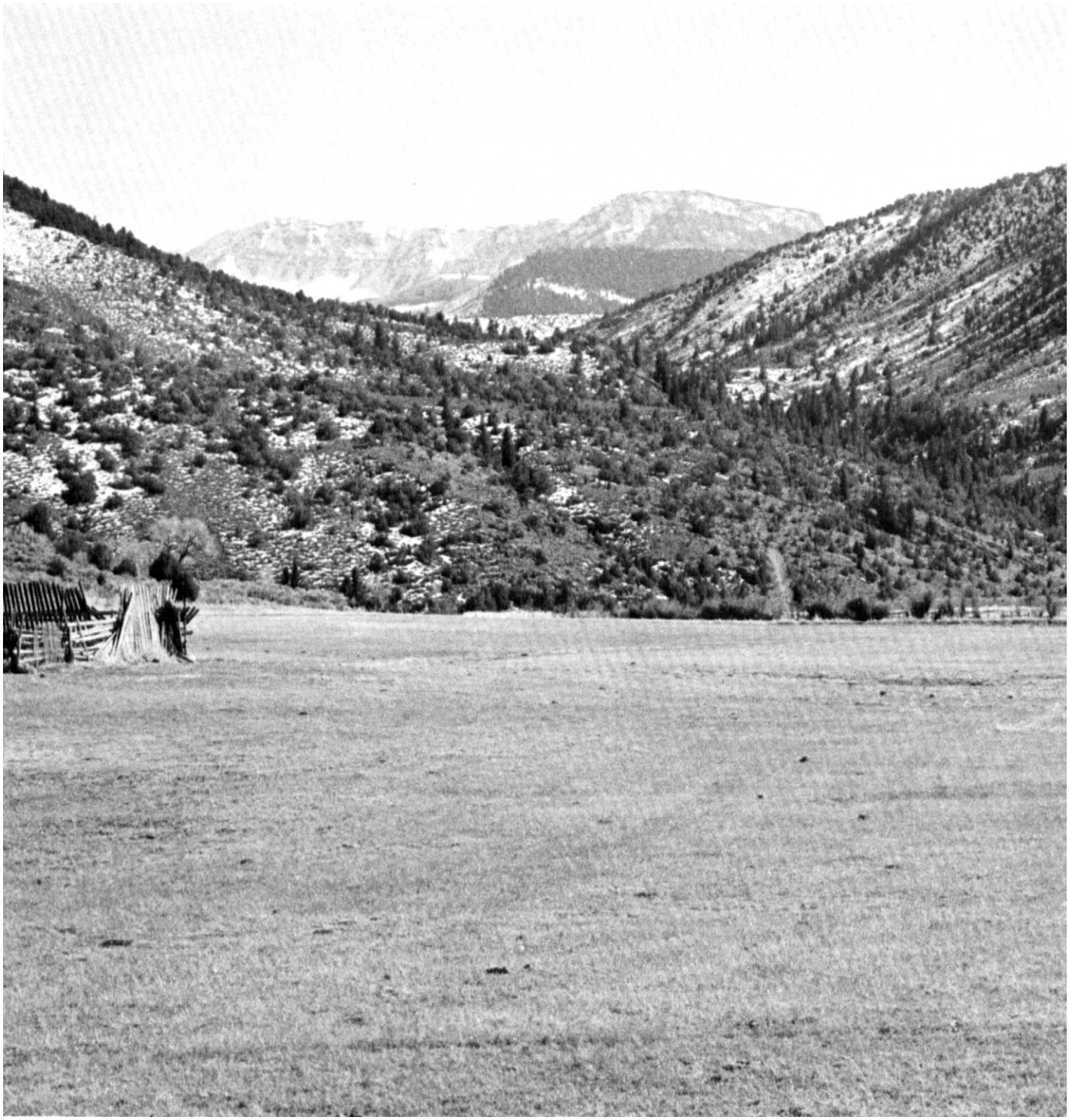
United States Department of Agriculture

Soil Conservation Service

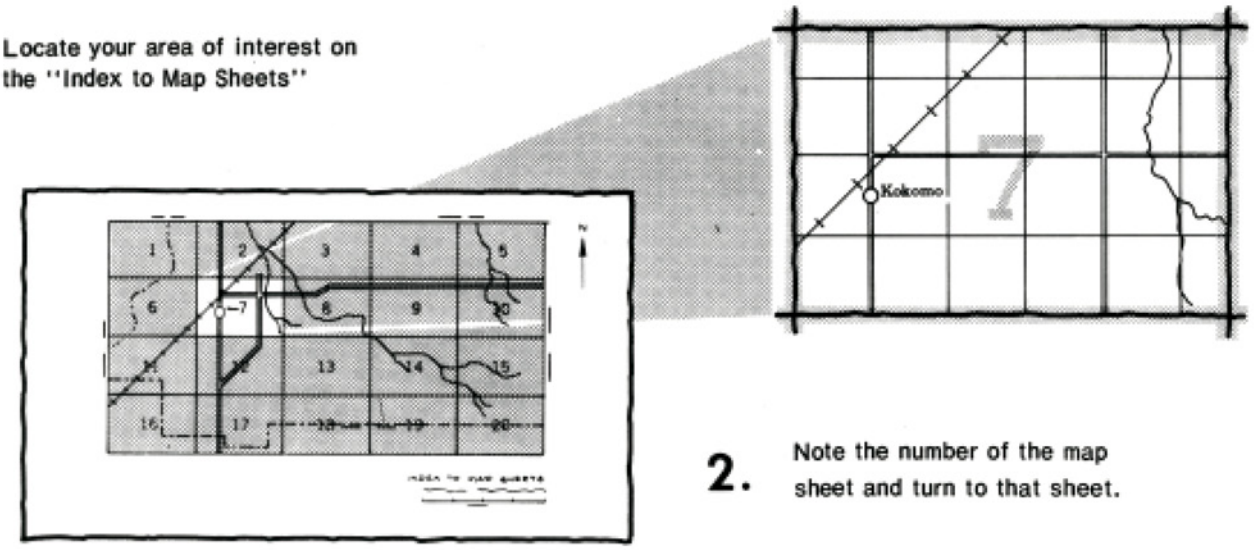
In Cooperation with United States Department of Agriculture, Forest Service, and Colorado Agricultural Experiment Station

Soil Survey of Grand County Area Colorado



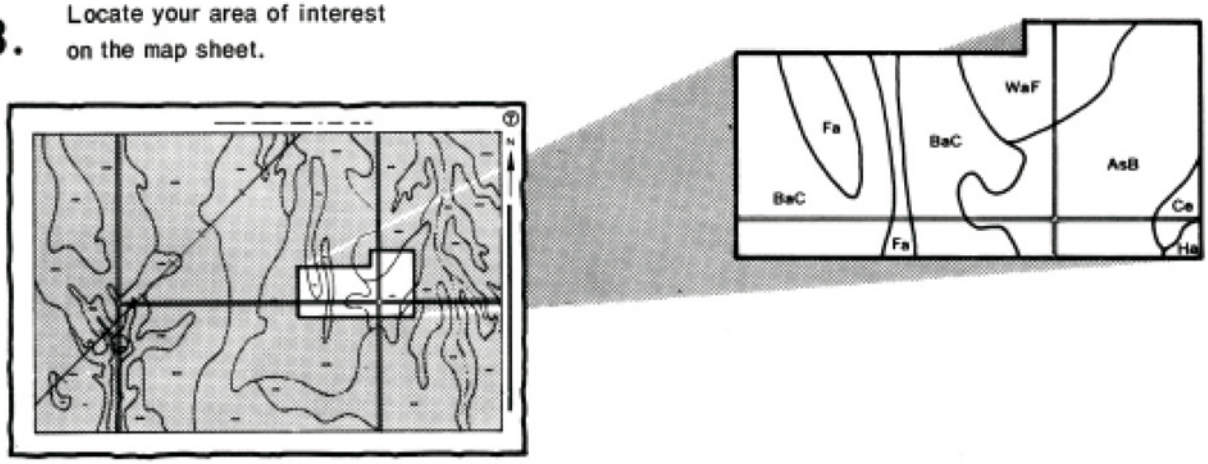
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

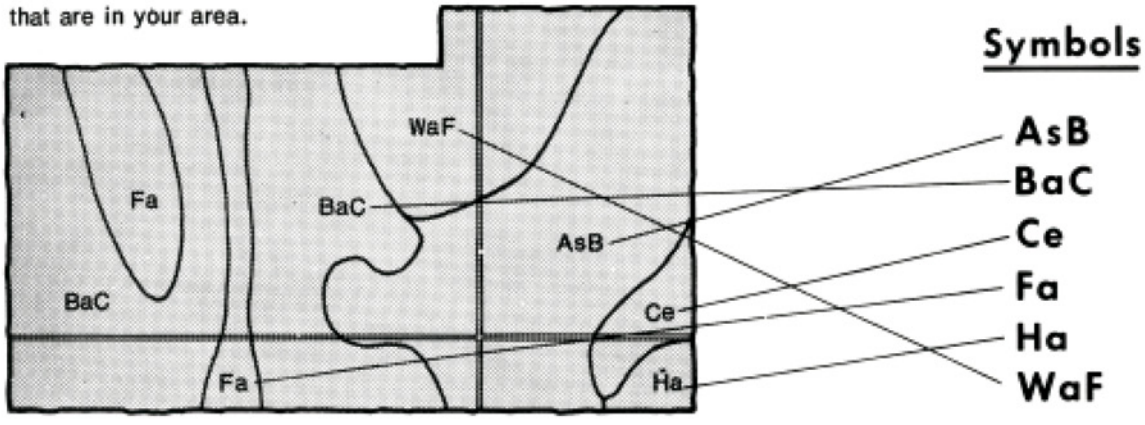


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

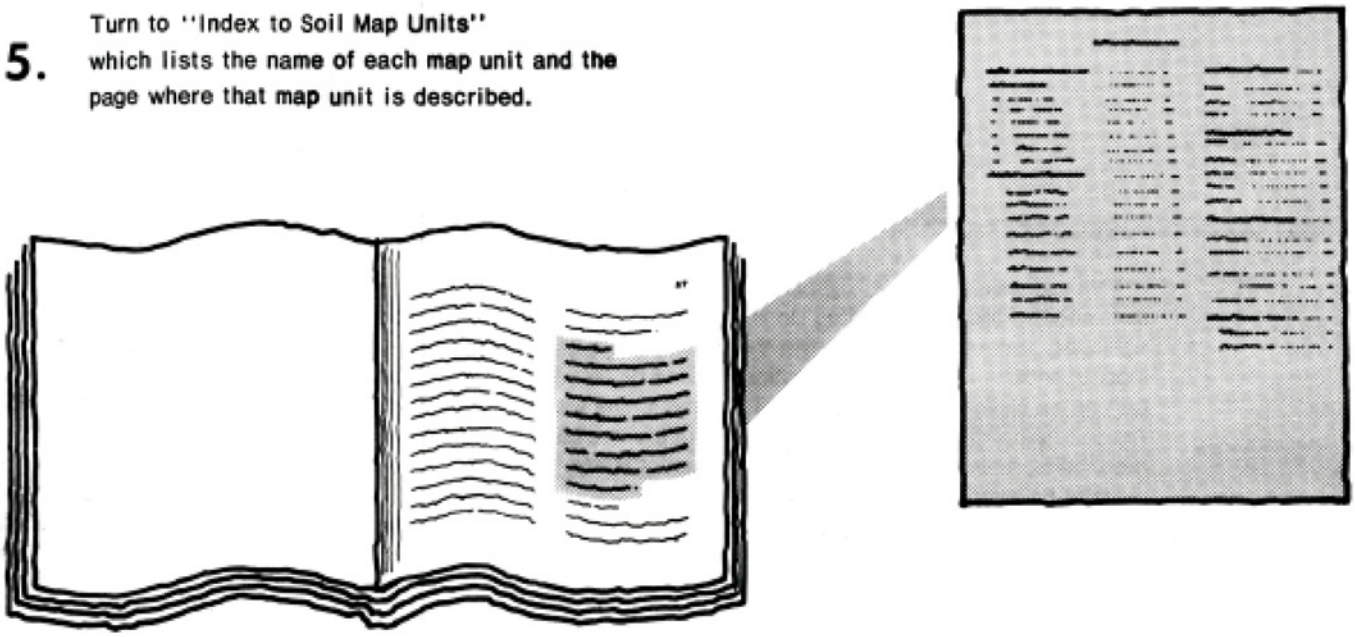


4. List the map unit symbols that are in your area.

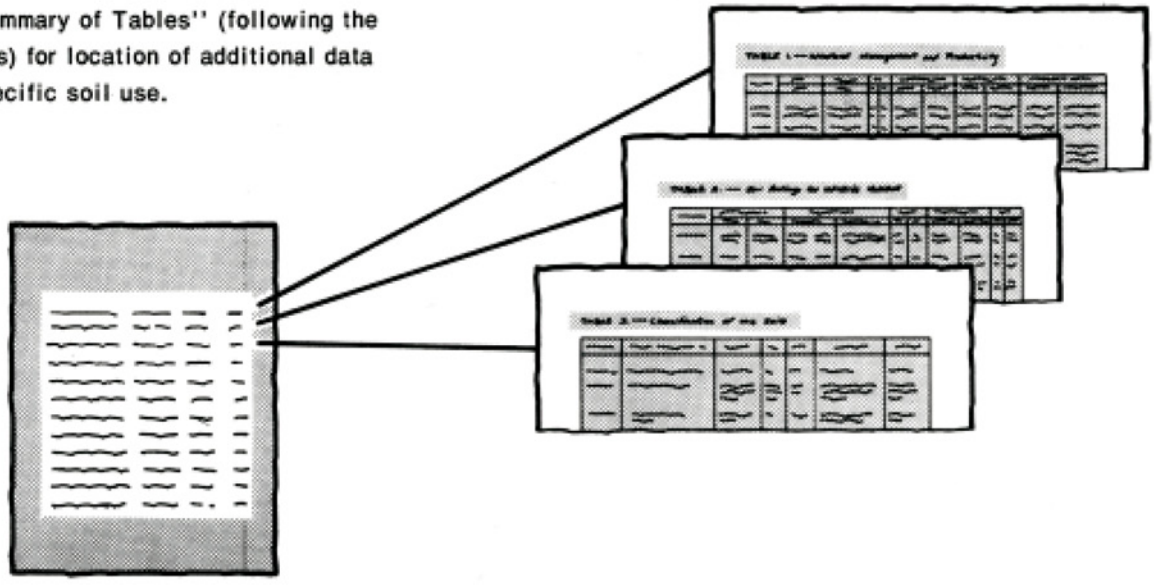


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1974-76. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and Forest Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Grand County Commissioners and the Middle Park Soil Conservation District.

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

Cover: The Forelle loam in the foreground is used for irrigated hayland. The steep Dahlquist-Stunner complex in the background provides good winter range for big game.

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Issued June 1983

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Summary of tables

Foreword

The Soil Survey of Grand County Area contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

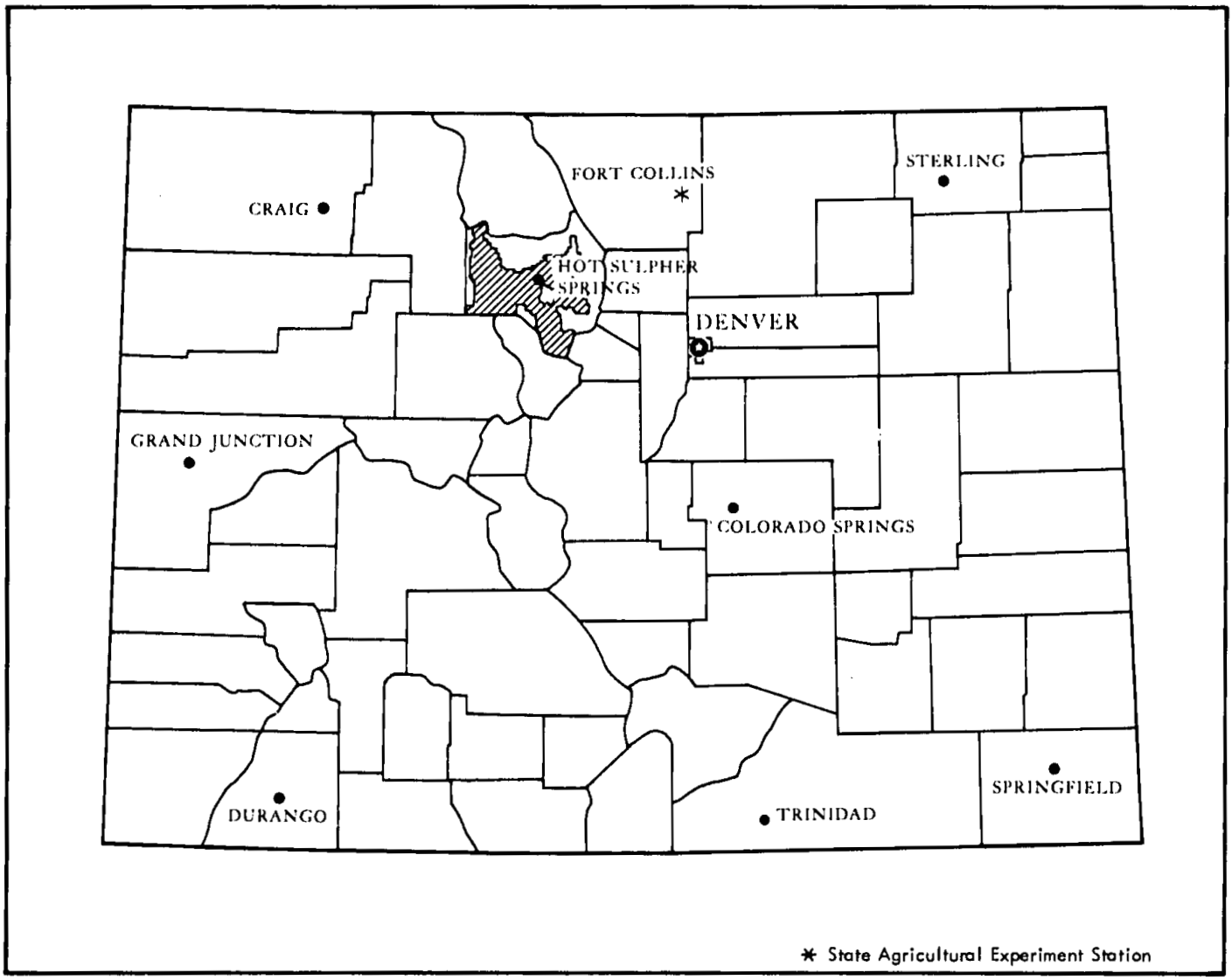
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Robert G. Halstead
State Conservationist
Soil Conservation Service



Location of Grand County Area in Colorado.

SOIL SURVEY OF GRAND COUNTY AREA, COLORADO

By David Alstatt and Ray L. Miles, Soil Conservation Service

Fieldwork by Ray L. Miles, Mike Peterson, and Darrell Schroeder, Soil Conservation Service

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

The Grand County survey area is the central part of the county. It excludes all Federal lands administered by the Forest Service except those in the Williams Fork area. Hot Sulphur Springs, the county seat, has a population of 225 and an elevation of 7,670 feet. Grand County has a total of 1,196,160 acres, or about 1,869 square miles. The survey area has a total of 635,425 acres, or about 993 square miles.

Grand County is in north-central Colorado in the Southern Rocky Mountain Province. The Colorado River, the major drainage, flows from the northeast to the southwestern part of the county. The Fraser River flows northwestward and enters the Colorado River west of Granby. The Williams Fork River flows northward and enters the Colorado River west of Parshall. The Blue River, which also flows northward, enters the Colorado River west of Kremmling. The county consists of steep mountainous uplands and areas covered with glacial drift. Elevations range from about 6,850 feet in the southwest corner to about 13,500 feet in the eastern part along the Continental Divide.

General nature of the county

A treaty between the United States and Spain, in 1819, ceded the Grand Area to the United States. The United States' claim to the area was further strengthened by the exploration of John C. Fremont in 1844 and 1845 and by a treaty with the Ute Indians. Colorado became a territory in 1861.

Grand County was established in 1874. It was named after Grand Lake and the Grand River, now the Colorado River. After construction of the Moffat Railroad in 1906, homesteaders and ranchers established large farms and ranches.

Grand County is surrounded by the Continental Divide to the east and north, by Routt County to the west, and by Summit County to the south. The Middle Park Area is a high mountain park in the Grand County Area.

Hot Sulphur Springs, the county seat, has a population of 225. Kremmling, the largest town in the survey area, has a population of 764. Other towns are Fraser, Granby, and Grand Lake.

Climate

Summers in Grand County are warm or hot in most valleys and much cooler in the mountains. Winters are cold in the mountains. The valleys are colder than the lower slopes of adjacent mountains because of cold air drainage. Precipitation occurs in the mountains throughout the year, and a deep snowpack accumulates in winter. Snowmelt usually supplies much more water than is needed for agriculture in the county. In the valleys precipitation in summer occurs as showers. Some thunderstorms also occur. In winter the ground is covered with snow much of the time. The warm, dry Chinook winds, which blow downslope, often melt and evaporate the snow.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Fraser, Grand Lake, and Kremmling, for the period 1951 to 1974. The three stations represent the diversity of local climate found in high mountain valleys. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 12 to 17 degrees F, and the average daily minimum temperature is -6 to 2 degrees. The lowest temperature on record, -53 degrees, occurred at Fraser on January 10, 1962. In summer the average temperature is 52 to 59 degrees, and the average daily maximum temperature is 72 to 80 degrees. The highest temperature, 98 degrees, was recorded at Fraser on August 1, 1969.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days

accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 55 to 60 percent usually falls during the period April through September, which includes the growing season for most crops. The heaviest 1-day rainfall during the period of record was 3.20 inches at Fraser on September 27, 1959. Thunderstorms number about 41 each year, 29 of which occur in summer.

Average seasonal snowfall is 80 to 155 inches. The greatest snow depth at any one time during the period of record was 56 inches. On the average, 30 to 70 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

The average relative humidity in midafternoon is less than 40 percent. Humidity is higher at night, and the average at dawn is about 69 percent. The percentage of possible sunshine is 71 in summer and 70 in winter. The prevailing wind is from the south. Average windspeed is highest, 10.4 miles per hour, in April.

Natural resources

Water, one of the most important natural resources in Grand County, is used for municipal, industrial, domestic, and agricultural purposes along the entire Colorado River. It is also diverted to the eastern slope of the Colorado for use along the Front Range. The loss of water to the eastern slope is offset by a series of reservoirs along the Upper Colorado River. These reservoirs provide extra storage during spring runoff. This water is gradually released later in summer for use along the Lower Colorado. Shadow Mountain and Williams Fork Reservoirs have electrical generating facilities at their outlets. Boating and fishing are common at these reservoirs and at Granby Reservoir.

The amount of available water and the time of its release from the high country snow are predicted by the snow survey division of the Soil Conservation Service. These predictions are based on snow depth and density and soil moisture data collected from snow courses and soil moisture stations throughout the Colorado River headwaters area.

Experiments with different timber cutting methods and how they affect the snowmelt have been conducted in the Fraser Experimental Forest.

Soil, another important natural resource, can be expected to yield benefits without depletion if it is well managed. The purpose of this survey is to aid in maintaining and improving the value of the soil resource. Sand and gravel are available for building roads and other structures. The sources of these materials are the alluvial land and benches adjacent to the Colorado River and the Blue River. The native plant cover is grass and timber. The grass, grazed by livestock and wildlife, can be maintained under careful grazing management. The timber is used for lumber, poles, posts, and firewood. Maintaining the native plant cover is essential in minimizing soil losses through erosion.

Agriculture

The first settlers in Grand County were mainly cattle or sheep ranchers. Ranching is still the main agricultural enterprise. Over the years, ranchers have improved the quality of hay production through good water management and fertilization programs.

The Middle Park Soil Conservation District, formed August 12, 1957, has assisted ranchers in the management of their grazing and irrigation systems. Since 1972, the district board has reviewed subdivision plans for the county commissioners and in this way has helped in making sound land use decisions. The district also assists landowners in recommending seeding, brush management, and fertilizer; in selecting and revegetating construction sites; and in considering the soils suitable for development.

The suitability of most soils in the Grand County Area for crop production is limited by the cold climate and the short growing season. In the past, the truck farm was an important part of the farm program. Today small truck farmers cannot compete successfully with the advanced technology of agriculture in other parts of Colorado and the nation.

Agriculture is still an important economic influence in the Grand County Area. Recreation and related industries are beginning to have a large economic impact.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

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

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. The major land uses are hayland, woodland, urban areas, and recreation areas. Hay crops are grass hay produced by ranchers for winter feed or for sale. Woodland refers to land that is producing trees native to the area. Urban areas are residential, commercial, and recreational developments. Recreation areas include campsites, picnic areas, playgrounds, and similar areas subject to heavy foot traffic.

Soils on low terraces, flood plains and adjacent fans, and side slopes and ridges.

These nearly level to very steep soils are adjacent to the Colorado River and its major tributaries. The soils on the flood plains are poorly drained, and in many areas they are used as hayland. The soils on the terraces are well drained and are used as hayland in areas where irrigation water is available.

The plant cover on the flood plain is dominantly rushes, sedges, and grasses. On the terraces and terrace breaks, it is dominantly grasses and brush.

These soils make up about 28 percent of the survey area.

1. Cumulic Cryaquolls-Tine

Deep, nearly level to steep, poorly drained and well drained soils that formed in outwash and alluvium; on fans, terraces, and flood plains.

This map unit occurs along the Colorado River and its major tributaries. Elevations range from 7,500 to 8,500 feet. The average annual precipitation is about 14 inches, the mean annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 75 days.

This unit, about 44,100 acres, makes up about 7 percent of the survey area. It is about 60 percent Cumulic Cryaquolls, 30 percent Tine soils, and 10 percent Cimarron, Youga, Harsha, and Quander soils.

Cumulic Cryaquolls typically are nearly level, poorly drained soils formed in alluvium and alluvial outwash material on the flood plains. The surface layer is loam that is mottled in the lower part. The underlying material ranges from sandy loam to heavy clay loam that is 0 to 70 percent rock fragments. A water table occurs at depths of 10 to 24 inches during the growing season.

Tine soils typically are well drained and nearly level to steep. They are on fans and terraces. They formed in alluvial outwash material. The surface layer is brown

gravelly sandy loam. The underlying material is very cobbly loamy sand and extremely cobbly sand.

Most of the unit is used for livestock grazing, wildlife habitat, recreation, and some irrigated hayland. The irrigated hayland is predominantly on the Cumulic Cryaquolls. Irrigating efficiently and maintaining fertility are the chief management concerns.

The potential for wetland wildlife is fair on the Cumulic Cryaquolls. The potential for rangeland wildlife is fair on the Tine soils.

The depth to the water table and the flood hazard are the main limitations of the Cumulic Cryaquolls for mountain homesites. Large stones and seepage are the main limitations of the Tine soils.

2. Aaberg-Waybe-Binco

Shallow to deep, gently sloping to very steep, well drained soils that formed in alluvium and residuum derived from shale and mudstone; on fans, side slopes, and ridges.

