIFICATION OF THE SOILS

Soil name	Classification
Agneston family	Loamy-skeletal, mixed Typic Cryoboralfs
Arabrab family	Loamy, mixed, mesic Lithic Haplustalfs
Beenom family	Loamy, mixed Lithic Argiborolls
Belain family	Coarse-loamy, mixed Typic Haploborolls
Boralfs	Boralfs
Borolls	Borolls
Callan family	Fine, mixed Aridic Argiborolls
Cebone family	Fine, montmorillonitic Boralfic Cryoboralfs
Cerro family	Fine, montmorillonitic Ustertic Argiborolls
Chilson family	Clayey, mixed Lithic Argiborolls
Chilson Variant	Clayey, mixed Lithic Eutroboralfs
Dalhart family	Fine-loamy, mixed, mesic Aridic Haplustalfs
Delson family	Fine, montmorillonitic Typic Argiborolls
Dough family	Loamy, mixed, frigid Lithic Ustochrepts
Durango family	Fine, mixed, mesic Aridic Haplustalfs
Empedrado family	Fine-loamy, mixed Typic Argiborolls
Falcon family	Loamy, mixed Lithic Haploborolls
Gralic family	Loamy-skeletal, mixed, nonacid Typic Cryorthents
Grenadier family	Loamy-skeletal, mixed Dystric Cryochrepts
Hapgood family	Loamy-skeletal, mixed Pachic Cryoborolls
Hoosan family	Fine, mixed Pachic Cryoborolls
Jodero family	Fine-loamy, mixed Cumulic Haploborolls
Kubler family	Fine, montmorillonitic Pachic Argiborolls
Lamphier family	Fine-loamy, mixed Pachic Cryoborolls
Leaps family	Fine, montmorillonitic Typic Cryoborolls
Mirand family	Fine, mixed Mollic Eutroboralfs
Olathe family	Loamy, mixed Lithic Cryochrepts
Overgaard family	Fine, mixed Typic Cryoboralfs
Pendergrass family	Loamy-skeletal, mixed, nonacid Lithic Cryorthents
Sawcreek family	Coarse-loamy, mixed Typic Cryoborolls
Sharrott family	Loamy-skeletal, mixed, frigid Lithic Ustochrepts
Showalter family	Clayey-skeletal, montmorillonitic Aridic Argiborolls
Splitro family	Loamy, mixed Lithic Cryoborolls
Supervisor family	Loamy-skeletal, mixed Typic Cryoborolls
Trampas family	Clayey-skeletal, mixed Typic Eutroboralfs
Ula family	Fine-loamy, mixed Mollic Cryoboralfs
Ustochrepts	Ustochrepts
Ustorthents	Ustorthents

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