This map unit occurs north of Kremmling and west of U.S. Highway 40. Elevations range from 7,500 to 8,500 feet. The average annual precipitation is about 12 inches, the mean annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 75 days.

This unit, about 31,500 acres, makes up about 5 percent of the survey area. It is about 30 percent Aaberg soils, 30 percent Waybe soils, 20 percent Binco soils, and 20 percent Cimarron, Mayoworth, and Roxal soils and small areas of rock outcrop.

Aaberg soils typically are moderately deep and moderately sloping to moderately steep. They are on mountainsides and ridges. They formed in material weathered from shale and mudstone. They have a clay loam surface layer. The subsoil and substratum are clay. Shale is at a depth of 20 to 40 inches.

Waybe soils typically are shallow and strongly sloping to very steep. They are on mountainsides and ridges. They formed in material weathered from shale and mudstone. The surface layer is clay loam. The underlying material is clay over shale at 10 to 20 inches.

Binco soils typically are deep and gently sloping to steep. They are on mountainsides and fans. They formed in alluvium from shale and mudstone. The surface layer is clay loam. The subsoil is heavy clay loam, and the substratum is clay.

Most of the unit is used for livestock grazing, wildlife habitat, irrigated hay, and recreation. Only the nearly level to gently sloping Aaberg and Binco soils are suitable for irrigation. The main management concern in rangeland is proper grazing use in order to maintain adequate ground cover for erosion control. The management concerns in hayland are irrigating efficiently and maintaining fertility. The potential for rangeland wildlife is fair. Sagebrush management is needed to maintain wildlife winter range.

Shrink-swell potential is the main limitation in homesite development. Depth to rock is also a limitation on the Aaberg and Waybe soils. These soils are also limited for use as septic tank absorption fields because of permeability.

3. Harsha-Leavitt

Deep, nearly level to steep, well drained soils that formed in alluvium; on side slopes, fans, and terraces.

This map unit occurs east of Muddy Creek and west of Troublesome Creek north of Kremmling. Elevations range from 7,500 to 8,500 feet. The average annual precipitation is about 12 to 16 inches, the mean annual air temperature is about 37 to 39 degrees F, and the frost-free season is about 35 to 75 days.

This unit, about 100,800 acres, makes up about 16 percent of the survey area. It is about 45 percent Harsha soils, 25 percent Leavitt soils, and 30 percent Mulstay and Roxal soils, Cryorthents, and rock outcrop.

Harsha soils typically are nearly level to steep. They are on fans, terraces, and mountainsides. They formed in alluvium from sedimentary rock. They have a loam surface layer. The subsoil is clay loam, and the substratum is loam.

Leavitt soils typically are nearly level to steep. They are on fans, terraces, and mountainsides. They formed in local alluvium from sedimentary rock. They have a loam surface layer. The subsoil and substratum are clay loam.

Most of the unit is used for livestock grazing, wildlife habitat, recreation, and irrigated hay. The most important practices in rangeland are grazing management and brush control. In hayland, irrigating efficiently and maintaining fertility are important. This unit has fair potential for rangeland wildlife and provides winter range for deer and elk.

In nearly level to gently sloping areas the main limitation to homesites is the shrink-swell potential. These soils are limited for use as septic tank absorption fields because of permeability. In the steeper areas slope is the main limitation.

Soils on mountainsides, ridges, and fans

These well drained gently sloping to steep soils are on mountainsides, ridges, and fans. They make up about 27 percent of the survey area.

The vegetation is dominantly grasses and brush. Some scattered pinyon-pine and Utah juniper are in the southwestern part of the survey area near Radium.

4. Cimarron-Mayoworth-Mord

Deep and moderately deep, gently sloping to steep, well drained soils that formed in alluvium and residuum from

sedimentary rock and in glacial drift; on mountainsides and fans.

This map unit occurs in the northwestern and eastern parts of the survey area. Elevations range from 7,500 to 9,500 feet. The average annual precipitation is about 16 to 20 inches, the mean annual air temperature is about 36 to 40 degrees F, and the frost-free season is about 30 to 75 days.

This unit, about 56,700 acres, makes up about 9 percent of the survey area. It is about 60 percent Cimarron soils, 10 percent Mayoworth soils, 10 percent Mord soils, and 20 percent Waybe, Cowdrey, Binco, Aaberg, Benteen, and Woodhall soils and rock outcrop.

Cimarron soils typically are deep and gently sloping to steep. They are on fans and mountainsides. They formed in local alluvium from shale. They have a loam surface layer. The subsoil is clay, and the substratum is clay loam.

Mayoworth soils typically are moderately deep and moderately sloping to steep. They are on mountainsides. They formed in material weathered from shale. They have a clay loam surface layer. The subsoil and substratum are clay over shale at 20 to 40 inches.

Mord soils typically are deep and gently sloping to steep. They are on mountainsides. They formed in glacial drift from mixed rock sources. They have a loam surface layer and a fine sandy loam subsurface layer. The subsoil is gravelly heavy clay loam, and the substratum is brown gravelly clay.

This unit is used for wildlife habitat, livestock grazing, recreation, and some irrigated hayland. The irrigated hayland is mainly on the Cimarron soils. Management concerns are irrigating efficiently and maintaining fertility. The potential for rangeland wildlife is fair to good. This unit provides spring and fall transition range for mule deer and elk.

The main limitations to summer homesites and cabins are the shrink-swell potential and the slope in the steeper areas. The depth to rock is an additional limitation in the Mayoworth soils. Permeability is also a limitation if the soils are used as septic tank absorption fields.

5. Quander-Youga-Anvik

Deep, gently sloping to steep, well drained soils that formed in colluvium and glacial drift; on mountainsides, ridges, and fans.

This map unit occurs throughout the survey area. Elevations range from 7,500 to 9,500 feet. The average annual precipitation is about 16 to 19 inches, the mean annual air temperature is about 38 to 39 degrees F, and the frost-free season is about 30 to 60 days.

This unit, about 100,800 acres, makes up about 16 percent of the survey area. It is about 35 percent Quander soils, 25 percent Youga soils, 15 percent Anvik soils, and 25 percent Woodhall, Irigul, and Clayburn soils.

Quander soils typically are gently sloping to steep. They are on mountainsides, ridges, and fans. They formed in glacial drift and colluvium from mixed rock sources. They have a stony loam surface layer. The subsoil is very stony sandy clay loam in the upper part and extremely stony loam in the lower part. The substratum is extremely stony loam.

Youga soils typically are gently sloping to steep. They are on fans and mountainsides. They formed in glacial drift and colluvium from mixed rock sources. They have a loam surface layer. The subsoil is loam and clay loam, and the substratum is clay loam.

Anvik soils typically are moderately sloping to steep. They are on mountainsides. They formed in colluvium or glacial drift from mixed rock sources. They have a loam surface layer and subsurface layer. The subsoil is cobbly clay loam, and the substratum is very cobbly clay loam.

Most of this unit is used for livestock grazing, wildlife habitat, and recreation. Grazing management and brush control are needed to maintain desirable vegetation in rangeland. The potential for rangeland wildlife is fair to good. Elk and deer graze mainly in spring and fall.

The main limitations to summer homesites and cabins are the shrink-swell potential and the slope. Large stones is an additional limitation in the Quander soils.

6. Rock outcrop-Dahlquist-Stunner

Rock outcrop and deep, gently sloping to steep, well drained soils that formed in alluvium and colluvium; on mountainsides, ridges, and toe slopes.

This map unit occurs in the southwestern part of the survey area. Elevations range from 6,600 to 7,300 feet. The average annual precipitation is about 12 inches, the mean annual air temperature is about 43 degrees F, and the frost-free season is about 80 to 110 days.

This unit makes up approximately 12,600 acres, about 2 percent of the survey area. It is about 40 percent rock outcrop, 20 percent Dahlquist soils, 15 percent Stunner soils, and 25 percent Forelle, Boettcher, and Tolman soils.

Rock outcrop typically is on steep escarpments and ridges along the Colorado River. It consists of exposed granite, sandstone, shale, mudstone, and basalt.

Dahlquist soils typically are gently sloping to steep. They are on side slopes and ridges. They have a very cobbly loam surface layer. The subsoil is very cobbly sandy clay loam in the upper part and extremely gravelly sandy clay loam in the lower part. The substratum is extremely cobbly loam.

Stunner soils typically formed on gently sloping to steep side slopes and toe slopes. The surface layer is very cobbly loam. The subsoil is clay loam, and the substratum is loam.

This unit is used for wildlife habitat, recreation, and livestock grazing. The potential for rangeland wildlife is fair.

The main limitations to summer homesites are the slope, large stones, and rock outcrop.

Soils on the high mountains and alpine slopes

These nearly level to very steep soils are on mountainsides, fans, and ridges. The soils are somewhat excessively drained and well drained. They make up about 45 percent of the survey area.

The vegetation is lodgepole pine at the lower elevations, spruce-fir at mid elevations, and alpine grasses and forbs above the timberline.

7. Frisco-Peeler-Uinta

Deep, gently sloping to very steep, well drained soils that formed in glacial drift or in residuum and colluvium from metamorphic rock; on mountainsides, ridges, and fans.

This map unit occurs mainly in the northeastern part of the area, most in the Willow area drainage basin. Elevations range from 8,000 to 10,500 feet. The average annual precipitation is about 25 inches, the mean annual air temperature is about 35 degrees F, and the frost-free season is about 30 to 60 days.

This unit, approximately 94,500 acres, makes up about 15 percent of the survey area. It is about 35 percent Frisco soils, 20 percent Peeler soils, 20 percent Uinta soils, and 25 percent Cowdrey, Scout, and Anvik soils and rock outcrop.

Frisco soils typically are gently sloping to very steep. They are on mountainsides, fans, and ridges. They formed in glacial drift. They have a duff layer of needles and twigs. The subsurface layer is gravelly sandy loam. The subsoil and substratum are very stony sandy clay loam.

Peeler soils typically are gently sloping to very steep. They are on mountainsides, ridges, and fans. They formed in glacial drift. They have a duff layer of needles and twigs. The subsurface layer is gravelly sandy loam. The subsoil and substratum are gravelly sandy clay loam.

Uinta soils typically are gently sloping to steep. They are on mountainsides, fans, and ridges. They formed in glacial drift and material weathered from metamorphic rock. They have a duff layer of needles and twigs. The subsurface layer is sandy loam. The subsoil is sandy clay loam. The substratum is very cobbly sandy loam.

This unit is used for wildlife habitat, recreation, and some timber production.

The potential for timber production is only fair because of the cold climate, the short growing season, and the limited available water holding capacity. The potential for woodland wildlife is fair. The main limitations to summer homesite development are the slope and large stones.

8. Scout-Upson

Deep and moderately deep, gently sloping to very steep, well drained soils that formed in glacial drift or in residuum and colluvium from granite; on mountainsides, ridge crests, and fans.

This map unit occurs throughout the survey area. Elevations range from 8,500 to 11,400 feet. The average annual precipitation is about 20 to 24 inches, the mean annual air temperature is about 35 to 40 degrees F, and the frost-free season is about 30 to 50 days.

This unit, approximately 56,700 acres, makes up about 9 percent of the survey area. It is about 45 percent Scout soils, 30 percent Upson soils, and 25 percent Frisco, Peeler, and Leighcan soils and rock outcrop. A few small areas of rock outcrop occur on the very steep slopes.

Scout soils typically are deep and gently sloping to very steep. They are on mountainsides, ridges, and fans. They formed in glacial drift and colluvium. The surface layer is cobbly sandy loam. The subsurface layer and subsoil are very cobbly sandy loam. The substratum is extremely cobbly sandy loam.

Upson soils typically are moderately deep and moderately sloping to very steep. They are on mountainsides and ridges. They formed in material weathered from granite. The surface layer is stony sandy loam in the upper part and sandy loam in the lower part. The underlying material is loamy coarse sand over weathered granite at a depth of 36 inches.

This unit is used for wildlife habitat, recreation; and some timber production (fig. 1).

The potential for timber production is only fair because of the cold climate and short growing season. In some areas large stones and boulders limit logging. The potential for woodland wildlife is fair. The main limitations to summer homesite development are the slope and large stones.

9. Cowdrey-Gateway

Deep and moderately deep, gently sloping to steep, well drained soils that formed in glacial drift and in residuum from shale and mudstone; on mountainsides, fans, and ridges.

This map unit is predominantly in the eastern part of the county. Elevations range from 8,000 to 9,500 feet. The average annual precipitation is about 21 inches, the mean annual air temperature is about 35 to 38 degrees F, and the frost-free season is about 30 to 60 days.

This unit, approximately 44,100 acres, makes up about 7 percent of the survey area. It is about 65 percent Cowdrey soils, 15 percent Gateway soils, and 20 percent

Frisco, Peeler, Mord, and Cimarron soils and a few small areas of shallow soils over shale.

Cowdrey soils typically are deep and gently sloping to steep. They are on mountainsides and fans. They formed in glacial drift from mixed rock sources. The surface layer and subsurface layer are loam. The subsoil and substratum are clay.

Gateway soils typically are moderately deep and moderately sloping and steep. They are on mountainsides and ridges. They formed in material weathered from mudstone and shale. The surface layer and subsurface layer are loam. The subsoil is clay over mudstone at depths of 20 to 40 inches.

This unit is used for wildlife habitat, recreation, and timber production.

The potential for timber production is only fair because of the cold climate and short growing season. The potential for woodland wildlife is fair. The limitations to summer homesite development are the shrink-swell potential and steep slopes.

10. Leighcan-Newcomb-Rock outcrop

Deep, nearly level to very steep, somewhat excessively drained and well drained soils that formed in glacial drift or in residuum and colluvium from granite, gneiss, and schist; and Rock outcrop; on mountainsides, terraces, and ridges.

This map unit is in the southeastern part of the survey area. Elevations range from 8,500 to 11,400 feet. The average annual precipitation is about 25 to 32 inches, the mean annual air temperature is about 35 degrees, and the frost-free season is about 10 to 50 days.

This unit, approximately 75,600 acres, makes up about 12 percent of the survey area. It is about 45 percent Leighcan soils, 20 percent Newcomb soils, 10 percent rock outcrop, and 25 percent Frisco, Peeler, and Upson soils, Cryaquolls, and Cryaquepts. The Frisco, Peeler, and Upson soils occur in the northwestern part of the unit. Cryaquolls occupy level or nearly level bottom lands along the Williams Fork River. Cryaquepts occur as scattered areas throughout the unit.

Leighcan soils typically are well drained and moderately steep to very steep. They are on mountainsides and ridges. They formed in material weathered from granite, gneiss, and schist. They have a drift layer of needles, leaves, and twigs. The subsurface layer is gravelly sandy loam. The subsoil is very cobbly sandy loam. The substratum is very cobbly loamy sand.

Newcomb soils typically are nearly level to very steep and somewhat excessively drained. They are on mountainsides and terraces. They formed in glacial drift and material weathered from granite, gneiss, and schist. They have a duff layer of needles and twigs. The subsurface layer is gravelly sandy loam. The subsoil is very gravelly loamy sand. The substratum is very gravelly sand.

Rock outcrop occurs along the ridge crests and entrenched streams. It consists of areas of exposed bedrock.

This unit is used for wildlife habitat, recreation, timber, and water production.

The potential for timber production is only fair because of the cold climate and short growing season. The potential for woodland wildlife is fair due to the lack of understory vegetation. The limitations to summer homesites are the slope, the large stones, and the Rock outcrop.

11. Meredith-Bross-Mirror

Deep and moderately deep, moderately steep to very steep, well drained soils that formed in residuum from granite, gneiss, and schist; on alpine slopes.

This map unit is above the timberline adjacent to the Continental Divide in the southern part of the survey area. Elevations range from 11,400 to 13,500 feet. The average annual precipitation is about 35 inches, the mean annual air temperature is about 28 degrees F, and the frost-free season is about 0 to 10 days.

This unit, approximately 12,600 acres, makes up about 2 percent of the survey area. It is about 40 percent Meredith soils, 30 percent Bross soils, 15 percent Mirror soils, and 15 percent Pergelic Cryorthents and rubble land.

Meredith soils typically are deep and very steep. They are on alpine slopes. They formed in material weathered from granite, gneiss, and schist. The surface layer is extremely stony sandy loam. The subsoil is very gravelly loam. The substratum is very gravelly sandy loam. Highly fractured bedrock occurs at a depth of 20 to 40 inches.

Bross soils typically are deep and moderately steep to steep. They are on alpine slopes. They formed in residuum from granite, gneiss, and schist. The surface layer is extremely stony sandy loam. The subsoil is very gravelly sandy loam. The substratum is very gravelly loamy coarse sand.

Mirror soils typically are moderately deep and moderately steep to very steep. They are on alpine slopes. They formed in residuum from granite, gneiss, and schist. The surface layer is extremely stony. The subsoil is very gravelly loam. The substratum is very gravelly sandy loam. Bedrock is at 20 to 40 inches.

This unit, part of a watershed, provides wildlife habitat and has esthetic value. The main limitations to summer homesites are the slope and large stones. The soils in this unit deteriorate readily. If disturbed, they are very difficult to stabilize and reclaim because of the cold temperature and short growing season. This unit provides summer range for mule deer, elk, and bighorn sheep.

Broad land use considerations

The major land uses in the survey area are range, irrigated hay, timber, recreation, and mountain homes and cabins. Areas suitable for irrigated hay but not developed are limited by the lack of a source of irrigation water. Some areas of rangeland and woodland have been converted to mountain homes and cabins and recreation facilities. This type of development is mainly in the eastern part of the survey area.

The lodgepole pine and spruce-fir woodland has poor potential for rangeland because of an insufficient amount of understory vegetation. If these areas were clear cut, they would have good potential for range. The potential is fair to good in the areas now used as rangeland. The higher precipitation areas—the Cimarron-Mayoworth-Mord and the Quander-Youga-Anvik units—have better potential for rangeland than the lower precipitation areas— the Harsha-Leavitt and the Aaberg-Waybe-Binco units. The Meredith-Bross-Mirror unit has poor potential for rangeland because the growing season is very short. The Frisco-Peeler-Uinta, the Cowdrey-Gateway, the Scout-Upson, and the Leighcan-Newcomb-Rock outcrop units have good potential for woodland wildlife habitat. The Quander soil in the Quander-Youga-Anvik unit has good potential for rangeland wildlife habitat. Youga and Anvik soils have only fair potential because they do not support browse plants. The other units in range provide valuable winter range for mule deer and elk, but they too have only fair potential because they lack browse.

The nearly level to strongly sloping areas of both the Cumulic Cryaquolls-Tine unit and the Harsha-Leavitt unit have good potential for irrigated hay if irrigation water is available. The gently and strongly sloping areas of the Cimarron-Mayoworth-Mord unit and the Aaberg and Binco soils in the Aaberg-Waybe-Binco unit have fair potential for irrigated hay. The Waybe soil has poor potential because it is shallow over bedrock.

The Frisco-Peeler-Uinta and the Cowdrey-Gateway units have good potential for woodland, but production is somewhat limited because the climate is cold and the growing season short. The Scout-Upson and the Leighcan-Newcomb-Rock outcrop units have fair potential for woodland because of the low water holding capacity and the short growing season.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a similar profile make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Harsha, 0 to 6 percent slopes, is one of several phases within the Harsha series.

Some map units are made up of two or more dominant kinds of soil. Only one such map unit, a soil complex, is shown on the soil map of this survey.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Dahlquist-Baettcher complex is an example.

Not all units in this survey area have been mapped with the same degree of detail. The broadly defined units are likely to be larger and to vary more in composition than units mapped in greater detail. Composition has been controlled well enough, however, for the expected use of the soils. The broadly defined units are indicated by an asterisk that follows the map unit name on the soil legend.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Gravel Pits is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

1—Aaberg clay loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on mountainsides and ridges at elevations of 7,500 to 8,500 feet. It formed in material weathered from shale and mudstone. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Binco clay loam, Cimarron loam, and Waybe clay loam, all having slopes of 6 to 15 percent. Also included are a few small areas of Cryorthents, Rock outcrop, Cumulic Cryaquolls, and Aaberg clay loam on slopes of less than 6 percent.

Typically the surface layer of this Aaberg soil is light grayish brown heavy clay loam about 4 inches thick. The subsoil is pale brown clay about 14 inches thick. The substratum is grayish brown, calcareous clay. Soft shale is at a depth of 22 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. Available water capacity is low. Surface runoff is rapid, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

The dominant rangeland vegetation is western wheatgrass, letterman needlegrass, muttongrass, and big sagebrush. As the range condition deteriorates, woody shrubs and forbs increase.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. Where shrubs have become dominant, brush control can improve range condition. Seeding also may be needed. Suitable for seeding are intermediate wheatgrass, western wheatgrass, smooth brome, slender wheatgrass, Arizona fescue, and Indian ricegrass. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

The depth to rock, low strength, and high shrink-swell potential are the soil properties most limiting to community development. Slippage may occur if the soil is saturated. Cut slopes should be designed to minimize potential soil slippage. Adequate control of surface runoff is needed to avoid excessive erosion of roads and streets.

The capability subclass is VIe.

2—Aaberg clay loam, 15 to 30 percent slopes. This moderately deep, well drained, moderately steep soil is on mountainsides and ridges at elevations of 7,500 to 8,500 feet. It formed in material weathered from shale and mudstone. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Binco clay loam, Cimarron loam, and Waybe clay loam, all having slopes of 15 to 50 percent. Also included are a few small areas of Cryorthents, Rock outcrop, and Cumulic Cryaquolls.

Typically the surface layer of this Aaberg soil is light grayish brown clay loam about 4 inches thick. The subsoil is pale brown clay about 14 inches thick. The substratum is grayish brown, calcareous clay. Soft shale is at a depth of 22 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. Available water capacity is low. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Woody shrubs become dominant as range condition declines.

Grazing management is essential. Brush control can improve range condition if there is enough grass to respond. In areas where the grass is sparse, deferred grazing is needed. The site generally is too steep to be seeded with a drill.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are needed to protect big game winter range.

The steep slopes, depth to rock, and high shrink-swell potential are the soil properties most limiting to community development. Slippage may occur if the soil is saturated. Cut slopes should be designed to minimize potential soil slippage. Adequate control of surface runoff is needed to avoid excessive erosion of roads.

The capability subclass is VIIe.

3—Anvik loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides at elevations of 7,500 to 9,500 feet. It formed in colluvium or glacial drift from mixed rock sources. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Youga loam, Clayburn loam, Quander cobbly loam, and Frisco-Peeler gravelly sandy loam. Also included are a few small areas of Cumulic Cryaquolls and small areas of similar soils derived from red granite.

Typically the surface layer of this Anvik soil is dark grayish brown loam about 11 inches thick. The subsurface layer is pinkish gray loam about 12 inches thick. The subsoil is light brown cobbly clay loam about 17 inches thick. The substratum is pink very cobbly clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is medium, and the erosion hazard is moderate.

This soil is used chiefly for range. Part of it is used for recreation and wildlife. Most of the acreage has an aspen overstory and an understory of grasses (fig. 2).

The cold climate and short growing season limit the production of introduced grasses and wood crops and preclude the use of this soil as cropland.

Thurber fescue and wheatgrasses dominate the rangeland vegetation. As the range condition deteriorates, woody shrubs become dominant.

Grazing management is needed to maintain the condition of this site. Periodic deferment from grazing until the dominant grasses have made seed will greatly improve plant vigor. The site can be seeded if it is in poor condition. Smooth brome, big bluegrass, Kentucky bluegrass, Arizona fescue, slender wheatgrass, and western wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

The wildlife are predominantly blue grouse, mule deer, elk, snowshoe hare, and black bear. Clear cut openings in the timber provide a greater abundance of shrubs, grasses, and forbs for deer and elk in summer.

This soil is suited to quaking aspen. It can produce 25 to 35 cubic feet of wood per acre per year. The steep slopes make logging difficult. Special care is required to prevent soil erosion.

The shrink-swell potential and low strength are the soil properties most limiting to community development. Adequate control of surface runoff is needed to avoid excessive erosion of roads.

The capability subclass is VIe.

4—Anvik loam, 15 to 50 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 7,500 to 9,500 feet. It formed in colluvium or glacial drift from mixed rock sources. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Youga loam, Clayburn loam, Quander cobbly loam, and Frisco-Peeler gravelly sandy loams. Also included are small areas of similar soils derived from red granite.

Typically the surface layer of this Anvik soil is dark grayish brown loam about 11 inches thick. The subsurface layer is pinkish gray loam about 9 inches thick. The subsoil is light brown cobbly clay loam about 17 inches thick. The substratum is pink very cobbly clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is medium and the erosion hazard is high.

This soil is used primarily for range. Part of it is used for recreation and wildlife. Most of the acreage has an overstory of trees and an understory of grasses.

The cold climate and the short growing season limit the production of introduced grasses and wood crops and preclude the use of this soil as cropland. Rangeland vegetation is dominated by Thurber fescue and wheatgrasses. As the range condition deteriorates, woody shrubs become dominant.

Grazing management is needed to maintain the condition of this site. Periodic deferment from grazing until the dominant grasses have produced seed will greatly improve plant vigor. This site is too steep to be seeded with a drill.

Wildlife are predominantly blue grouse, mule deer, elk, snowshoe hare, and black bear. Clear cut openings in the timber allow a greater abundance of shrubs, grasses, and forbs for deer and elk in summer.

This soil is suited to quaking aspen. It can produce 25 to 35 cubic feet of wood per acre per year. The steep slopes make logging difficult. Special care is required to prevent soil erosion.

The shrink-swell potential, low strength, and steep slopes are the soil properties most limiting to community development. Adequate control of surface runoff is necessary to avoid excessive erosion of roads. Cut and fill slopes should be kept to a minimum to avoid hillside slippage.

The capability subclass is VIIe.

5—Benteen loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on mountainsides and ridges at elevations of 8,000 to 9,500 feet. The average annual precipitation is about 18 to 22 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Cimarron loam and Youga loam, both having slopes of 6 to 15 percent. Also included are a few small areas of Cryoborolls, Rock outcrop, and Cumulic Cryaquolls.

Typically the surface layer of this Benteen soil is very dark grayish brown loam about 7 inches thick. The subsoil is grayish brown and brown light clay loam about 31

inches thick. Hard fractured limestone is at a depth of 38 inches.

Permeability is moderate. The effective rooting depth is 20 to 40 inches. The available water capacity is moderate. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Thurber fescue and wheatgrasses dominate the rangeland vegetation. As range condition deteriorates, woody shrubs become dominant.

Grazing management is needed to maintain the condition of this site (fig. 3). Periodic deferment from grazing until the dominant grasses have produced seed will greatly improve plant vigor. The site can be seeded if it is in poor condition. Smooth brome, big bluegrass, Kentucky bluegrass, Arizona fescue, slender wheatgrass, and western wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game range.

The depth to rock is the feature most limiting to community development. Cut slopes should be designed to minimize potential soil slippage.

The capability subclass is VIe.

6—Benteen loam, 15 to 40 percent slopes. This moderately deep, well drained, moderately steep to steep soil is on mountainsides and ridges at elevations of 8,000 to 9,500 feet. The average annual precipitation is about 18 to 22 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Cimarron loam and Youga loam, both having slopes of 15 to 40 percent. Also included are a few small areas of Cryoborolls and Rock outcrop.

Typically the surface layer of this Benteen soil is very dark grayish brown loam about 7 inches thick. The subsoil is grayish brown and brown light clay loam. Hard fractured limestone is at a depth of 38 inches.

Permeability is moderate. The effective rooting depth is 20 to 40 inches. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland (fig.4). Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly Thurber fescue and wheatgrasses. As range condition deteriorates, woody shrubs become dominant.

Grazing management is needed to maintain the condition of this site (fig. 4). Periodic deferment from grazing until the dominant grasses have produced seed will greatly improve plant vigor. Most of this site cannot be seeded with a drill because of steep slopes and the high erosion hazard.

This soil provides spring and fall transition range for elk and mule deer. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock and controlling sagebrush are necessary to protect the big game range.

The depth to rock and the steep slope are the features most limiting to community development. Cut slopes should be designed to minimize soil slippage. Adequate control of surface runoff is needed to avoid excessive erosion of roads and streets.

The capability subclass is VIIe.

7—Binco clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is on mountainsides, foot slopes, and fans at elevations of 7,500 to 8,000 feet. It formed in local alluvium from shale to mudstone. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Aaberg clay loam, Cimarron loam, and Waybe clay loam. Also included are a few small areas of Cryorthents, Rock outcrop, and alkali spots.

Typically the surface layer of this Binco soil is light brownish gray clay loam about 7 inches thick. The subsoil is light brownish gray heavy clay loam about 17 inches thick. The substratum is light brownish gray clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is medium, and the erosion hazard is slight.

Most of the acreage is rangeland (fig. 5). Part of it is used for wildlife and recreation. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

The dominant rangeland vegetation is western wheatgrass, letterman needlegrass, muttongrass, and big sagebrush. As range condition deteriorates, woody shrubs and forbs increase.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. Where shrubs have become dominant, brush control can improve range condition. Seeding may be needed. Suitable for seeding are intermediate wheatgrass, western wheatgrass, smooth brome, slender wheatgrass, Arizona fescue, and Indian ricegrass. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

The high shrink-swell potential, low strength, and high clay content are the soil properties most limiting to community development.

The capability subclass is VIe.

8—Binco clay loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides, foot slopes, and fans at elevations of 7,500 to 8,000 feet. It formed in local alluvium from shale or mudstone. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the average frost-free season is about 35 to 75 days.

Included in mapping are small areas of Aaberg clay loam, Cimarron loam, and Waybe clay loam. Also included are a few small areas of Cryorthents and Rock outcrop.

Typically the surface layer of this Binco soil is light brownish gray clay loam about 7 inches thick. The subsoil is light brownish gray heavy clay loam about 17 inches thick. The substratum is light brownish gray clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is rapid. The erosion hazard is moderate.

Most of the acreage is rangeland and part of it is for wildlife and recreation. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, letterman needlegrass, muttongrass, and big sagebrush dominate the rangeland vegetation. Woody shrubs become dominant over an extremely sparse stand of grass as range condition declines.

Grazing management is essential. Brush control is needed to improve range condition where there are still remnants of native grass. Seeding is needed also. Suitable for seeding are big bluegrass, Indian ricegrass, slender wheatgrass, western wheatgrass, Arizona fescue, intermediate wheatgrass, and smooth brome. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

The high shrink-swell potential, low strength, and high clay content are the soil properties most limiting to community development.

The capability subclass if VIe.

9—Binco clay loam, 15 to 35 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides, foot slopes, and fans at elevations of 7,500 to 8,000 feet. It formed in local alluvium or residuum from shale or mudstone. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Aaberg clay loam, Cimarron loam, and Waybe clay loam. Also included are a few small areas of Cryorthents, Rock outcrop, and small areas of similar soils derived from red shale.

Typically the surface layer of this Binco soil is light brownish gray clay loam about 7 inches thick. The subsoil is a light brownish gray heavy clay loam about 17 inches thick. The substratum is light brownish gray clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is rapid. The erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Woody shrubs become dominant as the range condition declines.

Grazing management is essential. Brush control is needed to improve range condition where there are still remnants of native grass. If the site has deteriorated to the extent that there is not enough grass to respond to brush control, deferred grazing is needed. Most of this site is too steep to be seeded with a drill.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

The high shrink-swell potential, low strength, and steep slopes are the soil properties most limiting to community development. This soil is subject to hillside slippage if it becomes saturated. Road design should provide drainage outlets for surface runoff.

The capability unit is VIIe.

10—Bross-Mirror extremely stony sandy loams, 20 to 50 percent slopes. These moderately steep to steep soils are on alpine slopes in the southeastern part of the survey area. Elevations are 11,400 to 13,500 feet. The average annual precipitation is about 30 to 40 inches, and the average annual air temperature is about 25 to 30 degrees F. This map unit is about 60 percent Bross soil and 30 percent Mirror soil. The Bross soil does not have bedrock above 40 inches but is otherwise similar to the Mirror soil. About 10 percent of the unit is Meredith

extremely stony sandy loam and Pergelic Cryorthents-Rock outcrop.

The Bross soil is stony, deep, and well drained. It formed in deeply weathered residuum from granite, gneiss, schist, and other metamorphic material.

Typically the surface layer is grayish brown, very strongly acid, extremely stony sandy loam about 12 inches thick. The subsoil is light yellowish brown, very strongly acid, very gravelly sandy loam about 10 inches thick. The substratum is very pale brown, very strongly acid, very gravelly loamy coarse sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more, but the available water capacity is very low. Surface runoff is slow. The erosion hazard is high in areas where the natural vegetation is disturbed.

The Mirror soil is stony, moderately deep, and well drained. It formed in residuum from granite, gneiss, schist, and other metamorphic material.

Typically the surface layer is grayish brown, very strongly acid, extremely stony sandy loam about 8 inches thick. The subsoil is light yellowish brown, very strongly acid, very gravelly loam about 12 inches thick. The substratum is very pale brown, very strongly acid, very gravelly sandy loam. Bedrock is at a depth of 31 inches.

Permeability is moderately rapid. The effective rooting depth is 20 to 40 inches. The available water capacity is very low. Surface runoff is slow. The erosion hazard is high in areas where the natural vegetation is disturbed.

This unit has esthetic value, provides wildlife habitat, and is a source of water. A few areas are used as rangeland.

Rangeland vegetation is dominantly kobresia, bluegrass, and wheatgrass. As range condition deteriorates, the ground cover, plant vigor, and production decline.

Good grazing management is essential because this site is extremely fragile. Since the site is too steep and stony to be seeded, deferred grazing is the chief means of range improvement.

This unit provides summer range for elk, mule deer, bighorn sheep, and Rocky Mountain goat. Other wildlife include pika, marmot, and ptarmigan.

Because these soils deteriorate readily, they are severely limited for all uses. If the vegetation is disturbed, reclaiming and stabilizing this unit is extremely difficult.

The capability subclass is VIIe.

11—Cebone loam, 15 to 50 percent slopes. This moderately deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 7,500 to 9,000 feet. It formed in residuum from shale and sandstone. The average annual precipitation is about 16 to 20 inches, the average annual air temperature is about 36 to 41 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Cimarron loam, Mayoworth clay loams, Anvik loam, and Lake Creek loam. Also included are a few small areas of Cumulic Cryaquolls, Cryoborolls, and Rock outcrop.

Typically the surface layer of this Cebone soil is grayish brown loam about 11 inches thick. The subsurface layer is light gray loam about 5 inches thick. The subsoil is yellowish brown clay loam about 16 inches thick. The substratum is grayish brown clay. Soft, partially weathered shale is at a depth of 36 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. Small areas have an overstory of quaking aspen. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as either cropland or woodland.

The rangeland vegetation is dominantly Thurber fescue and wheatgrass. As range condition deteriorates, woody shrubs become dominant.

Grazing management is needed to maintain the condition of this site. Periodic deferment from grazing until the dominant grasses have produced seed will greatly improve plant vigor. Most of this site is too steep to be seeded with a drill.

This soil provides food and cover for mule deer, elk, sage grouse, jackrabbit, and coyote. Wildlife can be increased if livestock grazing is well managed.

In stands of quaking aspen, this soil can produce 25 to 35 cubic feet of wood per acre per year. The steep slopes make harvesting difficult.

The depth to rock, the high shrink-swell potential, and the slope are the soil properties most limiting to community development. This soil is subject to hillside slippage if it becomes saturated. Road design should provide drainage outlets for surface runoff. Cut and fill slopes should be kept to a minimum.

The capability subclass is VIIe.

12—Cimarron loam, 2 to 6 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is on mountainsides and fans at elevations of 7,500 to 8,500 feet. It formed in local alluvium from shale. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Youga loam, Quander cobbly loam, Mayoworth clay loam, Woodhall loam, and Benteen loam. Also included are a few small areas of Cumulic Cryaquolls.

Typically the surface layer of this Cimarron soil is dark grayish brown loam about 10 inches thick. The subsoil is grayish brown and pale brown clay about 22 inches

thick. The substratum is light yellowish brown clay loam that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more and the available water capacity is high. Surface runoff is slow. The erosion hazard is slight.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland. Wheatgrass, muttongrass, Idaho fescue, and big sagebrush dominate the rangeland vegetation.

Grazing no more than 50 percent of the key species, by weight of the current season production, can maintain the condition of this site. Where shrubs have become dominant, brush control can improve range condition. If the site is in poor condition, seeding is needed. Arizona fescue, big bluegrass, slender wheatgrass, smooth brome, western wheatgrass, and intermediate wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

The high shrink-swell potential is the soil property most limiting to community development. Slow permeability is also a limitation if this soil is used for septic tank absorption fields.

The capability subclass is VIe.

13—Cimarron loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides and fans at elevations of 7,500 to 8,500 feet. It formed in local alluvium from shale. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and frost-free season is about 35 to 75 days.

Included in mapping are small areas of Youga loam, Quander cobbly loam, Mayoworth clay loam, Woodhall loam, and Benteen loam.

Typically the surface layer of this Cimarron soil is dark grayish brown loam about 10 inches thick. The subsoil is grayish brown and pale brown clay about 22 inches thick. The substratum is light yellowish brown clay loam that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more and the available water capacity is high. Surface runoff is medium. The erosion hazard is moderate.

Most of the acreage is rangeland (fig. 6). Part of it is used for wildlife and recreation. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland. Wheatgrass, muttongrass, Idaho fescue, and big sagebrush are the dominant species in the rangeland vegetation.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. Where shrubs have become dominant, brush control can improve range condition. If the site is in poor condition, seeding is needed. Arizona fescue, big bluegrass, slender wheatgrass, smooth brome, western wheatgrass, and intermediate wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

The high shrink-swell potential is the soil property most limiting to community development. Slow permeability is also a limitation if this soil is used for septic tank absorption fields. Cut slopes, where necessary, should be designed to minimize potential soil slippage.

The capability subclass is VIe.

14—Cimarron loam, 15 to 35 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 7,500 to 8,500 feet. It formed in local alluvium from shale. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Youga loam, Quander stony loam, Mayoworth clay loam, Woodhall loam, and Benteen loam.

Typically the surface layer of this Cimarron soil is dark grayish brown loam about 10 inches thick. The subsoil is grayish brown and pale brown clay about 22 inches thick. The substratum is a light yellowish brown clay loam that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is rapid. The erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly western wheatgrass, muttongrass, Idaho fescue, and big sage.

Grazing management is needed to maintain range condition. If woody shrubs are dominant, brush control is needed. Most of the site is too steep to be seeded with a drill.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

Steep slopes and the high shrink-swell potential are the soil properties most limiting to community development. Cut slopes, where necessary, should be designed to minimize potential soil slippage. Adequate control of surface runoff is needed to avoid excessive erosion of roads.

The capability subclass is VIIe.

15—Clayburn loam, 2 to 6 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is in mountain swales and depressions at elevations of 7,500 to 9,000 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Anvik loam, Cimarron loam, Youga loam, and Quander cobbly loam. Also included are a few small areas of Cumulic Cryaquolls.

Typically the surface layer of this Clayburn soil is dark grayish brown loam about 9 inches thick. The subsoil is grayish brown and pale brown loam and clay loam about 38 inches thick. The substratum is light yellowish brown gravelly clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more and the available water capacity is high. Surface runoff is slow. The erosion hazard is slight.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Thurber fescue and wheatgrass dominate the rangeland vegetation. As range condition deteriorates, woody shrubs become dominant.

Good grazing management is needed to maintain the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed will greatly improve plant vigor. The site can be seeded if it is in poor condition. Smooth brome, big bluegrass, Kentucky bluegrass, Arizona fescue, slender wheatgrass, and western wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife are sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing is necessary to protect the big game range.

The shrink-swell potential is the soil property most limiting to community development.

The capability subclass is VIe.

16—Clayburn loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides, in swales, and in depressions at elevations of 7,500 to 9,000 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Anvik loam, Cimarron loam, Youga loam, and Quander cobbly loam.

Typically the surface layer of this Clayburn soil is dark grayish brown loam about 9 inches thick. The subsoil is grayish brown and pale brown loam and clay loam about 38 inches thick. The substratum is light yellowish brown gravelly clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is medium. The erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Thurber fescue and wheatgrass dominate the rangeland vegetation (fig. 7). As range condition deteriorates, woody shrubs become dominant.

Grazing management is needed to maintain the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed will greatly improve plant vigor. The site can be seeded if it is in poor condition. Smooth brome, big bluegrass, Kentucky bluegrass, Arizona fescue, slender wheatgrass, and western wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing is necessary to protect the big game range.

The moderate shrink-swell potential is the soil property most limiting to community development.

The capability subclass is VIe.

17—Clayburn loam, 15 to 25 percent slopes. This deep, well drained, moderately steep soil is on mountainsides at elevations of 7,500 to 9,000 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Anvik loam, Cimarron loam, Sudduth loam, Youga loam, and Quander cobbly loam.

Typically the surface layer of this Clayburn soil is dark grayish brown loam about 9 inches thick. The subsoil is grayish brown and pale brown loam and clay loam about 38 inches thick. The substratum is light yellowish brown gravelly clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more and the available water capacity is

high. Surface runoff is medium. The erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly Thurber fescue and wheatgrass. As range condition deteriorates, woody shrubs become dominant.

Grazing management is needed to maintain the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed will greatly improve plant vigor. Seeding will increase production and reduce erosion.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing is needed to protect the big game range.

The moderate shrink-swell potential and steep slope are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIe.

18—Clayburn loam, 25 to 50 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 7,500 to 9,000 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Anvik loam, Cimarron loam, Sudduth loam, Youga loam, and Quander cobbly loam.

Typically the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is dark grayish brown and pale brown loam and clay loam about 38 inches thick. The substratum is light yellowish brown gravelly clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is rapid. The erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly Thurber fescue and wheatgrass. As range condition deteriorates, woody shrubs become dominant.

Grazing management will maintain the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed will greatly improve plant vigor. This site is too steep to be seeded with a drill.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing is necessary to protect the big game range.

The moderate shrink-swell potential and steep slopes are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

19—Cowdrey loam, 2 to 6 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is on mountainsides and fans at elevations of 8,000 to 9,500 feet. It formed in glacial drift from mixed rock sources. The average annual precipitation is about 18 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Mord loam, Frisco-Peeler gravelly sandy loams, Gateway loam, and Sudduth loam. Also included are a few small areas of Cumulic Cryaquolls and Rock outcrop.

Typically the Cowdrey soil has a duff layer of needles and twigs about 1-inch thick. Surface layer is grayish brown loam about 3 inches thick. The subsurface layer is very pale brown loam about 5 inches thick. The subsoil is light brown clay about 38 inches thick. The substratum is light brown clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is slow. The erosion hazard is slight.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. A small acreage is used for timber. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, quaking aspen, and scattered Engelmann spruce and a sparse understory of grasses, shrubs, and forbs.

Cowdrey soils are suited to lodgepole pine. This can produce 20 to 30 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. If the soil is wet, care is required in logging to prevent soil compaction and root damage.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for mule deer and elk. The big game range can be improved if livestock grazing is well managed and openings are cut in the timber.

The high shrink-swell potential is the soil property most limiting to community development. Adequate control of surface runoff is necessary to avoid excessive erosion of roads.

The capability subclass is VIe.

20—Cowdrey loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides and fans at elevations of 8,000 to 9,500 feet. It formed in glacial drift from mixed

rock sources. The average annual precipitation is about 18 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Mord loam, Frisco-Peeler gravelly loams, Gateway loam, and Sudduth loam. Also included are a few small areas of Rock outcrop.

Typically the Cowdrey soil has a duff layer of needles and twigs about 1 inch thick. The surface layer is grayish brown loam about 3 inches thick. The subsurface layer is very pale brown loam about 5 inches thick. The subsoil is light brown clay about 38 inches thick. The substratum is light brown clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is medium. The erosion hazard is moderate.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. A small acreage is used for timber. The cold climate and short growing season limit the production of introduced grasses and wood crops.

The potential native vegetation is dominantly lodgepole pine. The potential yield on this soil is 20 to 30 cubic feet of wood per acre per year. Thinning the stand makes these wooded areas accessible to big game. If the soil is wet, care is required in harvesting to prevent soil compaction and root damage.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for mule deer and elk. The big game range can be improved if livestock grazing is well managed and openings are cut in the timber.

The high shrink-swell potential is the soil property most limiting to development. Adequate control of surface runoff is necessary to avoid excessive erosion of roads. Cut slopes, where needed, should be designed to minimize potential soil slippage.

The capability subclass is VIe.

21—Cowdrey loam, 15 to 45 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides and ridges at elevations of 8,000 to 9,500 feet. It formed in glacial drift from mixed rock sources. The average annual precipitation is about 18 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Mord loam, Frisco-Peeler gravelly sandy loams, Gateway loam, and Sudduth loam. Also included are a few small areas of Rock outcrop.

Typically the Cowdrey soil has a duff layer of needles and twigs about 1 inch thick. The surface layer is grayish brown loam about 3 inches thick. The subsurface layer is very pale brown loam about 5 inches thick. The subsoil is light brown clay about 38 inches thick. The substratum is light brown clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is rapid and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. A small acreage is used for timber. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, scattered Engelmann spruce, and a sparse understory of grasses, shrubs, and forbs.

Cowdrey soils are suited to lodgepole pine. They can produce 40 to 50 cubic feet of wood per acre per year. Thinning the stand produces poles for fences, corrals, and power lines. Care should be taken to prevent erosion of skid trails and access roads. The steep slopes make harvesting difficult, especially when the soil surface is wet.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for mule deer and elk. The big game range can be improved if livestock grazing is well managed and openings are cut in the timber.

The steep slope and high shrink-swell potential are the soil properties most limiting to community development. Cut slopes should be designed to minimize potential soil slippage. Adequate control of surface runoff is needed to avoid excessive erosion of roads.

The capability subclass is VIIe.

22—Cryaquepts, sloping. Cryaquepts are deep to moderately deep, poorly drained to very poorly drained soils. They occupy moderately sloping to moderately steep mountainsides and drainageways. They formed in old landslide deposits and alluvium. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 32 to 35 degrees F, and the frost-free season is 25 to 50 days.

Included in mapping are small areas of Leighcan and Newcomb soils.

Cryaquepts are clayey and loamy soils that in places have as much as a 10-inch organic mat at the surface. The water table is at or near the surface most of the year.

All the acreage is woodland and wildlife habitat. The potential native vegetation is subalpine fir, Engelmann spruce, and a sparse understory of grasses, shrubs, and forbs.

This unit is suited to Engelmann spruce. It can produce 70 to 95 cubic feet of wood per acre per year. Wetness limits the type of equipment used in harvesting.

This unit provides habitat for wildlife, such as mule deer, elk, blue grouse, snowshoe hare, and black bear. The habitat for deer and elk can be improved if the timber is well managed.

Soil wetness is the feature most limiting to community development.

The capability subclass is VIw.

23—Cryoborolls-Rock outcrop complex, very steep. This steep to very steep unit is on mountainsides at elevations of 8,000 to 9,000 feet. The average annual precipitation is 16 to 18 inches, the average annual air temperature is 34 to 40 degrees F, and the average frost-free season is 30 to 60 days. This unit is 70 percent Cryoborolls, 20 percent Rock outcrop, and 10 percent Upson and Newcomb soils.

Cryoborolls are moderately deep to deep, well drained soils that formed in material weathered from granite, schist, and gneiss. The surface layer is dark colored stony or gravelly loam or sandy loam. The underlying material is extremely variable and includes very stony loam, stony or gravelly loam, and gravelly sandy loam. Granite is at a depth of 20 to more than 60 inches. The content of stones and gravel throughout the profile ranges from 20 to 60 percent.

Surface runoff is rapid, and the erosion hazard is high. The Rock outcrop is granite, gneiss, and schist. This unit is rangeland and wildlife habitat.

The potential native vegetation is dominantly big sagebrush, snowberry, junegrass, wheatgrasses, fescues, and numerous forbs. As range condition deteriorates, woody shrubs increase.

Wildlife include sage grouse, mule deer, elk, jackrabbit, and coyote. Managing livestock grazing is needed to protect big game range.

The slope and depth to bedrock are the features most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

24—Cryorthents-Rock outcrop complex, extremely steep. This steep to very steep unit is on mountainsides, ridges, and escarpments at elevations of 7,500 to 9,500 feet. The average annual precipitation is from 11 to 18 inches, the mean annual air temperature is from 37 to 42 degrees F, the average summer soil temperature is 53 to 57 degrees F, and the frost-free season is 30 to 75 days. This unit is about 55 percent Cryorthents and 30 percent Rock outcrop.

Included in mapping are small areas of Harsha loam, Aaberg clay loam, Binco clay loam, and Tine cobbly sandy loam.

Cryorthents are shallow to moderately deep, well drained, clayey to loamy soils. They have a light colored surface layer, lack subsoil development, and have bedrock at a depth of 10 to 40 inches. Reaction is neutral to strongly alkaline.

The available water capacity is low. Surface runoff is rapid, and the erosion hazard is high.

The Rock outcrop is shale, sandstone, mudstone, or basalt.

This unit provides wildlife habitat.

The potential native vegetation is dominantly big sagebrush, rabbitbrush, wheatgrass, and numerous forbs.

This unit is severely limited for agriculture and all development.

The capability subclass is VIIs.

25—Cumulic Cryaquolls, nearly level. Cumulic Cryaquolls are poorly drained soils on flood plains at elevations of 7,500 to 8,500 feet. They formed in alluvium and alluvial outwash. The average annual precipitation is 12 to 20 inches, the average annual air temperature is about 37 to 43 degrees F, and the frost-free season is 30 to 80 days. Some are only 2 to 4 feet deep over sand and gravel. The profile ranges from sandy loam to clay and is commonly stratified.

The surface layer is dark colored and is 20 or more inches thick. The water table is within 10 to 24 inches of the surface during the growing season.

Surface runoff is slow. The erosion hazard is slight. Shallow, brief flooding occurs during spring runoff.

Included in mapping are small areas of soils that have peat at the surface. Soils that do not have a thick, dark colored surface layer are also included.

Much of the acreage is irrigated and used for hay (fig. 8). Part of it is used for wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Management of irrigation water, subsurface drainage, and fertilization are needed to maintain grass hay production. Suitable for seeding are slender wheatgrass, smooth brome, Garrison creeping foxtail, and timothy. The total annual production averages about 2,500 pounds of air-dry forage per acre.

Irrigation systems must be designed to avoid overirrigation, ponding, and erosion, and to return excess water to the streams. Ponded irrigation water decreases hay production.

Spring fertilization is suggested. Fall applications of fertilizer may be partly lost during the spring snowmelt. Large quantities of nitrogen, 40 to 100 pounds per acre, and phosphorous, 15 to 30 pounds per acre, are needed for most irrigated hayland.

Fencing is needed if this unit is grazed.

Rangeland vegetation is dominantly tufted hairgrass, slender wheatgrass, sedges, and rushes. The average annual production is about 2,500 pounds. As range condition declines, shrubs and forbs become abundant, along with introduced grasses, such as timothy, smooth brome, redtop, Kentucky bluegrass, and orchardgrass, which are not native to the area.

If plants become rootbound, production decreases. Ripping or breaking up the dense root growth when the water table is low restores plant vigor. If low production is caused by a lack of plant cover, seeding is needed. Suitable for seeding are slender wheatgrass, smooth brome, timothy, Kentucky bluegrass, and Garrison creep-

ing foxtail. The seed should be drilled into a firm seedbed.

Wetland wildlife, such as mallard, teal, and various shore birds, are attracted to this unit, which is typically wet and produces an abundance of wetland vegetation. Other wildlife are beaver, mink, and muskrat. The numbers can be further increased if shallow water developments are constructed and the natural plant cover is allowed to develop. The wetlands can be improved by managing livestock grazing, fencing to control livestock, preventing fires, and preventing drainage. This unit is also valuable as big game winter range.

Seasonal flooding and depth to the water table are the most limiting features to be considered in the design of access roads and community development. An onsite investigation is necessary before planning any construction because of the wide variation of soil properties. Adequate soil drainage is needed for most land uses.

The capability subclass is VIw, and the range site is Mountain Meadow.

26—Dahlquist-Boettcher complex, 6 to 30 percent slopes. These moderately deep to deep, well drained, moderately sloping to steep soils are on mountainsides at elevations of 6,600 to 7,300 feet. They formed in residuum and local colluvium and alluvium from sandstone and shale. The average annual precipitation is about 12 inches, the average annual air temperature is about 43 degrees F, and the frost-free season is 80 to 110 days. This map unit is about 50 percent Dahlquist soil and 30 percent Boettcher soil. Included in mapping are small areas of Stunner very cobbly loam, Haploborolls, and Rock outcrop.

Typically the Dahlquist soil has a brown very cobbly loam surface layer about 6 inches thick. The upper 16 inches of the subsoil is strong brown very cobbly sandy clay loam. The lower 8 inches is strong brown extremely cobbly sandy clay loam. The substratum is very pale brown extremely cobbly loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

Typically the Boettcher soil has a yellowish brown stony loam surface layer about 2 inches thick. The subsoil is brown clay loam about 21 inches thick. The substratum is light brownish gray clay loam about 10 inches thick. Soft shale is at a depth of 33 inches.

Permeability is slow, and the available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate. All of the acreage is rangeland that is utilized by both livestock and wildlife. The cold climate and short growing season limit the production of crops and of introduced grasses.

Bluebunch wheatgrass, western wheatgrass, squirreltail, and big sagebrush dominate the rangeland vegetation. Shrubby species become dominant as range condition declines. Some pinyon and juniper may invade the site.

Grazing management is needed to maintain the site. Where shrubs have become dominant, brush management may be needed. The site is too stony to be seeded with a drill.

This unit provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are needed to protect the big game winter range.

Fence posts and firewood can be cut where the woodland is dominantly pinyon pines and juniper. The low available water holding capacity limits seedling survival.

Depth to bedrock, large stones, and the high shrink-swell potential are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff. Cut and fills should be avoided to prevent soil slippage.

The capability subclass is VIIs.

27—Dahlquist-Stunner very cobbly loams, 3 to 15 percent slopes. These deep, well drained, gently sloping to strongly sloping soils are on mountainsides, fans, and toe slopes at elevations of 6,600 to 7,300 feet. These soils formed in local alluvium and colluvium. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 35 to 44 degrees F, the average annual summer air temperature is about 62 degrees F, and the frost-free season is about 80 to 110 days.

These soils are found only in the southwestern part of the county near Radium.

The Dahlquist soil occupies the side slopes and terrace positions and makes up about 50 percent of the unit. The Stunner soil occupies the side slopes and steeper fan parts of the landscape and makes up about 40 percent of the unit. Included in this unit are small areas of Forelle loam and Boettcher stony loam. Also included are a few small areas of Rock outcrop.

Typically the Dahlquist soil has a brown very cobbly loam surface layer about 6 inches thick. The subsoil is brown very cobbly sandy clay loam about 24 inches thick. The substratum is very pale brown extremely cobbly loam that extends to 60 inches or more (fig. 9).

Permeability is moderate. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

Typically the Stunner soil has a dark grayish brown very cobbly loam surface layer about 6 inches thick. The subsoil is brown to pale brown clay loam about 16 inches thick. The upper 10 inches of the substratum is pale brown sandy clay loam. The lower part is very pale brown, highly calcareous loam that extends to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland and pinyon-juniper woodland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

Bluebunch wheatgrass, western wheatgrass, squirreltail, and big sagebrush dominate the rangeland vegetation. Shrubby species become dominant as range condition declines. Some pinyon and juniper may invade the site.

Grazing management is needed to maintain the site. Where shrubs have become dominant (fig. 10), brush control may be needed for improvement. The site is generally too steep and cobbly to be seeded.

This unit provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are needed to protect the big game winter range.

Fence posts and firewood can be cut where the woodland is dominantly pinyon pine and juniper. The low available water holding capacity limits seedling survival. Large stones is the feature most limiting to community development. Cut and fill slopes should be designed to minimize soil slippage.

The capability subclass is VIIs.

28—Dahlquist-Stunner very cobbly loams, 15 to 50 percent slopes. These deep, well drained, moderately steep to steep soils are on mountainsides and terrace slopes at elevations of 6,600 to 7,300 feet. They formed in local alluvium and colluvium. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 35 to 44 degrees F, the average annual summer air temperature is about 62 degrees F, and the frost-free season is about 80 to 110 days. These soils occur only in the southwestern part of the county near Radium.

Dahlquist soil occupies the side slopes and terrace positions and makes up about 50 percent of the unit. The Stunner soil occupies the side slopes and steeper parts of the landscape and makes up about 40 percent of the unit. Included in this unit are small areas of Forelle loam and Boettcher stony loam. Also included are a few small areas of Rock outcrop.

Typically the Dahlquist soil has a brown very cobbly loam surface layer about 6 inches thick. The subsoil is brown very cobbly sandy clay loam about 24 inches thick. The substratum is very pale brown extremely cobbly loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

Typically the Stunner soil has a dark grayish brown very cobbly loam surface layer about 6 inches thick. The subsoil is brown to pale brown clay loam about 16 inches thick. The upper 10 inches of the substratum is pale brown sandy clay loam. The lower part is very pale brown, highly calcareous loam that extends to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland and pinyon-juniper woodland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

Bluebunch wheatgrass, western wheatgrass, squirreltail, and big sagebrush dominate the rangeland vegetation. Shrubby species become dominant as range condition declines. Some pinyon and juniper may invade the site.

Grazing management is needed to maintain the site. Where shrubs have become dominant, brush control may be needed to improve the condition of the site. The site is too cobbly to be seeded with a drill.

This unit provides winter range for mule deer and elk. Other wildlife include sage grouse, cottontail, jackrabbit, and coyote. Managing livestock grazing and controlling sagebrush are needed to protect the big game winter range.

Fence posts and firewood can be cut where the woodland is dominantly pinyon pine and juniper. The steep slopes limit harvesting. The low available water capacity limits seedling survival.

Steep slopes and large stones are the features most limiting to community development. Cut and fill slopes should be designed to minimize soil slippage. Adequate surface drainage should be designed before road construction.

The capability subclass is VIIs.

29—Forelle loam, 3 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on side slopes, foot slopes, and fans at elevations of 6,600 to 7,500 feet. It formed in local alluvium from various sources of sedimentary material. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 42 to 46 degrees F, the average summer air temperature is about 61 degrees F, and the frost-free season is about 80 to 110 days.

Included in mapping are small areas of Stunner and Dahlquist soils.

Typically the Forelle soil has a brown loam surface layer about 5 inches thick. The subsoil is light yellowish brown and pale brown sandy clay loam 28 inches thick. The substratum is pale brown and very pale brown sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is high. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used as recreation and wildlife. The cold climate and short growing season limit the production of grasses and of crops.

Rangeland vegetation on this site is dominated by western wheatgrass, green needlegrass, and big sagebrush. As range condition declines, grass production becomes lower and shrubs dominant.

Grazing management is needed to maintain range condition. Brush control will improve range condition where shrubs are dominant if there is enough grass to respond. In areas where the grass is sparse, seeding is needed. Suitable for seeding are Indian ricegrass, western wheatgrass, and pubescent wheatgrass. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote.

Grazing management and sagebrush control are needed to protect big game winter range.

Low strength and shrink-swell potential are the soil properties most limiting to community development. Road design should provide adequate drainage for surface runoff.

The capability subclass is VIe.

30—Forelle loam, 15 to 30 percent slopes. This deep, well drained, moderately steep soil is on mountainsides, foot slopes, and fans at elevations of 6,600 to 7,500 feet. It formed in local alluvium from various sources of sedimentary material. The average annual precipitation is 11 to 14 inches, the average annual air temperature is about 42 to 46 degrees F, the average annual summer air temperature is about 61 degrees F, and the frost-free period is about 80 to 110 days.

Included in mapping are small areas of Stunner and Dahlquist soils. Also included are a few small areas of Tolman stony loam and Rock outcrop.

Typically the Forelle soil has a brown loam surface layer about 5 inches thick. The subsoil is light yellowish brown and pale brown sandy clay loam about 28 inches thick. The substratum is pale brown and very pale brown sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is high. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of grasses and of crops.

Rangeland vegetation is dominantly western wheatgrass, green needlegrass, and big sagebrush. As range condition declines, grass production decreases and shrubs become dominant.

Grazing management is needed to maintain range condition. Brush control will improve range condition where shrubs are dominant if there is enough grass to respond. In areas where the grass is sparse, this site can be seeded to adapted species.

This soil provides winter range for mule deer. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote.

Grazing management and sagebrush control are necessary for the big game winter range.

Steep slope, low strength, and the shrink-swell potential are the soil properties most limiting to community development. Road design should provide adequate drainage for surface runoff.

The capability subclass is VIe.

31—Frisco-Peeler gravelly sandy loams, 2 to 6 percent slopes. These deep, well drained, gently sloping to moderately sloping soils are on mountainsides, ridges, and fans at elevations of 8,000 to 10,500 feet. They formed in glacial drift. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 60 days.

The Frisco soil occupies the sloping parts of the landscape and makes up about 65 percent of the unit. The Peeler soil occupies the gently sloping or depressional positions, and makes up about 25 percent of this unit. The Frisco soil has a larger volume of coarse fragments in the subsoil than the Peeler soil but is similar otherwise. Small areas of Anvik loam, Youga loam, Grenadier gravelly loam, Quander cobbly loam, and Cowdrey loam make up about 10 percent of this unit. Also included are a few small areas of Rock outcrop and Cumulic Cryaquolls.

Typically the Frisco soil has a duff layer about 1 inch thick consisting of needles and twigs. The subsurface layer is pinkish gray gravelly sandy loam about 14 inches thick. The subsoil is light brown very stony sandy clay loam about 27 inches thick. The substratum is light brown very stony sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow, and the erosion hazard is slight.

Typically the Peeler soil has a duff layer about 2 inches thick consisting of needles and twigs. The subsurface layer is light gray gravelly sandy loam about 5 inches thick. The subsoil is brown and strong brown gravelly sandy clay loam about 57 inches thick. The substratum is yellowish brown gravelly sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is woodland. Part of it is used for recreation, timber production, and wildlife. The cold cli-

mate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominated by lodgepole pine, Engelmann spruce, scattered quaking aspen, and a sparse understory of grasses, shrubs, and forbs.

This unit is suited to lodgepole pine. It produces about 40 to 50 cubic feet of wood per acre per year.

Thinning the stand provides poles for fences, corrals, and power lines. The low water holding capacity of the Frisco soil limits seedling survival.

This unit provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for mule deer and elk. Managing the livestock grazing and the timber improves habitat for the big game summer range.

Large stones is the feature most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIe.

32—Frisco-Peeler gravelly sandy loams, 6 to 25 percent slopes. These deep, well drained, moderately sloping to moderately steep soils are on mountainsides, ridges, and fans at elevations of 8,000 to 10,500 feet. They formed in glacial drift. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 60 days.

The Frisco soil occupies the steeper parts of the landscape and makes up about 65 percent of the unit. The Peeler soil occupies the concave and more gently sloping positions and makes up about 25 percent of the unit. The Frisco soil has a larger volume of coarse fragments in the subsoil than the Peeler soil but is otherwise similar. Small areas of Anvik loam, Youga loam, Grenadier gravelly loam, Quander stony loam, and Cowdrey loam make up about 10 percent of this map unit.

Typically the Frisco soil has a duff layer about 1-inch thick consisting of needles and twigs. The subsurface layer is pinkish gray gravelly sandy loam about 14 inches thick. The subsoil is light brown very stony sandy clay loam about 27 inches thick. The substratum is a light brown very stony sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is moderate.

Typically the Peeler soil has a duff layer about 2 inches thick consisting of needles and twigs. The subsurface layer is light gray gravelly sandy loam about 5 inches thick. The subsoil is brown and strong brown gravelly sandy clay loam about 52 inches thick. The substratum is yellowish brown gravelly sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is woodland. Part of it is used for timber production, recreation, and wildlife. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, Engelmann spruce, scattered quaking aspen, and a sparse understory of grasses, shrubs, and forbs (fig. 11).

This unit is suited to lodgepole pine. It produces about 40 to 50 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. Care should be taken to prevent erosion of skid trails and access roads. The low water holding capacity of the Frisco soil limits seedling survival.

This unit provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for mule deer and elk. Managing the livestock grazing and the timber can improve habitat for the big game summer range.

Large stones and steep slopes are the features most limiting to community development. Road design should provide drainage outlets for surface runoff. Cut and fill slopes should be avoided to prevent hillside slippage.

The capability subclass is VIe.

33—Frisco-Peeler gravelly sandy loams, 25 to 65 percent slopes. These deep, well drained, moderately steep to very steep soils are on mountainsides, ridges, and fans at elevations of 8,000 to 10,500 feet. They formed in glacial drift. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 60 days.

The Frisco soil occupies the steeper parts and stony slopes. It makes up 65 percent of the unit. The Peeler soil occupies the concave positions and makes up 25 percent of the unit. The Frisco soil has a larger volume of coarse fragments in the subsoil than the Peeler soil, but is similar otherwise. Small areas of Grenadier gravelly loam, Quander stony loam, and Cowdrey loam make up about 10 percent of this map unit. Also included are a few small areas of Rock outcrop.

Typically the Frisco soil has a duff layer about 1 inch thick consisting of needles and twigs. The subsurface layer is pinkish gray gravelly sandy loam about 14 inches thick. The subsoil is light brown very stony sandy clay loam about 27 inches thick. The substratum is light brown very stony sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is rapid, and the erosion hazard is high.

Typically the Peeler soil has a duff layer about 2 inches thick consisting of needles and twigs. The subsur-

face layer is light gray gravelly sandy loam about 5 inches thick. The subsoil is brown to strong brown gravelly sandy clay loam about 52 inches thick. The substratum is yellowish brown gravelly sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation, timber production, and wildlife. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, subalpine fir, Engelmann spruce, scattered quaking aspen, and a sparse understory of grasses, shrubs, and forbs.

This unit is suited to lodgepole pine. It produces about 40 to 50 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. Care should be taken to prevent erosion of skid trails and access roads. Steep slopes may limit the type of equipment used in harvesting the timber.

This unit provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for mule deer and elk. Livestock grazing management and timber management may improve habitat for the big game summer range.

The steep slopes and large stones are the features most limiting to community development. Road design should provide drainage outlets for surface runoff. Cut and fill slopes should be designed to minimize soil slippage.

The capability subclass is VIIe.

34—Gateway loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on mountainsides and ridges at elevations of 8,000 to 9,500 feet. It formed in material weathered from mudstone and shale. The average annual precipitation is about 18 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Cebone loam, Cimarron loam, and Cowdrey loam. Also included are a few small areas of Histic Cryaquolls, Cumulic Cryaquolls, and Rock outcrop.

Typically the Gateway soil has a duff layer about 1 inch thick consisting of needles and twigs. The surface layer is brown loam about 3 inches thick. The subsurface layer is light gray loam about 5 inches thick. The subsoil is brown and light brown clay about 22 inches thick. Mudstone is at a depth of 30 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, quaking aspen, and a sparse understory of grasses, forbs, and shrubs.

This soil is suited to lodgepole pine. It produces about 25 to 35 cubic feet of wood per acre per year. Thinnings can be used for poles and firewood. Care should be taken to prevent erosion of skid trails and roads.

Wildlife include mule deer, elk, blue grouse, snowshoe hare, and black bear. Clear cut openings in the stand increase production of shrubs, forbs, and grasses for deer and elk in summer.

The depth to rock and the high shrink-swell potential of the soil are the features most limiting to community development. Cut and fill slopes should be kept to a minimum to avoid hillside slippage.

The capability subclass is VIe.

35—Gateway loam, 15 to 50 percent slopes. This moderately deep, well drained, moderately steep to steep soil is on mountainsides and ridges at elevations of 8,000 to 9,500 feet. It formed in material weathered from mudstone and shale. The average annual precipitation is about 18 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Cebone loam, Cimarron loam, and Cowdrey loam. Also included are a few small areas of Rock outcrop.

Typically the Gateway soil has a duff layer about 1 inch thick consisting of needles and twigs. The surface layer is brown loam about 3 inches thick. The subsurface layer is light gray loam about 5 inches thick. The subsoil is brown and light brown clay about 22 inches thick. Mudstone is at a depth of 30 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, quaking aspen, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to lodgepole pine. It produces about 30 to 40 cubic feet of wood per acre per year. Thinning the stand provides poles and firewood. Care should be taken to prevent the erosion of skid trails and roads. The steep slopes make harvesting difficult.

Wildlife includes mule deer, elk, blue grouse, snowshoe hare, and black bear. Clear cut openings in the stand increase production of shrubs, grasses, and forbs for deer and elk in summer.

The depth to rock, the slope, and the high shrink-swell potential are the soil properties most limiting to community development. Cut and fill slopes should be avoided to prevent hillside slippage. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

36—Grenadier gravelly loam, 15 to 55 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 9,000 to 11,400 feet. It formed in glacial drift and in material weathered from metamorphic rocks. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 37 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Frisco-Peeler gravelly sandy loams. Also included are a few small areas of Rock outcrop.

Typically the Grenadier soil has a duff layer about 2 inches thick consisting of needles and twigs. The subsurface layer is pink gravelly loam about 7 inches thick. The subsoil is brown gravelly light sandy clay loam about 8 inches thick. The substratum is pale brown very stony sandy loam that extends to 60 inches or more. This soil is very strongly acid in the subsurface layer and strongly acid below.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation, wildlife, and limited timber production. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, subalpine fir, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to lodgepole pine. It produces about 15 to 25 cubic feet of wood per acre per year. Steep slopes limit the types of equipment used in harvesting. Extreme care should be taken to prevent the erosion of skid trails and roads. The low water holding capacity limits seedling survival.

Wildlife includes mule deer, elk, blue grouse, and black bear. Clear cut openings in the stand increase production of shrubs, grasses, and forbs for deer and elk in summer.

The steep slopes and small stones are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

37—Harsha loam, 0 to 6 percent slopes. This deep, well drained, nearly level to moderately sloping soil is on fans and terraces at elevations of 7,500 and 8,500 feet. It formed in local alluvium from sedimentary rock. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Leavitt loam, Roxal loam, Quander cobbly loam, Rogert gravelly sandy loam, and Tamp gravelly sandy loam. Also included are a few small areas of soils that have layers of concentrated lime and similar soils that have weak subsoil development.

Typically the surface layer of the Harsha soil is dark grayish brown loam about 5 inches thick. The upper 28 inches of the subsoil is light brown and very pale brown clay loam. The lower 7 inches is light yellowish brown loam. The substratum is light yellowish brown loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. A small acreage is irrigated and used for hay.

The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is essential. Brush control is needed if there is enough grass to respond. In areas where the grass is sparse, seeding is needed. Suitable for seeding are Indian ricegrass, western wheatgrass, streambank wheatgrass, thickspike wheatgrass, pubescent wheatgrass, crested wheatgrass, and Russian wildrye. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Livestock grazing management and sagebrush control are needed to protect big game winter range.

The low strength and the shrink-swell potential are the soil properties most limiting to community development.

The capability subclass is VIe.

38—Harsha loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides, fans, and terraces at elevations of 7,500 to 8,500 feet. It formed in local alluvium from sedimentary rocks. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Leavitt loam, Roxal loam, Rogert gravelly sandy loam, and Tamp gravelly sandy loams. Also included are a few small areas of soils that have concentrated lime and similar soils that have weak subsoil development.

Typically the surface layer of the Harsha soil is dark grayish brown loam about 5 inches thick. The upper 28 inches of the subsoil is light brown and very pale brown clay loam. The lower 7 inches is light yellowish brown loam. The substratum is light yellowish brown loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. Brush control is needed if there is enough grass to respond. In areas where the grass is sparse, seeding is needed. Suitable for seeding are Indian ricegrass, western wheatgrass, streambank wheatgrass, thickspike wheatgrass, pubescent wheatgrass, crested wheatgrass, and Russian wildrye. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Livestock grazing management and sagebrush control are needed to protect the big game winter range and sage grouse habitat.

The low strength and the shrink-swell potential are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIe.

39—Harsha loam, 15 to 50 percent slopes, eroded. This deep, well drained, moderately steep to steep soil is on mountainsides and fans at elevations of 7,500 to 8,500 feet. It formed in local alluvium from sedimentary rocks. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Included in mapping are small areas of Leavitt loam, Roxal loam, Rogert loam, and Tamp gravelly sandy loams. Also included are a few small areas of Cryorthents, Rock outcrop, soils that have layers of concentrated lime, and similar soils that have weak subsoil development.

Typically the surface layer of the Harsha soil is dark grayish brown loam about 2 inches thick. The upper 28 inches of the subsoil is light brown to very pale brown clay loam. The lower 7 inches is light yellowish brown loam. The substratum is light yellowish brown loam that extends to 60 inches or more. Erosion has removed all the surface layer in some areas, and the soil is shallow in other areas.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Wheatgrass, needleandthread, Indian ricegrass, and junegrass dominate the rangeland vegetation. As range condition deteriorates, production of these grasses decreases.

Grazing management and deferred grazing are needed to maintain and improve range condition. The site is too steep to be seeded.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are needed to protect the big game winter range and sage grouse habitat.

Steep slopes, the shrink-swell potential, and low strength are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

40—Harsha cobbly loam, 15 to 50 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides and alluvial fans at elevations of 7,500 to 8,500 feet. It formed in alluvial material from sedimentary parent material. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Leavitt loam, Quander stony loam, and Tamp gravelly sandy loam are included in the map unit.

Typically the surface layer of the Harsha soil is a dark grayish brown cobbly loam about 5 inches thick. The upper 28 inches of the subsoil is a light brown and very pale brown clay loam. The lower 7 inches is light yellowish brown loam. The substratum is light yellowish brown loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is rapid, and the erosion hazard is high.

Much of the acreage is in rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses.

Rangeland vegetation is dominantly bluebunch wheatgrass, Idaho fescue, muttongrass, big sagebrush, and bitterbrush. As the range condition deteriorates, low quality shrubs become dominant.

Grazing management and deferred grazing improve depleted rangeland. This site cannot be seeded because of the steep slopes and the stones.

This soil is used as rangeland and as wildlife habitat. It provides fair habitat for mule deer, jackrabbit, coyote, and sage grouse.

Steep slopes, the shrink-swell potential, and low strength are the soil properties most limiting to community development.

The capability subclass is VIIs.

41—Histic Cryaquolls, nearly level. Histic Cryaquolls are poorly drained soils on flood plains adjacent to mountain streams at elevations of 9,000 to 11,500 feet. They formed in alluvium. The annual precipitation is 20 to 30 inches, the average annual air temperature is 36 to 42 degrees F, and the frost-free season is 20 to 70 days. The water table is at or near the surface most of the year.

Histic Cryaquolls have an 8- to 14-inch layer of peat at the surface. The next layer is dark colored and is 10 inches or more thick. The texture throughout the profile ranges from sandy loam to clay and is commonly stratified.

Surface runoff is slow. The erosion hazard is slight. Shallow ponding occurs in May, June, and July.

Included in mapping are small areas of similar soils that do not have a layer of peat at the surface. Similar soils that do not have a dark colored surface layer and areas of Cumulic Cryaquolls are also included.

If this unit is grazed, fencing is needed.

Rangeland vegetation is dominantly tufted hairgrass, sedges, and rushes (fig. 12). The average annual production is about 1,500 pounds. As range condition declines, shrubs and forbs become abundant along with introduced grasses, such as timothy, smooth brome, redtop, Kentucky bluegrass, and orchardgrass, that are not native to the area.

If plants become rootbound, production decreases. Ripping or breaking up the dense root growth restores plant vigor.

If the plant cover is sparse, seeding is needed. Suitable for seeding are slender wheatgrass, smooth brome, timothy, Kentucky bluegrass, and Garrison creeping foxtail. The seed should be drilled into a firm seedbed. Deep plowing is needed to mix the peat layer with the mineral soil.

Most of the acreage is used by wildlife. A small part is used for recreation. The cold climate, short growing season, seasonal flooding, and high water table preclude the use of this unit as cropland and recreation homesite subdivisions. Appropriate areas can be reserved for sports, fishing, and other recreation.

An onsite investigation is needed before planning construction because of the wide variation of soil properties. Flood protection measures should be designed to control, at least, 100-year storms. Adequate drainage is needed for most land uses.

Wetland wildlife, such as mallard, teal, and various shore birds, are attracted to this unit, which is typically wet and produces an abundance of wetland vegetation. Other wildlife include beaver, mink, and muskrat. The numbers can be further increased if shallow water developments are constructed and the natural plant cover is allowed to develop. This unit is also valuable as big game winter range. The wetlands can be improved by managing livestock grazing, fencing to control livestock, preventing fires, and preventing the drainage of wetlands.

The capability subclass is VIIw, and the range site is Mountain Meadow.

42—Irigul channery loam, 6 to 30 percent slopes. This shallow, well drained, moderately sloping to moderately steep soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in material weathered from slate. The average annual precipitation is about 15 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Woodhall loam and Quander stony loam. Also included are a few small areas of Rock outcrop.

Typically the Irigul soil has a dark grayish brown channery loam surface layer about 6 inches thick. The lower 2 inches of the surface layer is brown very channery loam. Slate is at a depth of about 8 inches.

Permeability is moderate. The effective rooting depth is only 5 to 20 inches. The available water capacity is very low. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, needlegrass, bluegrass, and big sagebrush dominate the rangeland vegetation. Shrubs become dominant as range condition deteriorates.

Grazing management and deferred grazing maintain the range condition. If shrubs are dominant, brush control is needed. The soil is very poorly suited to seeding because it is droughty.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game range.

Depth to rock is the soil property most limiting to community development.

The capability subclass is VIIe.

43—Lake Creek loam, 15 to 50 percent slopes. This moderately deep, well drained, moderately steep to

steep soil is on mountainsides and ridges at elevations of 8,500 to 9,500 feet. It formed in material weathered from sandstone. The average annual precipitation is about 18 to 25 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Uinta sandy loam, Leadville stony loam, and Woodhall loam. Also included are a few small areas of Rock outcrop.

Typically the Lake Creek soil has a duff layer of needles and twigs about 1 inch thick. The subsurface layer is pink loam about 5 inches thick. The subsoil is reddish yellow, very stony sandy clay loam about 30 inches thick. Sandstone is at a depth of about 35 inches.

Permeability is moderate. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, some quaking aspen, and a sparse understory of grasses, forbs, and shrubs.

This soil is suited to lodgepole pine. It produces about 20 to 35 cubic feet of wood per acre per year. Thinning the stand provides poles and firewood. Extreme care is needed to prevent the erosion of skid trails and roads. Excessive slope limits the types of equipment used in harvesting. The low water holding capacity limits seedling survival.

Wildlife include deer, elk, blue grouse, snowshoe hare, and black bear. Clear cut openings in the timber increase the production of shrubs, grasses, and forbs for deer and elk in summer.

Depth to rock, large stones, and slope are the soil properties most limiting to community development. Cut and fill slopes should be kept to a minimum to avoid hillside slippage. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

44—Leadville stony loam, 15 to 50 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides and ridges at elevations of 8,500 to 9,500 feet. It formed in material weathered from sandstone. The average annual precipitation is about 18 to 25 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Lake Creek loam, Uinta sandy loam, and Upson stony sandy loam. Also included are a few small areas of Rock outcrop.

Typically the Leadville soil has a duff layer about 2 inches thick consisting of needles and twigs. The subsurface layer is pink stony loam about 11 inches thick. The upper 8 inches of the subsoil is reddish brown stony loam. The lower 24 inches is red extremely stony clay loam. The substratum is red extremely stony loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine and a sparse understory of grasses, shrubs, and forbs.

Leadville soils are suited to lodgepole pine. It produces about 25 to 35 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. Care is needed to prevent erosion of skid trails and access roads. The low water holding capacity limits seedling survival.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for mule deer and elk. Managing livestock grazing and timber improves habitat for the big game summer range.

Large stones and steep slopes are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

45—Leavitt loam, 0 to 6 percent slopes. This deep, well drained, nearly level to moderately sloping soil is on fans at elevations of 7,500 to 8,500 feet. It formed in local alluvium from sedimentary rock. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Harsha loam, Roxal loam, Lymanson loam, and Tine gravelly sandy loam are included in mapping.

Typically the Leavitt soil has a grayish brown loam surface layer about 6 inches thick. The subsoil is brown clay loam about 28 inches thick. The substratum is pale brown clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow, and the erosion hazard is low.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Wheatgrass, muttongrass, Idaho fescue, and big sagebrush are dominant in rangeland vegetation.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. If shrubs have become domi-

nant, brush control is needed. If the site is in poor condition, seeding may be needed. Arizona fescue, big bluegrass, slender wheatgrass, smooth brome, western wheatgrass, and intermediate wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Livestock grazing management and sagebrush control are necessary to protect the big game winter range.

The low strength and high shrink-swell potential are the soil properties most limiting to community development.

The capability subclass is VIe.

46—Leavitt loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on fans and terraces at elevations of 7,500 to 8,500 feet. It formed in local alluvium from sedimentary rock. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Harsha loam, Roxal loam, Lymanson loam, and Tine cobbly loam are included in mapping.

Typically the Leavitt soil has a grayish brown loam surface layer about 6 inches thick. The subsoil is brown clay loam about 28 inches thick. The substratum is pale brown clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Wheatgrass, muttongrass, Idaho fescue, and big sagebrush are dominant in the rangeland vegetation.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. If shrubs are dominant, brush control is needed. If the site is in poor condition, seeding may be needed. Arizona fescue, big bluegrass, slender wheatgrass, smooth brome, western wheatgrass, and intermediate wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Livestock grazing management and sagebrush control are necessary to protect the big game winter range.

The low strength, the shrink-swell potential, and the slopes are the features most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIe.

47—Leavitt loam, 15 to 55 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 7,500 to 8,500 feet. It formed in local alluvium from sedimentary rock. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Harsha loam, Roxal loam, Lymanson loam, and Tine cobbly sandy loam are included in mapping.

Typically the Leavitt soil has a grayish brown loam surface layer about 6 inches thick. The subsoil is brown clay loam about 28 inches thick. The substratum is pale brown clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly western wheatgrass, muttongrass, Idaho fescue, and big sage.

Grazing management is needed to maintain range condition. If woody shrubs have become dominant, brush control is needed. The site is generally too steep to be seeded with a drill.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Livestock grazing management and sagebrush control are necessary to protect the big game winter range.

The steep slope is the soil feature most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

48—Leighcan gravelly sandy loam, 15 to 70 percent slopes. This deep, well drained, moderately steep to very steep soil is on mountainsides and ridges at elevations of 9,500 to 11,400 feet. In a few small areas the slope is steeper than 70 percent. This soil formed in material weathered from granite, gneiss, and metamorphic schist. The average annual precipitation is about 28 to 36 inches, the average annual air temperature is about 32 to 37 degrees F, and the frost-free season is about 10 to 50 days.

Small areas of Upson stony sandy loam, Scout cobbly sandy loam, and Newcomb gravelly sandy loam are included in mapping. A few small areas of Cryaquepts are also included.

Typically the Leighcan soil has a duff layer about 2 inches thick of needles, twigs, and leaves. It has a sub-

surface layer of pinkish gray gravelly sandy loam about 5 inches thick. The subsoil is brown very cobbly sandy loam about 20 inches thick. The substratum is very cobbly loamy sand to 60 inches or more.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. The cold climate, steep slopes, and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly Engelmann spruce, scattered lodgepole pine, and a sparse understory of grasses, shrubs, and forbs.

This Leighcan soil is suited to Engelmann spruce. In an Engelmann spruce stand, it produces about 55 to 65 cubic feet of wood per acre per year. In a lodgepole pine stand, it produces about 40 to 50 cubic feet of wood per acre per year. Timber harvesting and equipment are limited by steep slopes. Care is needed to prevent erosion on skid trails and access roads.

Wildlife include snowshoe hare, blue grouse, and black bear. The soil also provides summer range for mule deer and elk. Managing livestock grazing and timber improves habitat on the big game summer range.

The steep slopes is the soil feature most limiting to community development.

The capability subclass is VIIe.

49—Leighcan bouldery sandy loam, 15 to 70 percent slopes. This deep, well drained, moderately steep to very steep soil is on mountainsides and ridges at elevations of 9,500 to 11,400 feet. In a few small areas the slope is steeper than 70 percent. This soil formed in material weathered from granite, gneiss, and metamorphic schist. The average annual precipitation is about 28 to 36 inches, the average annual air temperature is about 32 to 37 degrees F, and the frost-free season is about 10 to 50 days.

Small areas of Upson stony sandy loam, Scout cobbly sandy loam, and Newcomb gravelly sandy loam are included in mapping. A few small areas of Cryaquepts are also included.

Typically the Leighcan soil has a duff layer about 2 inches thick of needles, twigs, and leaves. The subsurface layer is pinkish gray bouldery sandy loam about 5 inches thick. The subsoil is brown very bouldery sandy loam about 20 inches thick. The substratum is very bouldery loamy sand that extends to 60 inches or more.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. The cold climate, steep slopes, and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly Engelmann spruce, some scattered lodgepole pine (fig. 13), and a sparse understory of grasses, shrubs, and forbs.

This Leighcan soil is suited to Engelmann spruce. In an Engelmann spruce stand, it produces about 55 to 65 cubic feet of wood per acre per year. In a lodgepole pine stand, it produces about 40 to 50 cubic feet of wood per acre per year.

Timber harvesting and equipment are limited by steep slopes and boulders. Care is needed to prevent erosion on skid trails and access roads.

Wildlife include snowshoe hare, blue grouse, and black bear. This soil provides summer range for mule deer and elk. Managing livestock grazing and timber improves the habitat on the big game summer range.

The steep slopes and large stones are the soil features most limiting to community development.

The capability subclass is VIIs.

50—Lymanson loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in material weathered from limestone. The average annual precipitation is about 15 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Included in mapping are small areas of Leavitt loam and Roxal loam. Also included are a few small areas of Cryorthents, Rock outcrop, and areas of similar soil that has bedrock at a depth of 10 to 20 inches.

Typically the Lymanson soil has a dark grayish brown loam surface layer about 2 inches thick. The subsoil is grayish brown clay loam about 22 inches thick. The substratum is light grayish brown clay loam about 2 inches thick. Limestone is at a depth of about 26 inches.

Permeability is moderate. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. When range condition is poor, brush control is needed if there is enough grass to respond. In areas where the grass is sparse, seeding is needed. Suitable for seeding are Indian ricegrass, western wheatgrass, streambank wheatgrass, thickspike wheatgrass, pubescent wheatgrass, crested wheatgrass, and Russian wildrye. The seed should be drilled into a firm seedbed.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse,

cottontail, jackrabbit, and coyote. Livestock grazing management and sagebrush control are necessary to protect the big game range.

Depth to rock is the soil property most limiting to community development.

The capability subclass is VIe.

51—Lymanson loam, 15 to 40 percent slopes. This moderately deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in material weathered from limestone. The average annual precipitation is about 15 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Small areas of Leavitt loam and Roxal loam are included in mapping. Also included are a few small areas of Cryorthents and Rock outcrop, and areas of similar soils that have bedrock at 10 to 20 inches.

Typically the surface layer of the Lymanson loam is dark grayish brown loam about 2 inches thick. The subsoil is grayish brown clay loam about 22 inches thick. The substratum is light grayish brown clay loam about 2 inches thick. Limestone is at a depth of about 26 inches.

Permeability is moderate. The effective rooting depth is 20 to 40 inches. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. Where range condition is poor, brush control is needed. The site is too steep to be seeded with a drill.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, cottontail, jackrabbit, and coyote. Livestock grazing management and sagebrush control are necessary to protect big game range.

Steep slopes, low strength, and depth to rock are the soil properties most limiting to community development. Cut and fill slopes should be designed to minimize soil slippage. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

52—Mayoworth clay loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in material weathered from shale. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Cimarron loam, Cebone loam, and Waybe clay loam are included in mapping.

Typically the surface layer of the Mayoworth soil is dark grayish brown clay loam about 10 inches thick. The subsoil is light yellowish brown clay about 14 inches thick. The substratum is light yellowish brown clay about 4 inches thick. Shale bedrock is at a depth of about 28 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is rapid, and erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

The dominant rangeland vegetation is western wheatgrass, letterman needlegrass, muttongrass, and big sagebrush. As range condition deteriorates, woody shrubs and forbs increase.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. Where shrubs are dominant, brush control is needed to improve range condition. In areas where the grass is sparse, seeding is needed. Suitable for seeding are intermediate wheatgrass, western wheatgrass, smooth brome, slender wheatgrass, Arizona fescue, and Indian ricegrass. The seed should be drilled into a firm seedbed.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect big game range.

Depth to rock and the high shrink-swell potential are the soil properties most limiting to community development. Cut and fill slopes should be avoided to prevent hillside slippage.

The capability subclass is VIe.

53—Mayoworth clay loam, 15 to 50 percent slopes. This moderately deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in material weathered from shale. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Cimarron loam, Cebone loam, and Waybe clay loam are included in mapping.

Typically the surface layer of the Mayoworth soil is dark grayish brown clay loam about 10 inches thick. The subsoil is light yellowish brown clay about 14 inches thick. The substratum is light yellowish brown clay about

4 inches thick. Shale bedrock is at a depth of about 28 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, letterman needlegrass, muttongrass, and big sagebrush dominate the rangeland vegetation. Shrubs become dominant over an extremely sparse stand of grass as range condition declines.

Grazing management is essential for the maintenance of this site. Brush control is needed to improve range condition if there are still remnants of native grass. The site is too steep to be seeded with a drill.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect big game range and sage grouse habitat.

Depth to rock, the shrink-swell potential, and the slope are the soil properties most limiting to community development. Cut and fill slopes should be avoided to prevent hillside slippage. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

54—Meredith extremely stony sandy loam, 50 to 70 percent slopes. This deep, well drained, very steep soil is on alpine slopes at elevations of 11,400 to 13,500 feet. It formed in residuum from granite, gneiss, schist, and other metamorphic material. The average annual precipitation is about 35 inches, the average annual air temperature is about 28 degrees F, and the average frost-free season is about 0 to 10 days.

Included in this unit are small areas of Bross-Mirror extremely stony sandy loams and Pergelic Cryorthents-Rock outcrop complex.

Typically the surface layer of the Meredith soil is grayish brown, very strongly acid, extremely stony sandy loam about 9 inches thick. The subsoil is very pale brown and reddish yellow very strongly acid, very gravelly loam about 9 inches thick. The substratum is very pale brown, very strongly acid, very gravelly coarse sandy loam about 8 inches thick. Fragmental accumulations of fractured bedrock are at a depth of 26 inches.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. In areas where the natural cover has been disturbed, surface runoff is rapid and the erosion hazard is high.

This soil provides wildlife habitat, is a source of water, and has esthetic value. In a few areas, it is used as rangeland.

Rangeland vegetation is dominantly kobresia, bluegrass, and wheatgrass. As range condition deteriorates, ground cover, plant vigor, and production decline.

Grazing management is essential on this site because it is extremely fragile. Because the site is too steep to be seeded, deferred grazing is the only means of improving the range.

This soil provides summer range for elk, mule deer, bighorn sheep, and Rocky Mountain goat. Other wildlife include marmot, pika, and ptarmigan.

The soils in this unit are severely limited for all uses because they are extremely fragile and have large stones on the surface. This unit is extremely difficult to reclaim and stabilize if the vegetation is disturbed.

The capability subclass is VIIs.

55—Mord loam, 3 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on mountainsides at elevations of 8,500 to 9,500 feet. The average annual precipitation is about 18 to 22 inches, the average annual air temperature is about 35 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Cowdrey loam, Mulstay stony loam, Cimarron loam, and Sudduth loam are included in mapping.

Typically the Mord soil has a surface layer of dark gray loam about 13 inches thick. The subsurface layer is very pale brown very fine sandy loam about 5 inches thick. The subsoil is yellowish brown gravelly heavy clay loam about 37 inches thick. The substratum is light yellowish brown gravelly clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage has an overstory of quaking aspen. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Thurber fescue and wheatgrass dominate the rangeland vegetation. As range condition deteriorates, woody shrubs become dominant.

Grazing management maintains the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed will greatly improve plant vigor. The site can be seeded if it is in poor condition. Smooth brome, big bluegrass, Kentucky bluegrass, Arizona fescue, slender wheatgrass, and western wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides habitat for woodland wildlife such as blue grouse, snowshoe hare, and black bear (fig. 14). It also provides summer range for elk and mule deer. Managing livestock grazing and timber improves the habitat in big game summer range.

In areas where the woodland is dominantly quaking aspen, this soil produces about 40 to 50 cubic feet of wood per acre per year. Care in harvesting is needed when the soil is wet.

The high shrink-swell potential is the soil property most limiting to community development. Slow permeability is also a limitation if this soil is used for septic tank absorption fields. Road design should provide for adequate control of surface runoff.

The capability subclass is VIe.

56—Mord loam, 15 to 30 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 8,500 to 9,500 feet. It formed in glacial drift from mixed rock sources. The average annual precipitation is about 18 to 22 inches, the average annual air temperature is about 35 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Cowdrey loam, Mulstay stony loam, Cimarron loam, and Sudduth loam are included in mapping.

Typically the Mord soil has a surface layer of dark gray loam about 13 inches thick. The subsurface layer is very pale brown, very fine sandy loam about 5 inches thick. The subsoil is yellowish brown, gravelly heavy clay loam about 37 inches thick. The substratum is light yellowish brown gravelly clay that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage has an overstory of quaking aspen. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is domimantly Thurber fescue and wheatgrass. As range condition deteriorates, woody shrubs become dominant.

Grazing management can maintain the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed will greatly improve plant vigor. This site is too steep to be seeded with a drill.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, and black bear. It also provides summer range for elk and mule deer. Managing livestock grazing and timber improves habitat in the big game summer range.

In areas where the woodland is dominantly quaking aspen, this soil produces about 35 to 45 cubic feet of wood per acre per year. Steep slopes make harvesting difficult. Special attention is needed to keep soil erosion to a minimum during harvesting.

The high shrink-swell potential and steep slopes are the soil properties most limiting to community development. Slippage may occur if the soil becomes saturated or stressed. Cut and fill slopes should be avoided to prevent hillside slippage.

The capability subclass is VIIe.

57—Mulstay stony loam, 10 to 50 percent slopes. This deep, well drained, strongly sloping to steep soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in basalt overflow and material weathered from shale. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 35 to 40 degrees F, and the frost-free season is about 30 to 60 days.

Small areas of Harsha loam, Clayburn loam, and Mord loam are included in mapping. Also included are a few small areas of Cryorthents and Rock outcrop.

Typically the surface layer of this Mulstay soil is grayish brown stony loam about 4 inches thick. The upper 17 inches of the subsoil is pale brown heavy clay loam. The lower 39 inches is a buried subsoil of light yellowish brown clay loam. The substratum is light yellowish brown clay loam that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, letterman needlegrass, muttongrass, and big sagebrush dominate the rangeland vegetation. Woody shrubs become dominant as range condition declines.

Grazing management is essential for the maintenance of this site. Brush control is needed to improve range condition if there are still remnants of native grass. This site is generally too stony to be seeded with a drill.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Livestock grazing management and sagebrush control are necessary to protect the big game range.

Steep slopes and the high shrink-swell potential are the features most limiting to community development. Cut and fill slopes should be avoided to prevent hillside slippage. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

58—Newcomb gravelly sandy loam, 0 to 20 percent slopes. This deep, somewhat excessively drained, nearly level to moderately steep soil is on terraces and mountainsides at elevations of 8,500 to 10,000 feet. It formed in glacial till. The average annual precipitation is 18 to 25 inches, the average annual air temperature is 32 to 37 degrees F, and the frost-free season is 20 to 50 days.

Small areas of Cowdrey loam and Frisco gravelly sandy loam are included in mapping.

Typically the Newcomb soil has a duff layer about 2 inches thick consisting of undecomposed needles and twigs. The subsurface layer is very pale brown gravelly sandy loam about 12 inches thick. The subsoil is light yellowish brown very gravelly loamy sand about 34 inches thick. The substratum is light brownish gray very gravelly sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow, and the erosion hazard is slight.

The entire acreage is woodland. The wooded areas are also used for recreation and wildlife.

The potential native vegetation is dominantly lodgepole pine, subalpine fir, and a sparse understory of grasses, forbs, and shrubs.

The Newcomb soil is suited to lodgepole pine. It produces about 35 to 45 cubic feet of wood per acre per year. Thinning the stand provides poles and firewood. The low water holding capacity limits seedling survival. Care is needed to prevent erosion of skid trails and access roads.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, mule deer, elk, and black bear. Timber management may improve the habitat for big game.

Seepage and slope are the soil properties most limiting to community development.

The capability subclass is VIe.

59—Newcomb gravelly sandy loam, 20 to 50 percent slopes. This deep, somewhat excessively drained, moderately steep to steep soil is on mountainsides at elevations of 8,500 to 10,500 feet. It formed in glacial till and landslide deposits. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 32 to 37 degrees F, and the frost-free season is 20 to 50 days.

Small areas of Leighcan gravelly sandy loam, Scout cobbly sandy loam, and Upson stony sandy loam are included in mapping. Also included are a few small areas of Cryaquepts and Rock outcrop.

Typically the Newcomb soil has a duff layer about 2 inches thick consisting of needles and twigs. The subsurface layer is a very pale brown gravelly sandy loam about 12 inches thick. The subsoil is light yellowish brown very gravelly loamy sand about 34 inches thick. The substratum is light brownish gray very gravelly sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

All the acreage is woodland. Wooded areas are also used for recreation and wildlife.

The potential native vegetation is dominantly lodgepole pine, subalpine fir, and a sparse understory of grasses, forbs, and shrubs.

This Newcomb soil is suited to lodgepole pine. It produces about 35 to 45 cubic feet of wood per acre per year. Thinning the stand provides poles and firewood. The low water holding capacity limits seedling survival. Care is needed to prevent the erosion of skid trails and access roads. Slopes limit the types of equipment used in harvesting.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, elk, mule deer, and black bear. Timber management may improve the habitat for deer and elk.

Seepage and slope are the soil properties most limiting to community development.

The capability subclass is VIIe.

60—Newcomb-Rock outcrop complex, 20 to 50 percent slopes. This moderately steep to steep unit is on mountainsides at elevations of 8,500 to 10,500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 32 to 37 degrees F, and the frost-free season is 20 to 50 days.

This unit is 70 percent Newcomb soils, 15 percent Rock outcrop, and 15 percent small areas of Frisco gravelly sandy loam, Upson stony sandy loam, and Scout cobbly sandy loam.

The Newcomb soil is deep and somewhat excessively drained. It formed in material weathered from granite, gneiss, and schist. Typically it has a duff layer about 2 inches thick consisting of needles and twigs. The subsurface layer is a very pale brown gravelly sandy loam about 12 inches thick. The subsoil is a light yellowish brown very gravelly loamy sand about 34 inches thick. The substratum is light brownish gray very gravelly sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

The Rock outcrop is granite, gneiss, and schist.

This unit is woodland. It is also used for recreation and as wildlife habitat.

The potential native vegetation is lodgepole pine, subalpine fir, and a sparse understory of grasses, forbs, and shrubs.

The Newcomb soil is suited to lodgepole pine. It produces about 25 to 35 cubic feet of wood per acre per year. Thinning the stand provides poles and firewood. The low water holding capacity limits seedling survival.

The Rock outcrop limits timber harvest. The slope restricts the type of equipment used in harvesting. Care is needed to prevent the erosion of roads and trails.

This soil provides habitat for woodland wildlife, such as blue grouse, snowshoe hare, mule deer, elk, and black bear. Timber management may improve the habitat for deer and elk.

The Rock outcrop, steep slopes, and seepage are the features limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIs.

61—Newcomb-Rock outcrop complex, 50 to 70 percent slopes. This very steep unit is on mountainsides at elevations of 8,500 to 10,500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 32 to 37 degrees F, and the frost-free season is 20 to 50 days.

This unit is 60 percent Newcomb soils, 25 percent Rock outcrop, and 15 percent small areas of Frisco gravelly sandy loam, Upson stony sandy loam, and Scout cobbly sandy loam.

The Newcomb soil is deep and somewhat excessively drained. It formed in material weathered from granite, gneiss, and schist. Typically it has a duff layer about 2 inches thick consisting of needles and twigs. The subsurface layer is a very pale brown gravelly sandy loam about 12 inches thick. The subsoil is light yellowish brown very gravelly loamy sand about 34 inches thick. The substratum is light brownish gray very gravelly sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is rapid, and the erosion hazard is high.

The Rock outcrop is granite, gneiss, and schist.

This unit is woodland. It is also used for recreation and as wildlife habitat.

The potential native vegetation is lodgepole pine, subalpine fir, and a sparse understory of grasses, forbs, and shrubs.

This Newcomb soil is suited to lodgepole pine. It produces about 25 to 35 cubic feet of wood per acre per year. Thinning the stand provides poles and firewood. The outcrop of rock makes harvesting difficult. The slope limits the type of equipment used in harvesting.

This soil provides habitat for woodland wildlife, such as mule deer, elk, blue grouse, snowshoe hare, and black bear.

The rock outcrop and steep slopes are the properties most limiting to community development.

The capability subclass is VIIs.

62—Peeler sandy loam, 3 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on fans and mountainsides at elevations of 8,500 to 9,500 feet. It formed in glacial drift and material weathered from sandstone and metamorphic rock. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free period is about 30 to 50 days.

Small areas of Frisco gravelly sandy loam, Anvik loam, Uinta sandy loam, and Upson stony sandy loam are included in mapping. Also included are a few small areas of Cumulic Cryaquolls and Histic Cryaquolls.

Typically the Peeler soil has a duff layer of decomposing needles and twigs about 2 inches thick. The subsurface layer is light gray sandy loam about 5 inches thick. The subsoil is brown and strong brown gravelly sandy clay loam about 52 inches thick. The substratum is yellowish brown gravelly sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. A small acreage is used for timber. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, Engelmann spruce, and quaking aspen, and a sparse understory of grasses, shrubs, and forbs.

This Peeler soil is suited to lodgepole pine. It produces about 40 to 50 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. Care is needed to prevent erosion of skid trails.

Wildlife includes mule deer, elk, blue grouse, and black bear. Managing livestock grazing and timber improves the habitat on the big game summer range.

The frost action is the soil property most limiting to community development.

The capability subclass is VIe.

63—Peeler sandy loam, 15 to 50 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 8,500 to 9,500 feet. It formed in glacial drift and material weathered from sandstone and metamorphic rock. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Frisco gravelly sandy loam, Anvik loam, Uinta sandy loam, and Upson stony sandy loam are included in mapping.

Typically the Peeler soil has a duff layer of decomposing needles and twigs about 2 inches thick. The subsurface layer is light gray sandy loam about 5 inches thick. The subsoil is brown and strong brown gravelly sandy clay loam about 52 inches thick. The substratum is yellowish brown gravelly sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is woodland. The woodland is also used for recreation and wildlife. A small acreage is used for timber production. The cold climate and short

growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, Engelmann spruce, quaking aspen, and a sparse understory of grasses, shrubs, and forbs.

This Peeler soil is suited to lodgepole pine. It produces about 40 to 50 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. Care is needed to prevent erosion of skid trails.

Wildlife include mule deer, elk, blue grouse, and black bear. Managing livestock grazing and timber improves on the big game summer range.

Steep slope is the soil property most limiting to community development. Road design should provide drainage outlets for surface runoff. Cut and fill slopes should be designed to minimize soil slippage.

The capability subclass is VIIe.

64—Pergelic Cryorthents-Rock outcrop complex, extremely steep. This steep to extremely steep unit is on mountain ridges and side slopes at elevations of 11,400 to 13,550 feet. The average annual precipitation, mainly snow, is 30 to 35 inches. The average annual air temperature is 26 to 29 degrees F, and the frost-free season is less than 10 days.

This unit is 60 percent Pergelic Cryorthents, 30 percent Rock outcrop, and 10 percent small areas of Bross-Mirror extremely stony sandy loam and Meredith extremely stony sandy loam.

Pergelic Cryorthents are shallow to deep, well drained soils that formed in material weathered from granite, gneiss, schist, or other metamorphic material. The profile is gravelly sandy loam or cobbly sandy loam. These soils sometimes are frozen most of the year but thaw in summer.

Permeability is rapid. The available water capacity is very low. Surface runoff is medium, and the erosion hazard is severe.

The Rock outcrop is granite, schist, gneiss, or other metamorphic rock.

This unit is alpine grass and provides wildlife habitat.

The potential native vegetation is dominantly alpine bluegrass, alpine muhly, avens, and cinquefoil. If this unit is disturbed or excessively used, erosion may occur.

Wildlife include pika, ptarmigan, and marmot. The unit also provides summer range for elk, mule deer, bighorn sheep, and Rocky Mountain goat.

This unit is severely limited for all uses because it is extremely fragile. If the vegetation is disturbed, it is extremely difficult to reclaim and stabilize.

The capability subclass is VIIIe.

65—Quander cobbly loam, 2 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on mountainsides, ridges, and fans at elevations of 8,000 to 9,000 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Small areas of Youga loam, Woodhall loam, Anvik loam, and Clayburn loam are included in mapping.

Typically the Quander soil has a surface layer of very dark grayish brown cobbly loam about 10 inches thick. The upper 40 inches of the subsoil is pale brown and light yellowish brown very stony sandy clay loam. The lower 7 inches is light yellowish brown extremely stony loam. The substratum is light yellowish brown extremely stony loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly bluebunch wheatgrass, Idaho fescue, big sagebrush, and bitterbrush. As range condition deteriorates, big sagebrush becomes dominant.

Deferred grazing and grazing management are needed to maintain or improve range condition. The soil is too cobbly to be seeded with a drill. Brush control can improve range condition if big sagebrush has become dominant.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, cottontail, jackrabbit, and coyote. Livestock grazing management and sagebrush control are necessary to protect big game range.

Large stones is the soil property most limiting to community development. Cut and fill slopes should be designed to minimize soil slippage.

The capability subclass is VIs.

66—Quander stony loam, 15 to 55 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Small areas of Youga loam, Woodhall loam, Anvik loam, and Clayburn loam are included in mapping.

Typically the Quander soil has a surface layer of very dark grayish brown stony loam about 10 inches thick. The upper 40 inches of the subsoil is pale brown and light yellowish brown very stony sandy clay loam about 40 inches thick. The lower 7 inches is light yellowish brown extremely stony loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland (fig. 15). Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

The rangeland vegetation is dominantly bluebunch wheatgrass, Idaho fescue, big sagebrush, and bitterbrush. As range condition deteriorates, big sagebrush becomes dominant.

Deferred grazing and grazing management are needed to maintain or improve range condition. The soil is too stony and the slopes are too steep to be seeded with a drill (fig. 16). Brush control can improve range condition if big sagebrush becomes dominant.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, cottontail, jackrabbit, and coyote. Livestock grazing management and sagebrush control are necessary to protect big game range.

Steep slopes and large stones are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff. Cut and fill slopes should be designed to minimize soil slippage.

The capability subclass is VIIs.

67—Rock outcrop-Cryoboralfs complex, very steep. This steep to very steep unit is on mountainsides, ridges, and escarpments at elevations of 8,500 to 11,400 feet. It occurs throughout the survey area. The average annual precipitation ranges from 15 to 30 inches, the average annual air temperature is 32 to 38 degrees F, and the frost-free season is 20 to 65 days.

This unit is 50 to 65 percent Rock outcrop and 25 to 30 percent Cryoboralfs. Included in mapping are small areas of Cryorthents and Cryoborolls.

The Rock outcrop is hard bedrock of various parent material, including granite, sandstone, shale, mudstone, and basalt.

Cryoboralfs are shallow to moderately deep over rock. They are well drained and are commonly loamy and stony. Some soils have a thin layer of organic material over a light colored surface layer. The subsoil is well developed sandy clay loam to clay. The depth to bedrock ranges from 10 to 40 inches. Reaction is slightly acid to acid.

Surface runoff is moderate to high. The erosion hazard is high.

This unit is used as wildlife habitat.

The potential native vegetation is lodgepole pine, Engelmann spruce, subalpine fir, and a sparse understory of grasses, shrubs, and forbs.

This unit has severe limitations for all development. The capability subclass is VIIIs.

68—Rock outcrop-Cryoborolls complex, extremely steep. This steep to extremely steep unit is on mountainsides, ridges, and escarpments at elevations of 8,000 to 10,500 feet. It occurs throughout the survey area. The average annual precipitation is 14 to 28 inches, the average annual air temperature ranges from 32 to 38 degrees F, and the frost-free season is 20 to 65 days.

This unit is 60 to 70 percent Rock outcrop and 20 to 30 percent Cryoborolls. Included in mapping are small areas of Cryoboralfs.

The Rock outcrop is hard bedrock of various parent material, including granite, sandstone, mudstone, and basalt.

Cryoborolls are shallow to moderately deep over rock. They are well drained and are usually loamy and stony. The surface layer is dark colored. In some pedons the subsoil is clay loam. The depth to bedrock ranges from 10 to 40 inches. Reaction is slightly acid to neutral.

Surface runoff is rapid. The erosion hazard is high.

This unit is used as wildlife habitat.

Potential native vegetation includes big sagebrush, bluebunch and slender wheatgrass, and rabbitbrush.

This unit has severe limitations for all development. The capability subclass is VIIIs.

69—Rock outcrop-Haploborolls complex, extremely steep. This steep to extremely steep unit is on mountainsides, ridges, and escarpments at elevations of 6,400 to 7,800 feet. It occurs in the southwestern part of the survey area, near Radium. The average annual precipitation ranges from 11 to 14 inches, the average annual air temperature is 37 to 45 degrees F, and the frost-free season is 80 to 110 days.

This unit is 70 to 80 percent Rock outcrop and 15 to 25 percent Haploborolls. Included in mapping are small areas of Torriorthents.

The Rock outcrop is hard bedrock of various parent material, including granite, sandstone, and basalt.

Haploborolls are shallow to moderately deep over rock. They are well drained and are commmonly loamy and stony. In places the surface layer is dark colored. The subsoil in some pedons is weakly developed clay loam. The depth to bedrock ranges from 10 to 40 inches. Reaction is mildly alkaline to slightly acid.

Surface runoff is rapid. The erosion hazard is high.

This unit is used as wildlife habitat.

The potential native vegetation is pinyon pine, Rocky Mountain juniper, and big sagebrush, and a sparse understory of grasses and forbs.

This unit has severe limitations for all development. The capability subclass is VIIIs.

70—Rogert gravelly sandy loam, 15 to 60 percent slopes. This shallow, well drained, moderately steep to very steep soil is on mountain ridges and side slopes at elevations of 7,500 to 9,000 feet. It formed in residuum from granite or gneiss. The average annual precipitation

is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 60 days.

Small areas of Tamp gravelly sandy loam, Quander stony loam, Harsha loam, and Leavitt loam are included in mapping. Also included are a few small areas of Rock outcrop and Cryoborolls.

Typically the upper 5 inches of the surface layer of the Rogert soil is dark grayish brown, gravelly sandy loam. The lower 3 inches is dark grayish brown, very gravelly sandy loam. The underlying material is grayish brown, very gravelly sandy loam. Hard, partially weathered gneiss is at a depth of 14 inches.

Permeability is moderately rapid. The available water capacity is very low. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, needlegrass, bluegrass, and big sagebrush dominate the rangeland vegetation. Shrubs become dominant as range condition deteriorates.

Grazing management and deferred grazing will maintain range condition. If shrubs have become dominant, brush control is needed. This site cannot be seeded because it is steep and droughty.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Livestock grazing management and sagebrush control are necessary to protect the big game winter range.

Depth to rock and steep slopes are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

71—Roxal loam, 6 to 15 percent slopes. This shallow well drained, moderately sloping to strongly sloping soil is on mountain ridges and side slopes at elevations of 7,500 to 8,500 feet. It formed in material weathered from sandy shale. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 45 to 75 days.

Small areas of Harsha loam, Leavitt loam, and Waybe clay loam are included in mapping. Also included are a few small areas of soils that have bedrock at a depth of 20 to 40 inches and small areas of Cryorthents and Rock outcrop.

Typically the upper 6 inches of the surface layer of the Roxal soil is brown loam. The lower 4 inches is light yellowish brown loam. The underlying material is pale brown loam. Soft, paftially weathered calcareous sandy shale is at a depth of 15 inches.

Permeability is moderate. The available water capacity is very low. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. Where the range is in poor condition, brush control is needed if there is enough grass to respond. In areas where the grass is sparse, seeding is needed. Suitable for seeding are Indian ricegrass, western wheatgrass, streambank wheatgrass, thickspike wheatgrass, pubescent wheatgrass, crested wheatgrass, and Russian wildrye. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect big game winter range.

Slope and depth to rock are the soil properties most limiting to community development.

The capability subclass is VIe.

72—Roxal loam, 15 to 50 percent slopes. This shallow, well drained, moderately steep to steep soil is on mountain ridges and side slopes at elevations of 7,500 to 8,500 feet. It formed in material weathered from sandy shale. The average annual precipitation is about 11 to 14 inches, the average air temperature is about 37 to 42 degrees F, and the frost-free season is about 45 to 75 days.

Small areas of Harsha loam, Leavitt loam, and Waybe clay loam are included in mapping. Also included are a few small areas of Cryorthents, Rock outcrop, and similar soils that have bedrock at a depth of 20 to 40 inches.

Typically the Roxal soil has a surface layer of brown loam about 6 inches thick. The lower 4 inches is light yellowish brown loam. The underlying material is pale brown loam. Soft, partially weathered calcarecous sandy shale is at a depth of about 15 inches.

Permeability is moderate. The available water capacity is very low. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. Where big sagebrush has become dominant, brush control is needed if there is enough grass to re-

spond. The slopes are too steep to be seeded with a drill.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

The steep slopes and depth to rock are the soil properties most limiting to community development. Cut and fill slopes should be carefully designed to minimize potential soil slippage. Adequate drainage should be provided for surface runoff.

The capability subclass is VIIe.

73—Rubble land. Rubble land is on steep to extremely steep mountain ridges and talus slopes at elevations of 10,000 to 13,550 feet. It is commonly at the heads of glacial cirques and high alpine valleys.

More than 90 percent of the surface of Rubble land is covered with loose rock that ranges from single stones more than 10 inches in diameter to coarse gravel. Some pores between the rocks are filled with soil material, but the land is predominantly barren. Rubble land is moved by snowslides and gravity. Only part of it is stable.

The depth to bedrock ranges from 4 to 50 feet. Where the stony surface cover is thin, weeds and scattered spruce and alpine fir grow through the openings.

Rubble land is a good catchment area for water. It absorbs almost all the rain and snow. There is very little runoff or erosion. Much of the water's erosive force is broken down, and the water emerges downslope as springs and seeps.

The capability subclass is VIIIs.

74—Scout cobbly sandy loam, 2 to 6 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is on mountainsides, ridges, and fans at elevations of 10,000 to 11,400 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Frisco-Peeler gravelly sandy loams and Upson stony sandy loam are included in mapping. Also included are a few small areas of Rock outcrop and Histic Cryaquolls.

Typically the Scout soil has a duff layer about 2 inches thick consisting of needles and twigs. The surface layer is grayish brown, cobbly sandy loam about 2 inches thick. The subsurface layer is pink very cobbly sandy loam about 13 inches thick. The subsoil is light yellowish brown very cobbly sandy loam about 27 inches thick. The substratum is yellowish brown extremely cobbly sandy loam that extends to 60 inches or more.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is woodland. Part of it is used for recreation, wildlife, and timber. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine and a sparse understory of grasses, forbs, and shrubs.

Wildlife include mule deer, elk, blue grouse, and black bear. Clear cut openings in the timber increase the production of grasses, forbs, and shrubs for deer and elk in summer.

The soil is suited to lodgepole pine. It produces about 30 to 40 cubic feet of wood per acre per year. There are no restrictions on timber harvesting. Care is needed to prevent erosion on skid trails and roads. The low water holding capacity limits seedling survival.

The content of large and small stones and the rapid permeability are the soil properties most limiting to community development.

The capability subclass is VIe.

75—Scout cobbly sandy loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides, ridges, and fans at elevations of 10,000 to 11,400 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Frisco-Peeler gravelly sandy loams and Upson stony sandy loam are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the Scout soil has a duff layer about 2 inches thick consisting of needles and twigs. The surface layer is grayish brown cobbly sandy loam about 2 inches thick. The subsurface layer is pink very cobbly sandy loam about 13 inches thick. The subsoil is light yellowish brown very cobbly sandy loam about 27 inches thick. The substratum is yellowish brown extremely cobbly sandy loam that extends to 60 inches or more.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is woodland. Part of it is used for recreation, wildlife, and timber. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine and a sparse understory of grasses, forbs, and shrubs.

Wildlife include mule deer, elk, blue grouse, and black bear. Clear cut openings in the timber increase produc-

tion of grasses, forbs, and shrubs for deer and elk in summer.

This soil is suited to lodgepole pine. It produces about 30 to 40 cubic feet of wood per acre per year. Steep slopes limit the type of equipment used in timber harvesting. Care is needed to prevent erosion on skid trails and roads. The low water holding capacity limits seedling survival.

The content of large and small stones and the rapid permeability are the soil properties most limiting to community development. Road design should include drainage outlets for surface runoff.

The capability subclass is VIe.

76—Scout cobbly sandy loam, 15 to 65 percent slopes. This deep, well drained, moderately steep to very steep soil is on mountainsides at elevations of 10,000 to 11,400 feet. It formed in glacial drift and colluvium from mixed rock sources. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Frisco-Peeler gravelly sandy loams and Upson stony sandy loam are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the Scout soil has a duff layer about 2 inches thick consisting of needles and twigs. The surface layer is grayish brown cobbly sandy loam about 2 inches thick. The subsurface layer is pink very cobbly sandy loam about 13 inches thick. The subsoil is light yellowish brown very cobbly sandy loam about 27 inches thick. The substratum is yellowish brown extremely cobbly sandy loam that extends to 60 inches or more.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation, wildlife, and timber. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine and a sparse understory of grasses, forbs, and shrubs.

Wildlife include mule deer, elk, blue grouse, and black bear. Clear cut openings in the timber increase production of grasses, forbs, and shrubs for deer and elk in summer.

This soil is suited to lodgepole pine. It produces about 40 to 50 cubic feet of wood per acre per year. Steep slopes limit the types of equipment used in timber harvesting. Care is needed to prevent erosion on skid trails and roads. The low water holding capacity limits seedling survival.

The content of large and small stones, the rapid permeability, and the slope are the soil properties most limiting to community development. Road design should include drainage outlets for surface runoff.

The capability subclass is VIIe.

77—Sudduth loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil is on mountainsides, swales, and depressions at elevations of 8,000 to 9,500 feet. It formed in local alluvial sediments from shale and basalt. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Clayburn loam, Cimarron loam, Mord loam, and Cowdrey loam are included in mapping. Also included are a few small areas of Cumulic Cryaquolls.

Typically the surface layer of this Sudduth soil is dark grayish brown loam about 13 inches thick. The upper 15 inches of the subsoil is brown light clay loam. The lower 22 inches is light yellowish brown clay. The substratum to a depth of 60 inches or more is light olive brown channery clay loam.

Permeability is slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Thurber fescue and wheatgrasses dominate the rangeland vegetation. As range condition deteriorates, woody shrubs become dominant.

Good grazing management can maintain the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed will greatly improve plant vigor. The site can be seeded if it is in poor condition. Smooth brome, big bluegrass, Kentucky bluegrass, Arizona fescue, slender wheatgrass, and western wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil is used for spring and fall transition range by mule deer and elk. Other wildlife include sage grouse, cottontail, jackrabbit, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game range.

The shrink-swell potential is the soil property most limiting to community development. Cut and fill slopes should be kept to a minimum to prevent soil slippage.

The capability subclass is VIe.

78—Sudduth loam, 15 to 30 percent slopes. This deep, well drained, moderately steep soil is on mountainsides at elevations of 8,000 to 9,500 feet. It formed in local alluvial sediments from shale and basalt. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 de-

grees F, and the frost-free season is about 30 to 50 days.

Small areas of Clayburn loam, Cimarron loam, Mord loam, and Cowdrey loam are included in mapping.

Typically the surface layer of this Sudduth soil is dark grayish brown loam about 13 inches thick. The upper 15 inches of the subsoil is brown clay loam. The lower 22 inches is light yellowish brown clay. The substratum is light olive brown channery clay loam that extends to 60 inches or more.

Permeability is slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly Thurber fescue and wheatgrass. As the range condition deteriorates, woody shrubs become dominant.

Grazing management maintains the condition of this site. Periodic deferred grazing until the dominant grasses have produced seed greatly improves plant vigor. This site is too steep to be seeded with a drill.

This soil provides spring and fall transition range, for mule deer and elk. Other wildlife include sage grouse, cottontail, jackrabbit, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect big game range.

High shrink-swell potential of the soil and steep slopes are the features most limiting to community development. Cut and fill slopes should be kept to a minimum to prevent soil slippage. Adequate surface drainage should be provided in designing roads. Soil slippage may occur if the soil becomes saturated.

The capability subclass is VIe.

79—Tamp gravelly sandy loam, 3 to 15 percent slopes. The deep, well drained, gently sloping to strongly sloping soil is on mountainsides at elevations of 7,500 to 8,500 feet. It formed in material weathered from metamorphic rock granite. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 50 days.

Included in mapping are small areas of Harsha loam, Quander cobbly loam, Youga loam, Tine gravelly sandy loam, Cryorthents, and Rock outcrop.

Typically the surface layer of this Tamp soil is dark grayish brown gravelly sandy loam about 10 inches thick. The subsoil is brown gravelly sandy clay loam about 12 inches thick. The substratum is brown gravelly sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is used as rangeland. Part of it is used for wildlife habitat and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly bluebunch wheatgrass, Idaho fescue, big sagebrush, and bitterbrush. As range condition deteriorates, big sagebrush becomes dominant.

Deferred grazing and grazing management are needed to maintain or improve range condition. Brush control is needed if big sagebrush becomes dominant. If the site is in poor condition, seeding may be needed. Suitable for seeding are Indian ricegrass, western wheatgrass, pubescent wheatgrass, intermediate wheatgrass, and big bluegrass. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. It also provides habitat for sage grouse, jackrabbit, cottontail, and coyote.

The shrink-swell potential and moderate frost action are the soil features most limiting to community development.

The capability subclass is VIe.

80—Tamp gravelly sandy loam, 15 to 60 percent slopes. This deep, well drained, moderately steep to very steep soil is on mountainsides and ridges at elevations of 7,500 to 8,500 feet. It formed in material weathered from metamorphic rock and granite. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Harsha loam, Quander stony loam, Youga loam, Rogert loam, and Leavitt loam are included in mapping. Also included are a few small areas of Cryorthents and Rock outcrop.

Typically the surface layer of this Tamp soil is dark grayish brown gravelly sandy loam about 10 inches thick. The subsoil is brown gravelly sandy clay loam about 12 inches thick. The substratum is brown gravelly sandy clay loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly bluebunch wheatgrass, Idaho fescue, muttongrass, big sagebrush, and bitterbrush. As range conditions deteriorate, low quality shrubs become dominant.

Grazing management and deferred grazing improve depleted rangeland. This site cannot be seeded because of steep slopes.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are needed to protect the big game winter range.

Steep slope, shrink-swell potential, and low strength are the soil properties most limiting to community development. Road design should include drainage outlets for surface runoff. Cut and fill slopes should be kept to a minimum to avoid hillside slippage.

The capability unit is VIIe.

81—Tine gravelly sandy loam, 0 to 3 percent slopes. This deep, well drained, nearly level to gently sloping soil is on fans and terraces at elevations of 7,500 to 8,500 feet. It formed in alluvial outwash. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Harsha and Leavitt loam are included in mapping. Also included are a few small areas of Cryorthents, Rock outcrop, and soils that are calcareous above 40 inches but are otherwise similar to the Tine soil.

Typically the Tine soil has a surface layer of brown gravelly sandy loam about 14 inches thick. The upper 9 inches of the underlying material is pale brown very cobbly loamy sand. The lower part is extremely cobbly sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. Where range condition is poor, brush control is needed if there is enough grass to respond. In areas where the grass is sparse, seeding is needed. Suitable for seeding are Indian ricegrass, western wheatgrass, streambank wheatgrass, thickspike wheatgrass, pubescent wheatgrass, crested wheatgrass, and Russian wildrye. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

Large stones and seepage are the soil properties most limiting to community development.

The capability subclass is VIs.

82—Tine cobbly sandy loam, 3 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on fans and terraces at elevations of 7,500 to 8,500 feet. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Harsha loam and Leavitt loam are included in mapping. Also included are a few small areas of Cryorthents, Rock outcrop, and soils that are calcareous above 40 inches but are otherwise similar to the Tine soils.

Typically the surface layer of the Tine soil is brown cobbly sandy loam about 14 inches thick. The upper 9 inches of the underlying material is pale brown very cobbly loamy sand. The lower part is extremely cobbly sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. Where range condition is poor, brush control is needed if there is enough grass to respond. In areas where the grass is sparse, seeding is needed. Suitable for seeding are Indian ricegrass, western wheatgrass, streambank wheatgrass, thickspike wheatgrass, pubescent wheatgrass, crested wheatgrass, and Russian wildrye. The seed should be drilled into a firm seedbed.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect big game winter range.

Large stones and seepage are the soil properties most limiting to community development. If saturated, banks cut in excavation are likely to cave in.

The capability subclass is VIe.

83—Tine cobbly sandy loam, 15 to 55 percent slopes. This deep, well drained, moderately steep to steep soil is on terrace breaks at elevations of 7,500 to 8,500 feet. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is

about 37 to 42 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Harsha loam and Leavitt loam are included in mapping. Also included are a few small areas of Cryorthents, Rock outcrop, and soils that are calcareous above 40 inches but are otherwise similar to the Tine soils.

Typically the surface layer of this Tine soil is brown cobbly sandy loam about 14 inches thick. The upper 9 inches of the underlying material is pale brown very cobbly loamy sand. The lower part is extremely cobbly sand that extends to 60 inches or more.

Permeability is rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Muttongrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Big sagebrush becomes dominant as range condition deteriorates.

Grazing management is needed to maintain range condition. Brush control can improve range condition where big sagebrush has become dominant if there is enough grass to respond. The site cannot be seeded with a drill because of stones and steep slopes.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

Steep slopes, large stones, and seepage are the soil properties most limiting to community development. If saturated, banks cut in excavations are likely to cave in. Cut slopes should be designed to minimize potential soil slippage.

The capability subclass is VIIs.

84—Tolman stony loam, 15 to 50 percent slopes. This shallow, well drained, moderately steep to steep soil is on mountainsides at elevations of 6,600 to 7,800 feet. In a few areas, the slope is steeper than 50 percent. The soil formed in residuum from granite and sandstone. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 35 to 42 degrees F, the average summer air temperature is about 61 degrees F, and the frost-free season is about 80 to 110 days.

Small areas of Boettcher and Dahlquist soils are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the Tolman soil has a brown stony loam surface layer about 7 inches thick. The subsoil is brown very gravelly sandy clay loam about 10 inches thick. Hard granite is at a depth of 17 inches.

Permeability is moderate. The available water capacity is very low. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is range. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

Bluebunch wheatgrass, western wheatgrass, squirreltail, and big sagebrush dominate the rangeland vegetation. Shrubby species become dominant as range condition declines. Some pinyon and juniper may invade the site.

Grazing management is needed to maintain the site. Where shrubs have become dominant, brush control may be needed to improve range condition. The site is generally too steep and too stony to be seeded.

This soil provides winter range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

Depth to bedrock and large and small stones are the soil properties most limiting to community development.

The capability subclass is VIIs.

85—Torriorthents-Rock outcrop complex, steep. These steep to very steep soils are on mountainsides at elevations of 6,600 to 7,800 feet. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 35 to 42 degrees F, the average annual summer air temperature is 61 degrees F, and the frost-free season is 80 to 110 days. This unit is 60 percent Torriorthents, 25 percent Rock outcrop, and 15 percent a few small areas of Dahlquist, Stunner, and Boettcher soils.

Torriorthents are shallow to deep, well drained soils that formed in material weathered from sandstone and shale. The surface layer is light colored stony or cobbly loam to sandy clay loam. The underlying material is stony, cobbly, or gravelly sandy loam to clay. Shale or sandstone material is at a depth of 10 to 60 inches or more. The content of stones, cobbles, or gravel throughout the profile ranges from 15 to 60 percent.

Surface runoff is rapid, and the erosion hazard is high.

Rock outcrop is exposed shale or sandstone.

This unit is rangeland and wildlife habitat.

The potential native vegetation is dominantly pinyon pine, juniper, wheatgrass, Indian ricegrass, mountainmahogany, and some big sagebrush (fig. 17). Range condition deteriorates as woody shrubs increase.

Wildlife include sage grouse, mule deer, elk, jackrabbit, and coyote. Managing livestock grazing is necessary to protect the big game winter range.

Steep slopes and depth to bedrock are the soil properties most limiting to community development. Road design should include drainage outlets for surface runoff.

The capability subclass is VIIs.

86—Uinta sandy loam, 2 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on fans and mountainsides at elevations of 8,500 to 9,500 feet. It formed in glacial drift and material weathered from metamorphic rock. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free period is about 30 to 50 days.

Small areas of Frisco-Peeler gravelly sandy loams, Anvik loam, and Upson stony sandy loam are included in mapping. Also included are a few small areas of Cumulic Cryaquolls, Histic Cryaquolls, and Rock outcrop.

Typically the Uinta soil has a duff layer of decomposed needles and twigs about 2 inches thick. The subsurface layer is light gray sandy loam about 7 inches thick. The subsoil is reddish brown sandy clay loam about 38 inches thick. The substratum is reddish brown very cobbly sandy loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow, and erosion hazard is moderate.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. Small areas are used for timber production. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, subalpine fir, and a sparse understory of grasses, shrubs, and forbs.

The Uinta soil is suited to lodgepole pine. It produces about 25 to 35 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. Care is needed to prevent erosion on skid trails and access roads.

Wildlife include mule deer, elk, blue grouse, and black bear. Managing livestock grazing and timber improves habitat on the big game summer range.

Small stones is the soil property most limiting to community development.

The capability unit is VIe.

87—Uinta sandy loam, 15 to 50 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides and ridges at elevations of 8,500 to 9,500 feet. It formed in glacial drift and material weathered from metamorphic rock. The average annual precipitation is about 20 to 30 inches, the average air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Frisco-Peeler gravelly sandy loams, Anvik loam, and Upson stony sandy loam are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the Uinta soil has a duff layer of decomposed needles and twigs about 2 inches thick. The subsurface layer is light gray sandy loam about 7 inches thick. The subsoil is reddish brown sandy clay loam about 38 inches thick. The substratum is reddish brown very cobbly sandy loam that extends to 60 inches or more.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. A small acreage is used for timber.

The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential native vegetation is dominantly lodgepole pine, subalpine fir, and a sparse understory of grasses, shrubs, and forbs.

Uinta soil is suited to lodgepole pine. It produces about 35 to 45 cubic feet of wood per acre per year. Thinning the stand provides poles for fences, corrals, and power lines. Care is needed to prevent erosion on skid trails and access roads. Steep slopes limit the types of equipment used in timber harvest.

Wildlife include mule deer, elk, blue grouse, and black bear. Managing livestock grazing and timber improves habitat on the big game summer range.

Steep slopes and small stones are the soil properties most limiting to community development. Cut and fill slopes should be designed to minimize soil slippage. Road design should include drainage outlets for surface runoff.

The capability subclass is VIIe.

88—Upson stony sandy loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on mountainsides and ridges at elevations of 8,500 to 10,000 feet. It formed in highly weathered granite. The average annual precipitation is 20 to 30 inches, and air temperature is 32 to 40 degrees F. The frost-free season is 30 to 50 days.

Small areas of Frisco-Peeler gravelly sandy loams, Grenadier gravelly loam, Scout cobbly sandy loam, and Uinta sandy loam are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the Upson soil has a duff layer about 1 inch thick consisting of needles and twigs. The upper 18 inches of the surface layer is pale brown stony sandy loam. The lower 15 inches is brown sandy loam. The underlying material is grayish brown loamy coarse sand about 3 inches thick. Highly weathered granite is at a depth of 36 inches.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is woodland. Part of it is used for recreation and wildlife. A small acreage is used for timber. The cold climate and short growing season limit the production of introduced grasses and of wood crops.

The potential dominant vegetation is quaking aspen, lodgepole pine, and a sparse understory of grasses, shrubs, and forbs.

The Upson soil is suited to lodgepole pine. It produces about 30 to 40 cubic feet of wood per acre per year. Care is needed to prevent erosion on skid trails and access roads. Large boulders limit the type of equipment used in timber harvest. The low water holding capacity limits seedling survival.

Wildlife include mule deer, elk, blue grouse, and black bear. Managing livestock grazing and timber improves habitat on the big game summer range.

Depth to rock, rapid permeability, and large stones are the soil properties most limiting to community development.

The capability subclass is VIe.

89—Upson stony sandy loam, 15 to 65 percent slopes. This moderately deep, well drained, moderately steep to very steep soil is on mountainsides at elevations of 8,500 to 10,000 feet. It formed in highly weathered granite. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is about 32 to 40 degrees F, and the frost-free season is about 30 to 50 days.

Small areas of Frisco-Peeler gravelly sandy loams, Grenadier gravelly loam, Scout cobbly sandy loam, and Uinta sandy loam are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the Upson soil has a duff layer about 1 inch thick consisting of needles and twigs. The upper 18 inches of the surface layer is pale brown stony sandy loam. The lower 15 inches is brown sandy loam. The underlying material is grayish brown loamy coarse sand about 3 inches thick. Highly weathered granite is at a depth of 36 inches.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is medium, and erosion hazard is high.

The potential dominant vegetation is quaking aspen, lodgepole pine, and a sparse understory of grasses, shrubs, and forbs.

The Upson soil is suited to lodgepole pine. It produces about 30 to 40 cubic feet of wood per acre per year. Care is needed to prevent erosion on skid trails and access roads. The steep slopes and large stones limit felling and yarding. The low water holding capacity limits seedling survival.

Wildlife include mule deer, elk, blue grouse, and black bear. Managing livestock grazing and timber improves habitat on the big game summer range.

Depth to rock, steep slopes, and large stones are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff.

The capability subclass is VIIe.

90—Waybe clay loam, 10 to 55 percent slopes. This shallow, well drained, strongly sloping to very steep soil is on mountainsides and ridges at elevations of 7,500 to 8,500 feet. It formed in residuum from shale and mudstone. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 45 to 75 days.

Small areas of Aaberg clay loam, Binco clay loam, and Roxal loam are included in mapping. Also included are a few small areas of Rock outcrop and Cryorthents.

Typically the Waybe soil has a pale brown clay loam surface layer about 5 inches thick. The lower 6 inches of the surface layer is grayish brown clay. The underlying material is light grayish brown clay about 5 inches thick. Soft, partially weathered shale is at a depth of 16 inches.

Permeability is slow. The available water capacity is very low. Surface runoff is rapid, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Western wheatgrass, bluebunch wheatgrass, and big sagebrush dominate the rangeland vegetation. Woody shrubs become dominant as range condition declines.

Grazing management is essential. Brush control is needed to improve range condition where there are remnants of grass to respond. In areas where the grass is sparse, deferred grazing is needed. The site is too droughty and too steep to be seeded.

This soil provides winter range for mule deer and elk. Other wildlife are sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

Depth to rock, steep slopes, and the shrink-swell potential are the soil properties most limiting to community development. Cut and fill slopes should be kept to a minimum to limit potential soil slippage. Road design should provide adequate surface drainage.

The capability subclass is VIIe.

91—Woodhall loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on mountainsides and ridges at elevations of 8,000 to 9,000 feet. It formed in material weathered from sandstone and basalt. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 75 days.

Small areas of Quander cobbly loam, Irigul channery loam, and Benteen loam are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the surface layer of this Woodhall soil is grayish brown loam about 8 inches thick. The upper 4 inches of the subsoil is brown clay loam. The lower 6

inches is brown very stony clay loam. The substratum is brown very stony loam about 12 inches thick. Hard, highly fractured sandstone is at a depth of 30 inches.

Permeability is moderate. The available water capacity is low. Surface runoff is slow, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Wheatgrass, muttongrass, Idaho fescue, and big sagebrush dominate the rangeland vegetation.

Grazing is to be managed carefully on this fragile site. Deferred grazing can improve range condition. Where big sagebrush becomes dominant, brush control can improve range condition if there is enough grass to respond.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect big game winter range.

Depth to rock and large stones are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff. Cut and fill slopes should be avoided to prevent soil slippage.

The capability subclass is VIe.

92—Woodhall loam, 15 to 50 percent slopes. This moderately deep, well drained, moderately steep to steep soil is on mountainsides at elevations of 8,000 to 9,000 feet. It formed in material weathered from sandstone and basalt. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is 30 to 75 days.

Small areas of Quander stony loam, Irigul channery loam, and Benteen loam are included in mapping. Also included are a few small areas of Rock outcrop.

Typically the surface layer of this Woodhall soil is grayish brown loam about 8 inches thick. The upper 4 inches of the subsoil is brown clay loam. The lower 6 inches is brown very stony clay loam. The substratum is brown very stony loam about 12 inches thick. Hard, highly fractured sandstone is at 30 inches.

Permeability is moderate. The available water capacity is low. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Wheatgrass, muttongrass, Idaho fescue, and big sagebrush dominate the rangeland vegetation.

Grazing is to be managed carefully on this fragile site. Deferred grazing can improve range condition. Where big sagebrush becomes dominant, brush control can improve range condition if there is enough grass to respond.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game winter range.

Depth to rock, large stones, and slope are the soil properties most limiting to community development. Road design should provide drainage outlets for surface runoff. Cut and fill slopes should be avoided to prevent soil slippage.

The capability subclass is VIIe.

93—Youga loam, 2 to 6 percent slopes. This deep, well drained, gently sloping to moderately sloping soil occupies mountain fans, swales, and depressions at elevations of 8,000 to 9,000 feet. It formed in glacial drift and colluvium. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Small areas of Quander cobbly loam and Clayburn loam are included in mapping. Also included are a few small areas of Cumulic Cryaquolls and areas of soils that are red, but are otherwise similar to the Youga soil.

Typically the surface layer of this Youga soil is dark grayish brown loam about 4 inches thick. The upper 10 inches of the subsoil is dark grayish brown loam. The lower 42 inches is reddish yellow clay loam about 42 inches thick. The substratum is reddish yellow clay loam that extends to 60 inches or more.

Permeability is moderately slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Wheatgrass, muttongrass, Idaho fescue, and big sagebrush are the dominant species in the rangeland vegetation.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. Where shrubs have become dominant, brush control can improve range condition. Arizona fescue, big bluegrass, slender wheatgrass, smooth brome, western wheatgrass, and intermediate wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock

grazing and controlling sagebrush are necessary to protect the big game range.

The shrink-swell potential and low strength are the soil properties most limiting to community development.

The capability subclass is VIe.

94—Youga loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping to strongly sloping soil occupies mountain fans, swales, and depressions at elevations of 8,000 to 9,000 feet. It formed in glacial drift and colluvium. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Small areas of Quander cobbly loam and Clayburn loam are included in mapping. Also included are a few small areas of soils that are red but are otherwise similar to the Youga soil.

Typically the surface layer of this Youga soil is dark grayish brown loam about 4 inches thick. The upper 10 inches of the subsoil is dark grayish brown loam. The lower 42 inches is reddish yellow clay loam. The substratum is reddish yellow clay loam that extends to 60 inches or more.

Permeability is moderately slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium, and the erosion hazard is moderate.

Most of the acreage is rangeland. Part of it is used for recreation and wildlife. A small acreage is irrigated and used for hay. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Wheatgrass, muttongrass, Idaho fescue, and big sagebrush are the dominant species in the rangeland vegetation.

Grazing no more than 50 percent of the key species, by weight of the current season production, will maintain the condition of this site. Where shrubs have become dominant, brush control can improve range condition. Seeding may be needed if the site is in poor condition. Arizona fescue, big bluegrass, slender wheatgrass, smooth brome, western wheatgrass, and intermediate wheatgrass are suitable for seeding. The seed should be drilled into a firm seedbed.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game range.

The shrink-swell potential and the slope are the soil properties most limiting to community development.

The capability subclass is VIe.

95—Youga loam, 15 to 45 percent slopes. This deep, well drained, moderately steep to steep soil is on mountainsides and fans at elevations of 8,000 to 9,000 feet. It formed in glacial drift and colluvium. The average annual precipitation is about 18 to 20 inches, the average annual air temperature is about 37 to 42 degrees F, and the frost-free season is about 30 to 60 days.

Small areas of Quander stony loam and Clayburn loam are included in mapping.

Typically the surface layer of this Youga soil is dark grayish brown loam about 4 inches thick. The upper 10 inches of the subsoil is dark grayish brown loam. The lower 42 inches is reddish yellow clay loam about 42 inches thick. The substratum is reddish yellow clay loam that extends to 60 inches or more.

Permeability is moderately slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium, and the erosion hazard is high.

Most of the acreage is rangeland. Part of it is used for wildlife and recreation. The cold climate and short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Rangeland vegetation is dominantly western wheatgrass, muttongrass, Idaho fescue, and big sage.

Grazing management can maintain range condition. If woody shrubs become dominant, brush control can improve range condition. Most of this site is too steep to be seeded with a drill.

This soil provides spring and fall transition range for mule deer and elk. Other wildlife include sage grouse, jackrabbit, cottontail, and coyote. Managing livestock grazing and controlling sagebrush are necessary to protect the big game range.

Low strength and steep slopes are the soil properties most limiting to community development. Cut and fill slopes should be kept to a minimum because of potential slippage. Road design should provide adequate surface drainage.

The capability subclass is VIIe.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and

measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Capability classes and subclasses

Capability classes and subclasses (*6*) show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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 landforms have limitations that nearly preclude their use for commercial crop production.

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

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Hay and pasture

The paragraphs that follow provide information on the overall soil potential and on needed practices in the survey area. For each kind of soil, information about management is presented under "Soil Maps for Detailed Planning." Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil.

About 44,000 acres is used for irrigated grass hay and pasture. The acreage is predominantly Cumulic Cryaquolls and small areas of Cimarron, Youga, Tine, Harsha, and Leavitt soils.

The acreage in hay and pasture is gradually declining as more land is used for recreation and homesite devel-

opment. The use of this soil survey in making land use decisions that influence the future role of agriculture in the county is discussed in the section "General Nature of the County."

Soil erosion is not a problem on the irrigated meadows. The meadows are densely covered with grasses and are never cultivated.

Soil drainage is the major management practice needed on about two-thirds of the acreage used for hay meadows. In most areas, draining these soils would be impractical because of the high cost.

Soil fertility is naturally high in most soils used for hay meadows and rangeland. It is medium to low in woodland soils and low to very low in soils above the timberline.

Fertilization is needed for maximum hay production, generally 40 to 80 pounds of nitrogen and 15 to 30 pounds of phosphorus per acre. The best results can be obtained by applications in spring. A fall application may result in heavy losses of fertilizer because of leaching and surface runoff from snowmelt.

Yields from these grass hay meadows range from 1.5 to 2.5 tons per acre. The cold climate and the short growing season restrict the variety of plant species and allow only one cutting of grass hay per year.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

Rangeland

By Jim Kellogg, range conservationist, Soil Conservation Service.

About 55 percent of the land surveyed in the Grand County Area is rangeland. Almost all is grazed and browsed by cattle and wildlife. The livestock industry produces the third highest income, ranking behind recreation and mining. Most ranches are cow-calf enterprises. Some ranches keep the calves and market them as yearlings.

The average size ranch in the survey area is 2,000 acres of privately owned land in addition to grazing the National Forest. Many ranches have some woodland, and nearly all have irrigated land in addition to rangeland.

Irrigated land is grazed in spring and then allowed to grow for hay production in summer. The hay is cut late in July and in August. Cattle graze the rangeland and woodland in summer. They graze the irrigated land again in the fall to harvest the regrowth. In winter, they eat the hay produced on the irrigated land. In this operation, rangeland and woodland grazing are essential in order to permit the production of hay on the irrigated land.

Soils and effective precipitation strongly influence natural vegetation. Many factors, however, are considered—exposure, topography, texture and depth of soil, temperature, actual precipitation, and elevation. All interrelate to produce a given kind and amount of vegetation.

An improved range condition is the objective of rangeland management in attaining a stable site and vigorous, high-producing, healthy plants. To be considered are proper grazing use, a planned grazing system, brush management, and seeding.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 5 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed are used for crops or other purposes or cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 5.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing

conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. 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. 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 maximum production of vegetation, 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.

Grazing management requires that approximately 50 percent of each season's growth of the key forage plants is left on the site at the end of the grazing season. Uniform distribution of grazing animals is needed. The distribution of grazing animals can be improved by salt, fences, and well placed stock water developments. The vigor and production of the forage plants can be increased by a rotation grazing pattern, which allows a field to be deferred from grazing during the growing season at least once every 3 years.

If shrubs have become dominant in the plant community, the brushy species should be removed so that they no longer limit forage production. Caution is needed in specifying areas for proposed brush management. The areas must not be winter range for game, the slope must not be so steep that soil erosion is accelerated, and there must be enough grass to fill in the voids left by the brush. Sometimes the range condition has deteriorated to a point where seeding is the most economical and fastest method of restoration. Again, the site must be evaluated. Some sites are too steep, shallow, or rocky to be seeded successfully.

Woodland management and productivity

Woodland yields estimated by Robert Aaberg, timber assistant, Al Rogers, silviculturist, Forest Service, and Sherman Finch, woodland conservationist, Soil Conservation Service.

About 45 percent of the land surveyed in Grand County Area is woodland. There are two major forest types in the survey area—the spruce-fir type and the lodgepole pine.

The Engelmann spruce-subalpine fir forests generally occur as uneven aged stands at elevations of 9,500 to 11,500 feet. Some lodgepole pine and quaking aspen occur at the lower elevations and in areas disturbed by fire or logging. A large part of the spruce-fir forests are sawtimber and poletimber sized stands.

Forests in the survey areas are largely lodgepole pine. This type generally occurs as even aged stands at elevations of 8,500 to 10,000 feet. Most of the lodgepole pine is sawtimber and poletimber sized stands. There are scattered patches of quaking aspen on the deep fertile soils and in disturbed areas.

In addition to the spruce-fir and lodgepole pine forests, small isolated areas of Douglas-fir occur as mature stands on north-facing slopes at elevations of 8,000 to 9,500 feet. Colorado blue spruce and narrowleaf cottonwood grow in limited numbers along major drainageways. Neither species is commercially important in the Grand County Area.

Pinyon pine and Utah juniper is the dominant woodland cover in a small area in the southwest corner of the survey area. Pinyon pine and Utah juniper are used mainly for fenceposts and firewood. The cubic foot production rates shown under "Soil maps for detailed planning" express potential productivity in unmanaged stands (*3*). These production rates could become significantly higher under intensive management. The lower rates of production are used because few stands of trees in Colorado are intensively managed.

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Mapping unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; 5, moderately low; 6, low; and 7, very low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive

water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This 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. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of struc-

tures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local

officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 60 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important fac-

tors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 5 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 5 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 5 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey (*5*). In table 10 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil

blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The Grand County Area provides year-round recreation. Grand Lake, Granby, Shadow Mountain, Willow Creek, and the Williams Fork reservoirs offer fishing and boating. Winter sports, such as snowmobiling and skiing, are popular at Winter Park, Berthoud Pass, and other smaller ski resorts. Hunting deer, elk, and geese, and fishing for trout are other year-round sports.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Wildlife of the Grand County Area include species that are economically important in recreational hunting, such as mule deer, elk, and sage grouse. Other important wildlife include black bear, bighorn sheep, Rocky Mountain goat, snowshoe hare, jackrabbit, coyote, and beaver.

In winter large herds of mule deer and elk migrate from the forest to the brushy rangeland. As the snow recedes in spring, these herds migrate back to the forest.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is

inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat provided in the survey area are briefly described in the following paragraphs.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are muttongrass, lupine, mountain muhly, Parry oatgrass, wheatgrass, and grama.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are mountain-mahogany, bitterbrush, snowberry, and big sagebrush.

The kinds of wildlife habitat provided in the survey area are briefly described in the following paragraphs.

Openland habitat consists of pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grasses and legumes and wild herbaceous plants. Openland wildlife are uncommon because grain and seed crops are not grown in this area.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include blue grouse, showshoe hare, woodpeckers, squirrels, red fox, mule deer, black bear, big horn sheep, Rocky Mountain goat, marmot, and pika.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include coyote, mule deer, jackrabbit, sage grouse, and meadowlark.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for

many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted in table 13.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the

potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on

the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*7*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 16, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boralf (*Bor*, meaning cool, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Cryoboralf (*Cryo*, meaning cold, plus *boralf*, the suborder of Alfisols that are cold).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups 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 is thought to typify the great group. An example is Typic Cryoboralfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, Typic Cryoboralfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Aaberg series

The Aaberg series consists of moderately deep, well drained soils that formed in material weathered from shale and mudstone. Aaberg soils are on mountainsides and ridges. Slopes are 6 to 30 percent. The average annual precipitation is about 10 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 7,500 to 8,500 feet.

Aaberg soils are similar to Binco soils and are near Waybe, Binco, Cimarron, and Mulstay soils. Binco, Cimarron, and Mulstay soils do not have bedrock above 40 inches. Waybe soils have bedrock above 20 inches.

Typical pedon of Aaberg clay loam, 6 to 15 percent slopes, about 10 miles north of Kremmling, 300 feet south of northeast corner sec. 27, T. 3 N., R. 81 W.

A1—0 to 4 inches; light grayish brown (10YR 6/4) heavy clay loam, dark brown (10YR 4/3) moist; moderate medium granular structure; slightly hard, firm, sticky and plastic; calcareous, mildly alkaline; clear smooth boundary.

B2—4 to 18 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; slickensides on faces of peds; calcareous, mildly alkaline; clear smooth boundary.

C1ca—18 to 22 inches; grayish brown (2.5Y 5/3) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; visible seams and streaks of lime; calcareous, moderately alkaline; abrupt wavy boundary.

C2r—22 to 26 inches; soft, partly weathered shale.

Texture of the control section ranges from heavy clay loam to clay.

Depth to bedrock ranges from 20 to 40 inches. These soils have cracks up to 1 inch wide to a depth of 20 inches or more.

The A horizon has hue of 5Y through 7.5YR, value of 5 or 6 dry, 3 or 4 moist, and chroma of 2 through 4. It is neutral or mildly alkaline. The B2 horizon has hue of 5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 6. It is neutral to moderately alkaline. The C horizon has hue of 5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 6. It is neutral to strongly alkaline.

Anvik series

The Anvik series consists of deep, well drained soils that formed in colluvium or glacial drift. Anvik soils are on mountainsides. Slopes are 6 to 50 percent. The average annual precipitation is about 19 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is about 30 to 60 days. The elevations are 7,500 to 9,500 feet.

Anvik soils are similar to the Cebone and Mord soils and are near Youga, Clayburn, Cimarron, Mord, Frisco, Peeler, and Quander soils. Youga, Clayburn, and Quander soils lack subsurface horizons. Cimarron, Cebone, and Mord soils are more than 35 percent clay in the subsoil. Frisco and Peeler lack a thick dark colored surface layer.

Typical pedon of Anvik loam, 15 to 50 percent slopes, about 4 miles west of Kremmling, about 500 feet west of southeast corner sec. 9, T. 1 N., R. 81 W.

A1—0 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

A2—11 to 20 inches; pinkish gray (7.5YR 6/2) loam, brown (7.5YR 5/2) moist; moderate medium granular structure parting to weak fine granular; soft, friable, slightly sticky and slightly plastic; neutral; 5 percent gravel; gradual wavy boundary.

A&B—20 to 23 inches; 55 percent pinkish gray (7.5YR 7/2) and 45 percent light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist, moderate fine subangular blocky structure parting to moderate medium granular; slightly hard, firm, slightly sticky and plastic; thin patchy clay films on faces of more clayey peds; neutral; 10 percent gravel and 5 percent cobbles; gradual wavy boundary.

B2t—23 to 40 inches; light brown (7.5YR 6/4) cobbly clay loam, dark brown (7.5YR 4/4) moist; strong fine prismatic structure parting to weak fine subangular blocky; hard, firm, sticky and plastic; thin nearly continuous clay films on faces of peds; neutral; 15 percent gravel and 10 percent cobbles; gradual wavy boundary.

C—40 to 60 inches; pink (7.5YR 8/4) very cobbly clay loam, pinkish gray (7.5YR 7/2) moist; massive; hard, firm, sticky and plastic; 30 percent cobbles and 15 percent gravel; neutral.

The dark colored surface layer ranges from 7 to 15 inches thick. The solum ranges from 20 to 50 inches thick. The content of rock fragments ranges from 0 to 35 percent by volume in the solum and from 25 to 50 percent by volume in the C horizon. Reaction is slightly acid or neutral throughout.

The A1 horizon has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 2 or 3. The A2 horizon has hue of 2.5Y through 7.5YR, value of 6 through 8 dry, 4 through 6 moist, and chroma of 2 through 4. The B2t is a cobbly heavy loam or cobbly clay loam. The B2t has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 3 through 5 moist, and chroma of 3 through 6.

Benteen series

The Benteen series consists of moderately deep, well drained soils that formed in limestone or sandstone. Benteen soils are on mountainsides and ridges. Slopes are 6 to 40 percent. The average annual precipitation is about 20 inches, the average annual air temperature is about 36 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,000 to 9,500 feet.

Benteen soils are similar to the Sudduth and Clayburn soils and are near Cimarron and Youga soils. Sudduth, Clayburn, Cimarron, and Youga soils lack bedrock at 20 to 40 inches.

Typical pedon of Benteen loam, 6 to 15 percent slopes, about 20 miles northwest of Kremmling, about 1,300 feet south and 1,600 feet west of northeast corner sec. 3, T. 3 N., R. 82 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; noncalcareous, mildly alkaline; clear smooth boundary.

B1—7 to 15 inches; dark grayish brown (10YR 4/2) light clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; noncalcareous, mildly alkaline; clear smooth boundary.

B21t—15 to 21 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; moderately thick continuous clay films on faces of peds; neutral; clear smooth boundary.

B22t—21 to 35 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; moderately thick continuous clay films on faces of peds; neutral; clear smooth boundary.

B3—35 to 38 inches; pale brown (10YR 6/3) gravelly light clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; thin patchy clay films on faces of peds; calcareous, moderately alkaline; 30 percent limestone gravel; abrupt wavy boundary.

R—38 inches; hard, highly fractured limestone.

Depth to bedrock is 20 to 40 inches. The hue is 10YR or 2.5Y throughout the pedon. Reaction is neutral to mildly alkaline throughout the pedon. In some pedons just above the contact, the B3 or C horizon is weakly effervescent and moderately alkaline and the content of rock fragments by volume ranges from 20 to 40 percent.

Binco series

The Binco series consists of deep, well drained soils that formed in local alluvium from shale and mudstone. Binco soils are on mountainsides, foot slopes, and fans. Slopes are 2 to 35 percent. The average annual precipitation is about 13 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 7,500 to 8,000 feet.

Binco soils are similar to the Aaberg soils and are near Aaberg and Waybe soils. Aaberg soils are 20 to 40 inches over shale. Waybe soils are 10 to 20 inches over shale.

Typical pedon of Binco clay loam, 2 to 6 percent slopes, about 10 miles north of Kremmling, 750 feet north and 2,400 feet east of southwest corner sec. 22, T. 3 N., R. 81 W.

A1—0 to 7 inches, light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; slightly hard, friable, very sticky and very plastic; calcareous, moderately alkaline; clear smooth boundary.

B2—7 to 24 inches; light brownish gray (2.5Y 6/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; few slickensides; calcareous, moderately alkaline; clear smooth boundary.

C1—24 to 37 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; calcareous, moderately alkaline; clear smooth boundary.

C2ca—37 to 48 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; calcareous, visible streaks and seams of secondary lime, strongly alkaline; clear smooth boundary.

C3—48 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; calcareous; strongly alkaline.

The 10- to 40-inch control section is normally clay, but ranges to clay loam. The clay content ranges from 35 to 60 percent. The content of rock fragments ranges from 0 to 25 percent by volume. The fragments are mainly shale fragments one-half inch to 3 inches in diameter. Cracks up to 1 inch or more wide occur when the soil is dry. The cracks extend to a depth of 20 inches or more.

The A horizon has hue of 10YR through 5Y, value of 4 through 6 dry, 4 or 5 moist, and chroma of 2 through 4. The B2 horizon has hue of 10YR through 5Y, value of 4 through 6 dry, 4 or 5 moist, and chroma of 2 through 4. Some pedons have a zone of secondary calcium carbonate accumulation.

Boettcher series

The Boettcher series consists of moderately deep, well drained soils that formed in residuum from shale. Boettcher soils are on mountainsides. Slopes are 6 to 30 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 43 degrees F, and the frost-free season is 80 to 110 days. Elevations are 6,600 to 7,300 feet.

Boettcher soils are similar to Dahlquist, Forelle, Harsha, Mulstay, and Stunner soils. They are near Dahlquist, Forelle, and Stunner soils. The control section of the deep Dahlquist, Forelle, and Stunner soils is less than 35 percent clay. Harsha and Mulstay soils occur in cryic temperature regime.

Typical pedon of Boettcher stony loam, 6 to 15 percent slopes, about 2 miles northeast of Radium, 1,100 feet east of center sec. 14, T. 1 S., R. 82 W.

A1—0 to 2 inches; yellowish brown (10YR 5/2) stony loam, dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; 10 percent stones; mildly alkaline; clear smooth boundary.

B2t—2 to 19 inches; brown (10YR 5/3) heavy clay loam, dark brown (10YR 4/3) moist; strong medium subangular blocky structure parting to strong fine subangular blocky; very hard, firm, very sticky and very plastic; moderately thick continuous clay films on faces of peds; moderately alkaline; gradual wavy boundary.

B3ca—19 to 23 inches; light brownish gray (2.5Y 6/2) heavy clay loam, grayish brown (2.5Y 5/2) moist; strong medium subangular blocky structure parting to strong fine subangular blocky; very hard, firm, very sticky and very plastic; visible seams of secondary lime; calcareous; moderately alkaline; gradual wavy boundary.

C1ca—23 to 33 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; very hard, friable, very sticky and very plastic; visible streaks and seams of secondary lime; calcareous; strongly alkaline; gradual wavy boundary.

C2r—33 to 60 inches; soft calcareous shale.

Depth to shale ranges from 20 to 40 inches. The content of rock fragments ranges from 0 to 35 percent by volume in the solum. The fragments are mainly shale one-fourth to 1 inch in diameter.

The A horizon has hue of 5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 1 through 4. It is neutral or mildly alkaline. The B2t horizon has hue of 5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 1 through 4. It ranges from heavy clay loam to clay. The reaction is neutral to moderately alkaline. The C horizon is heavy clay loam or clay. It is moderately to strongly alkaline.

Bross series

The Bross series consists of deep, well drained soils that formed in deeply weathered residuum from igneous rocks. Bross soils are on alpine mountain slopes that range from 20 to 50 percent. The average annual precipitation is 30 to 40 inches, the average annual air temperature is less than 32 degrees F, and the frost-free season is 0 to 10 days. Elevations are 11,400 to 13,500 feet.

Bross soils are similar to and are near Meredith and Mirror soils. Meredith soils have a fragmental substratum. Mirror soils are 20 to 40 inches to bedrock.

Typical pedon of Bross extremely stony sandy loam, 20 to 50 percent slopes, along Jones Pass Road about one-quarter mile west of the summit; sec. 27, T. 3 S., R. 76 W.

O1—1 inch to 0; organic mat of roots.

A1—0 to 12 inches; grayish brown (10YR 5/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; 20 percent stones and 45 percent gravel; very strongly acid; abrupt wavy boundary.

B2—12 to 22 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; 40 percent gravel and 20 percent angular cobbles; very strongly acid; clear wavy boundary.

C—22 to 60 inches; very pale brown (10YR 7/4) very gravelly loamy coarse sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 55 percent gravel and 15 percent angular cobbles; very strongly acid.

The thickness of the solum ranges from 15 to 30 inches. The content of coarse fragments in the solum ranges from 35 to 75 percent by volume. The fragments range from fine gravel to angular cobbles.

The A1 horizon has hue of 2.5Y through 7.5YR, value of 3 through 5 dry, 2 or 3 moist, and chroma of 1 through 3. The B2 horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 1 through 4. Reaction is strongly or very strongly acid throughout the pedon.

Cebone series

The Cebone series consists of moderately deep, well drained soils that formed in shale and sandstone. Cebone soils are on mountainsides. Slopes are 15 to 50 percent. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 7,500 to 9,000 feet.

Cebone soils are similar to the Anvik and Mord soils and are near Cimarron, Mayoworth, Anvik, and Lake Creek soils. Cimarron and Mayoworth soils lack a subsurface layer. Anvik and Mord soils do not have bedrock at a depth of 20 to 40 inches. The subsoil of Lake Creek soils is more than 35 percent rock fragments by volume.

Typical pedon of Cebone loam, 15 to 50 percent slopes, about 5 miles east of Granby, 2,000 feet west

and 1,500 feet south of northeast corner sec. 9, T. 1 N., R. 76 W.

A1—0 to 11 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist, moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; slightly acid; gradual smooth boundary.

A2—11 to 16 inches; light gray (10YR 7/2) loam, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable, slightly sticky and slightly plastic; slightly acid; gradual smooth boundary.

B2t—16 to 32 inches; yellowish brown (10YR 5/4) heavy clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure, hard, firm, sticky and plastic; thin continuous clay films on faces of peds; neutral; gradual wavy boundary.

C1—32 to 36 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; neutral; clear smooth boundary.

C2r—36 to 40 inches; soft, partially weathered shale.

The thickness of the solum ranges from 25 to 35 inches. The content of rock fragments ranges from 0 to 15 percent by volume. The fragments are predominantly shale. Depth to shale ranges from 20 to 40 inches. Reaction is slightly acid or neutral throughout the pedon.

Cimarron series

The Cimarron series consists of deep, well drained soils that formed in local alluvium from shale. Cimarron soils are on mountainsides and fans. Slopes are 2 to 35 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 40 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 7,500 to 8,500 feet.

Cimarron soils are similar to Leavitt, Lymanson, Mayoworth, Woodhall, Youga, and Quander soils and are near Mayoworth, Quander, and Mord soils. The subsoil of Leavitt, Lymanson, Woodhall, Youga, and Quander soils is less than 35 percent clay. Mayoworth soils have bedrock above a depth of 40 inches. Mord soils have an A2 horizon below the A1 horizon.

Typical pedon of Cimarron loam, 6 to 15 percent slopes, about 13 miles north of Kremmling, 1,800 feet north and 1,300 feet west of southeast corner sec. 6, T. 3 N., R. 80 W.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

A12—5 to 10 inches; dark grayish brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21t—10 to 14 inches; grayish brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; hard, firm, sticky and plastic; thin nearly continuous clay films on faces of peds; thin vertical cracks when dry that may extend to base of A12; neutral; clear wavy boundary.

B22t—14 to 24 inches; pale brown (10YR 6/3) clay, dark grayish brown (10YR 4/2) moist, moderate medium subangular blocky structure parting to moderate fine angular blocky; hard, very firm, very sticky and very plastic; moderately thick nearly continuous clay films on faces of peds; thin vertical cracks when dry; neutral; clear wavy boundary.

B3t—24 to 32 inches; light yellowish brown (10YR 6/4) heavy clay loam, brown (10YR 5/3) moist; moderate coarse subangular blocky structure parting to weak medium subangular blocky; very hard, extremely firm, very sticky and very plastic; thin nearly continuous clay films on faces of peds; thin vertical cracks when dry may extend to a depth of 30 inches; neutral; gradual wavy boundary.

C—32 to 60 inches; light yellowish brown (10YR 6/4) heavy clay loam, brown (10YR 5/3) moist; massive; hard, very firm, sticky and plastic; 10 percent gravel; neutral.

The dark colored surface layer ranges from 10 to 16 inches thick. The content of rock fragments ranges from 0 to 20 percent by volume.

The A horizon has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 1 through 3. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 6. It is heavy clay loam or clay. The C horizon has hue of 2.5Y through 7.5YR. It is heavy clay loam or clay. Reaction is slightly acid or neutral throughout the pedon.

Clayburn series

The Clayburn series consists of deep, well drained soils that formed in alluvium and colluvium. Clayburn soils occupy mountainsides, swales, and depressions. Slopes are 2 to 50 percent. The average annual precipitation is about 19 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 7,500 to 9,000 feet.

Clayburn soils are similar to the Benteen and Sudduth soils and are near Anvik, Mord, Youga, Cimarron, Quander, Sudduth, Frisco, and Peeler soils. Benteen soils have bedrock at 20 to 40 inches. The subsoil of Sudduth and Cimarron soils is more than 35 percent clay. Youga and Quander soils have a dark colored surface layer less than 16 inches thick. Frisco, Peeler, Anvik, and Mord soils have light colored subsurface horizons.

Typical pedon of Clayburn loam, 6 to 15 percent slopes, about 20 miles north of Kremmling, 2,600 feet south and 1,000 feet east of northwest corner sec. 29, T. 4 N., R. 80 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure parting to moderate medium granular; soft, friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B1—9 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slight hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B21t—16 to 29 inches; grayish brown (10YR 5/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; thin patchy clay films on faces of peds; neutral; clear wavy boundary.

B22t—29 to 40 inches; pale brown (10YR 6/3) clay loam, yellowish brown (10YR 6/3) clay loam, yellowish brown (10YR 5/4) moist; strong medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; thin patchy clay films on faces of peds; neutral; gradual wavy boundary.

B3—40 to 47 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure parting to weak medium subangular blocky; slightly hard, firm, sticky and plastic; neutral; gradual wavy boundary.

C—47 to 60 inches; light yellowish brown (10YR 6/4), gravelly clay loam, yellowish brown (10YR 5/4) moist; massive, slightly hard, firm, sticky and plastic; 15 percent gravel; neutral.

The thickness of the solum ranges from 44 to 54 inches. The content of rock fragments in the C horizon ranges from 0 to 25 percent by volume. The fragments are predominantly less than 3 inches in diameter. Reaction ranges from slightly acid to neutral throughout the pedon.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 through 6 dry, 3 through 5 moist, and chroma of 2 through 4. It is loam or clay loam. The texture of the C horizon ranges from loam to gravelly clay loam.

Cowdrey series

The Cowdrey series consists of deep, well drained soils that formed in glacial drift. Cowdrey soils are on mountainsides and fans. Slopes are 2 to 45 percent. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,000 to 9,500 feet.

Cowdrey soils are similar to the Frisco, Peeler, Gateway, Uinta, Leadville, and Lake Creek soils and are near Anvik, Cimarron, Sudduth, Mord, Frisco, Peeler, and Gateway soils. Anvik, Cimarron, Sudduth, and Mord soils have a thicker dark colored surface layer. The subsoil of Frisco, Peeler, Uinta, and Leadville soils is less than 35 percent clay. Gateway and Lake Creek soils have bedrock at 20 to 40 inches.

Typical pedon of Cowdrey loam, 15 to 45 percent slopes, about 3.5 miles southeast of Fraser, 750 feet north and 1,500 feet west of southeast corner sec. 34, T. 1 S., R. 75 W.

O1—2 inches to 0; undecomposed needles and twigs.

A1—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; weak coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

A2—3 to 8 inches; very pale brown (10YR 7/3) loam, brown (10YR 4/3) moist; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B2t—8 to 36 inches; light brown (7.5YR 6/4) clay, dark brown (7.5YR 4/4) moist, few light gray (10YR 7/2) bleached sand grains in upper part of horizon; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; thin continuous clay films on faces of peds; 10 percent fine gravel; slightly acid; gradual wavy boundary.

B3—36 to 46 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; 10 percent gravel; thin patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

C—46 to 60 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 5/4) moist; massive; very hard, firm, very sticky and very plastic; 10 percent gravel; slightly acid.

The thickness of the solum ranges from 20 to 50 inches. The content of rock fragments, mainly gravel, ranges from 0 to 15 percent by volume. Reaction is slightly acid or neutral throughout.

A thin A1 horizon is present in some pedons and absent in others. The A2 horizon has hue or 2.5Y

through 7.5YR, value of 6 through 8 dry, 4 through 6 moist, and chroma of 2 or 3. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 through 4. The texture ranges from heavy clay loam to clay. The C horizon has hue of 2.5Y through 7.5YR. The texture ranges from heavy clay loam to clay.

Cryaquepts

Cryaquepts are deep and moderately deep, poorly and very poorly drained soils formed in colluvium and alluvium. The average annual precipitation is about 25 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is 35 to 50 days. Elevations are 9,000 to 11,500 feet.

Cryaquepts are not similar to any other soil in the survey area. They are near Leighcan and Newcomb soils. Leighcan and Newcomb soils are well drained.

A reference profile of Cryaquepts, about 15 miles south of Parshall along Ute Pass Trail, sec. 2, T. 3 S., R. 78 W.

O1—2 inches to 0; undecomposed needles, leaves, and twigs.
A1—0 to 3 inches; dark gray (10YR 4/1) heavy clay loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; hard, firm, sticky and plastic; medium acid; clear wavy boundary.
B21—3 to 8 inches; mixed colors, 50 percent yellowish brown (10YR 5/4) 50 percent gray (10YR 5/1) clay; dark yellowish brown (10YR 4/4) and dark gray (10YR 4/1) moist; moderate coarse subangular blocky structure; very hard, firm, very sticky and very plastic; medium acid; clear wavy boundary.
B22g—8 to 12 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common large distinct mottles of yellowish brown (10YR 5/4); strong coarse subangular blocky structure; very hard, firm, very sticky and very plastic; medium acid; clear wavy boundary.
C1g—12 to 27 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct mottles of yellowish red (5YR 5/6) and few fine faint mottles of yellowish brown (10YR 5/4); massive; very hard, firm, very sticky and very plastic; medium acid; abrupt wavy boundary.
C2r—27 inches; weathered shale.

The depth to bedrock is 20 to 60 inches or more. A surface layer of organic material ranges from 2 to 10 inches thick. The water table is at the surface or within 10 inches of the surface most of the time. The texture of the B2 horizon ranges from loam to clay.

Cryoboralfs

Cryoboralfs are shallow and moderately deep, well drained soils formed in colluvium and residuum from various parent materials. Cryoboralfs are on steep and very steep mountainsides. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 36 to 42 degrees F, and the frost-free season is 30 to 50 days.

Cryoboralfs are similar to and are near Frisco, Peeler, Cowdrey, and Leadville soils. Frisco, Peeler, Cowdrey, and Leadville soils lack bedrock above 40 inches.

A reference profile of Cryoboralfs, about 2 miles southwest of Hot Sulphur Springs, about 700 feet west of southeast corner sec. 9, T. 1 N., R. 78 W.

O1—1 inch to 0; undecomposed needles and twigs.
A2—0 to 5 inches; pink (7.5YR 7/4) stony loam, light brown (7.5YR 6/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; 15 percent stones, 10 percent cobbles, 10 percent gravel; slightly acid; clear wavy boundary.
B&A—5 to 9 inches; 75 percent reddish yellow (7.5YR 6/6) and 25 percent pink (7.5YR 7/4) stony sandy clay loam, strong brown (7.5YR 5/6) and light brown (7.5YR 6/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; 15 percent stones, 10 percent cobbles; slightly acid; clear wavy boundary.
B2t—9 to 15 inches; reddish yellow (7.5YR 6/6) stony sandy clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; 10 percent stones, 10 percent cobbles; slightly acid; abrupt wavy boundary.
R—15 inches; hard fractured sandstone.

The depth to bedrock ranges from 10 to 40 inches. The B2t horizon has hue of 10R through 10YR. The texture of the B2t horizon ranges from clay to sandy loam. The content of rock fragments in the B2t horizon ranges from 0 to 80 percent by volume.

Cryoborolls

Cryoborolls are shallow to deep, well drained soils formed in colluvium and residuum from various sedimentary and metamorphic rocks. Cryoborolls are on steep to extremely steep mountainsides. The annual precipitation ranges from 16 to 28 inches, the annual air temperature ranges from 36 to 45 degrees F, and the frost-free season is 30 to 80 days.

Cryoborolls are similar to and are near Tamp, Leavitt, Lymanson, Woodhall, Quander, and Irigul soils. They vary widely within short distances.

A reference profile of Cryoborolls, about 10 miles south of Parshall along Williams Fork River, sec. 34, T. 1 S., R. 78 W.

A1—0 to 10 inches; grayish brown (10YR 5/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable,

nonsticky and nonplastic; 40 percent gravel; neutral; clear wavy boundary.
AC—10 to 22 inches; grayish brown (10YR 5/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; 50 percent gravel; neutral; gradual wavy boundary.
C—22 to 33 inches; grayish brown (10YR 5/2) extremely gravelly coarse loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, very friable, 65 percent gravel; neutral; abrupt wavy boundary.
R—33 inches; hard granite and gneiss.

The depth to bedrock ranges from 10 to 60 inches or more. The dark colored surface layer is 10 to 40 inches thick. The B2 horizon, if present, ranges from sandy loam to very cobbly clay loam. The content of rock fragments ranges from 10 to 80 percent by volume. The fragments are one-fourth inch to 10 inches in diameter.

Cryorthents

Cryorthents are shallow and moderately deep, well drained soils formed in alluvium and colluvium. Cryorthents are on steep to extremely steep mountainsides. The annual precipitation ranges from 11 to 18 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 30 to 60 days.

Cryorthents are near Aaberg, Binco, Harsha, and Leavitt soils. Aaberg, Binco, Harsha, and Leavitt soils have a subsoil.

A reference profile of Cryorthents, about 14 miles north of Kremmling, in the northwest quarter sec. 3, T. 3 N., R. 81 W.

A1—0 to 3 inches; weak red (2.5YR 5/2) clay loam, (2.5YR 4/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.
C1—3 to 16 inches; weak red (2.5YR 5/2) clay loam, (2.5YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; calcareous, moderately alkaline; abrupt wavy boudary.
C2r—16 inches; weathered shale.

The depth to bedrock ranges from 10 to 40 inches. Bedrock ranges from shale to hard sandstone.

The A horizon has hue of 2.5YR through 2.5Y. The C horizon has hue of 2.5YR through 2.5Y. The texture ranges from sandy loam to clay. The content of rock fragments ranges from 0 to 50 percent by volume.

Cumulic Cryaquolls

Cumulic Cryaquolls are deep, poorly drained soils formed in alluvium and alluvial outwash. Cumulic Cryaquolls are on nearly level flood plains adjacent to major drainages. The annual precipitation ranges from 12 to 24 inches, the average annual air temperature is 37 to 43 degrees F, and the frost-free period is 30 to 80 days.

Cumulic Cryaquolls are similar to Histic Cryaquolls and are near Tine soils and Histic Cryaquolls. The Tine soils are well drained. Histic Cryaquolls have an organic layer of peat on the surface.

A reference profile of Cumulic Cryaquolls, about 4 miles south of Parshall, about 2,640 feet west of northeast corner sec. 1, T. 1 S., R. 79 W.

O1—3 inches to 0; undecomposed mat of roots and grasses.
A11—0 to 11 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.
A12g—11 to 27 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; few fine distinct mottles of strong brown (7.5YR 5/6); moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.
AC—27 to 31 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common medium distinct mottles of yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6); massive; soft, very friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.
IIC—31 to 55 inches; pale brown (10YR 6/3) very cobbly sand, dark brown (10YR 4/3) moist; few fine faint mottles of yellowish brown (10YR 5/6) on gravels and cobbles; single grained; loose, very friable; 45 percent cobbles; neutral.

Some profiles are underlain by sand and gravel at depths of 2 to 4 feet. Others have no sand or gravel above 60 inches. The texture of the control section ranges from sandy loam to heavy clay loam. The content of rock fragments ranges from 0 to 35 percent by volume in the A1 and C horizons and from 20 to 70 percent in the IIC horizon. The fragments range from one-fourth inch to 10 inches in diameter.

Dahlquist series

The Dahlquist series consists of deep, well drained soils that formed in old landslide deposits and in highly fractured sandstone. Dahlquist soils are on mountainsides and ridges. Slopes are 6 to 50 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 43 degrees F, and the frost-free season is 80 to 110 days. Elevations are 6,600 to 7,300 feet.

Dahlquist soils are similar to Boettcher, Forelle, Harsha, Mulstay, and Stunner soils. They are near Boettcher, Forelle, and Stunner soils. Boettcher soils are 20 to 40 inches deep over shale. Forelle and Stunner soils have a nonskeletal control section. Harsha and Mulstay soils occur in a cryic temperature regime.

Typical pedon of Dahlquist very cobbly loam, 6 to 50 percent slopes, about 2 miles northeast of Radium, 1,100 feet east of center sec. 14, T. 1 S., R. 82 W.

A1—0 to 6 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; 5 percent stones, 25 percent cobbles, 15 percent gravel; mildly alkaline; clear smooth boundary.

B2t—6 to 22 inches; brown (7.5YR 5/4) very cobbly sandy clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, very friable, sticky and plastic; thin continuous clay films on faces of peds; 30 percent gravel, 20 percent cobbles, 10 percent stones; mildly alkaline; clear wavy boundary.

B3ca—22 to 30 inches; strong brown (7.5YR 5/6) extremely cobbly sandy clay loam, reddish yellow (7.5YR 6/6) moist; weak medium subangular blocky structure; slightly hard, very friable, sticky and plastic; thin nearly continuous clay films on faces of peds; 40 percent gravel, 20 percent cobbles, 10 percent stones; calcareous, moderately alkaline; gradual wavy boundary.

Cca—30 to 60 inches; very pale brown (10YR 7/3) extremely cobbly loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 30 percent gravel, 30 percent cobbles, 10 percent stones; calcareous, moderately alkaline.

The thickness of the solum ranges from 21 to 38 inches. The content of rock fragments ranges from 35 to 80 percent by volume. The fragments are predominantly less than 10 inches in diameter.

The A horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 or 3. It is neutral or mildly alkaline. The B2t horizon has a hue of 10YR through 5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 through 4. It is neutral or mildly alkaline. The C horizon has accumulations of calcium carbonate. Reaction is moderately or strongly alkaline.

Forelle series

The Forelle series consists of deep, well drained soils that formed in local alluvium. Forelle soils are on toe slopes and fans. Slopes are 3 to 30 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 46 degrees F, the average summer air temperature is about 61 degrees F, and the frost-free season is about 80 to 110 days. Elevations are 6,600 to 7,500 feet.

Forelle soils are similar to Boettcher, Dahlquist, Harsha, Mulstay, and Stunner soils. They are near Boettcher, Dahlquist, and Stunner soils. The profile of Dahlquist soils is more than 35 percent rock fragments. Stunner soils have calcic horizons. The subsoil of Boettcher soils averages more than 35 percent clay. Harsha and Mulstay soils occur in cryic temperature regimes.

Typical pedon of Forelle loam, 3 to 15 percent slopes, about 15 miles southwest of Kremmling, 1,000 feet east and 600 feet north of southwest corner sec. 18, T. 1 S., R. 81 W.

A1—0 to 5 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 4/2) moist; weak thin platy structure parting to moderate medium granular; soft, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B1—5 to 9 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B2t—9 to 21 inches; light yellowish brown (10YR 6/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; strong medium subangular blocky structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; calcareous, moderately alkaline; clear wavy boundary.

B3ca—21 to 33 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak medium prismatic structure, hard, friable, slightly sticky and slightly plastic; visible lime seams; strongly alkaline; gradual wavy boundary.

C1—33 to 41 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; strongly alkaline; gradual wavy boundary.

C2—41 to 60 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky and slightly plastic; moderately alkaline.

The thickness of the solum is 22 to 46 inches. Coarse fragments make up 0 to 10 percent of the solum.

The A horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 4. It is neutral or mildly alkaline. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 through 6. It is sandy clay loam or clay loam. Reaction of the B2t horizon is mildly through strongly alkaline. The C horizon is moderately to strongly alkaline.

Frisco series

The Frisco series consists of deep, well drained soils that formed in glacial drift. Frisco soils are on mountainsides, ridges, and fans. Slopes are 2 to 65 percent. The average annual precipitation is about 24 inches, the average annual air temperature is about 35 degrees F,

and the frost-free season is about 30 to 50 days. Elevations are 8,000 to 10,500 feet.

Frisco soils are similar to Peeler, Cowdrey, Gateway, Lake Creek, Leadville, and Uinta soils and are near Anvik, Clayburn, Quander, Youga, Cowdrey, Peeler, Grenadier, and Uinta soils. The profile of Peeler, Uinta, and Cowdrey soils is less than 35 percent rock fragments. Gateway and Lake Creek soils have bedrock above 60 inches. Anvik, Clayburn, Quander, and Youga soils have a thick dark colored surface layer. Leadville soils are redder in color. Grenadier soils lack a well developed subsoil.

Typical pedon of Frisco gravelly sandy loam, 6 to 25 percent slopes, about 14 miles northeast of Kremmling, 2,500 feet east and 800 feet north of southwest corner sec. 7, T. 3 N., R. 79 W.

O1—1 inch to 0; undecomposed leaves, twigs, cones, needles, and grass.

A2—0 to 14 inches; pinkish gray (7.5YR 7/2) gravelly sandy loam, brown (7.5YR 5/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; 15 percent gravel; strongly acid; clear wavy boundary.

A&B—14 to 21 inches; pink (7.5YR 7/4) very stony light sandy clay loam, 75 percent brown (7.5YR 5/2) moist; 25 percent dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure parting to weak medium granular; soft, very friable, slightly sticky and slightly plastic; 35 percent stones, 10 percent cobbles; strongly acid; gradual wavy boundary.

B2t—21 to 41 inches; light brown (7.5YR 6/4) very stony sandy clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; hard, firm, sticky and plastic; thin patchy clay films on faces of peds; 35 percent stones, 5 percent cobbles; medium acid; gradual wavy boundary.

C—41 to 60 inches; light brown (7.5YR 6/4) very stony sandy clay loam, brown (7.5YR 4/4) moist; massive, slightly hard, firm, sticky and plastic; 50 percent stones, 10 percent cobbles; medium acid.

The content of rock fragments ranges from 35 to 80 percent in the major part of the solum and the C horizon. The fragments are predominantly 10 to 24 inches in diameter. Reaction ranges from strongly acid to medium acid.

The A2 horizon has hue of 2.5Y through 7.5YR, value of 5 through 8 dry, 4 through 7 moist, and chroma of 2 through 4. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 through 6. The B2t horizon is loam, sandy clay loam, or clay loam.

Gateway series

The Gateway series consists of moderately deep, well drained soils that formed in material weathered from mudstone or shale. Gateway soils are on mountainsides and ridges. Slopes are 6 to 50 percent. The average annual precipitation is about 21 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 8,000 to 9,500 feet.

Gateway soils are similar to Frisco, Peeler, Cowdrey, Lake Creek, Leadville, and Uinta soils and are near Cowdrey, Cebone, and Cimarron soils. Frisco, Peeler, Cowdrey, and Uinta soils lack bedrock above 40 inches. The subsoil of Lake Creek and Leadville soils is more than 35 percent rock fragments. Cebone and Cimarron have a thick dark colored surface layer.

Typical pedon of Gateway loam, 15 to 50 percent slopes, about 4 miles east of Fraser, 1,620 feet east and 500 feet south of northwest corner sec. 16, T. 1 S., R. 75 W.

O1—1 inch to 0; undecomposed needles and twigs.

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

A2—3 to 8 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; moderate medium platy structure parting to weak medium granular; slightly sticky and slightly plastic; neutral; clear smooth boundary.

B&A—8 to 12 inches; brown (7.5YR 5/4) heavy clay loam, brown (7.5YR 5/3) moist; light gray (10YR 7/2) stains in upper part of horizon; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; thin nearly continuous clay films on faces of peds; neutral; gradual smooth boundary.

B21t—12 to 23 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 5/3) moist; moderate and strong medium angular blocky structure; hard, firm, sticky and plastic; thin continuous clay films on faces of peds; neutral; gradual wavy boundary.

B22t—23 to 30 inches; brown (7.5YR 5/4) heavy clay loam, brown (7.5YR 5/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; 30 percent mudstone chips; neutral; gradual wavy boundary.

Cr—30 to 38 inches; soft, partly fractured, white Troublesome Mudstone.

In some pedons a thin A1 horizon occurs below the organic layer and above the A2 horizon. The solum ranges from 19 to 39 inches thick. The depth to bedrock is 20 to 40 inches. The content of rock fragments ranges

from 0 to 15 percent by volume in the pedon but may range to 30 percent at or near the contact.

The A2 horizon has hue of 2.5Y through 7.5YR, value of 6 or 7 dry, 4 or 5 moist, and chroma of 2 through 4. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 3 through 6. Reaction is slightly acid or neutral throughout the pedon.

Grenadier series

The Grenadier series consists of deep, well drained soils that formed in glacial drift. Grenadier soils are on mountainsides and ridges. Slopes are 15 to 55 percent. The average annual precipitation is about 25 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 9,000 to 11,400 feet.

Grenadier soils are similar to Scout and Leighcan soils and are near Frisco and Peeler soils. The subsoil of Scout and Leighcan soils is less than 18 percent clay. Frisco and Peeler soils have a well developed subsoil.

Typical pedon of Grenadier gravelly loam, 15 to 55 percent slopes, about 18 miles northeast of Kremmling, 500 feet south and 100 feet west of northeast corner sec. 6, T. 3 N., R. 79 W.

O1—2 inches to 0; undecomposed needles, twigs, and moss.

A2—0 to 7 inches; pink (7.5YR 7/4) gravelly loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure parting to weak medium granular; soft, very friable, slightly sticky and nonplastic; 15 percent gravel, 5 percent cobbles; very strongly acid; clear wavy boundary.

B2—7 to 15 inches; brown (7.5YR 5/2) gravelly light sandy clay loam, dark brown (7.5YR 4/2) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20 percent gravel, 10 percent cobbles; strongly acid; gradual wavy boundary.

C—15 to 60 inches; pale brown (10YR 6/3) very stony heavy sandy loam, brown (10YR 5/3) moist; massive, soft, very friable, slightly sticky and nonplastic; 30 percent stones, 10 percent gravel, 10 percent cobbles; strongly acid.

The content of rock fragments ranges from 35 to 80 percent by volume in the B2 and C horizons. Reaction is strongly acid or very strongly acid.

The A2 horizon has hue of 2.5Y through 7.5YR, value of 5 through 8 dry, 4 through 7 moist, and chroma of 2 through 4. The B2 horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 through 6. The control section is a very stony loam, very stony sandy clay loam, or very stony light clay loam.

Haploborolls

Haploborolls are shallow and moderately deep, well drained soils formed in colluvium and alluvium. Haploborolls are on steep to extremely steep mountainsides and escarpments adjacent to the Colorado River in the southwest corner of the survey area. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 37 to 45 degrees F, and the frost-free season is 80 to 110 days.

Haploborolls are similar to and are near Forelle, Dahlquist, and Stunner soils. Forelle, Dahlquist, and Stunner soils are deep.

A reference profile of Haploborolls, about 6 miles southwest of Kremmling along the Colorado River, near the southeast corner sec. 13, T. 1 S., R. 82 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; 20 percent stones, 20 percent cobbles, 30 percent gravel; neutral; clear wavy boundary.

C—8 to 17 inches; brown (10YR 5/3) extremely stony sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; 20 percent stones, 30 percent cobbles, 20 percent gravel; neutral; abrupt wavy boundary.

R—17 inches; unweathered hard granite.

The depth to bedrock ranges from 10 to 40 inches. The control section ranges from clay loam to extremely stony sandy loam. Colors range in hue from 2.5Y to 2.5YR.

Harsha series

The Harsha series consists of deep, well drained soils that formed in alluvial sediments from sedimentary rock. Harsha soils are on mountainsides, fans, and terraces. Slopes are 0 to 50 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 7,500 to 8,500 feet.

Harsha soils are similar to Forelle and Mulstay soils and are near Leavitt, Tine, Roxal, Rogert, and Tamp soils. Forelle soil has a warmer summer soil temperature. The subsoil of Mulstay soils is more than 35 percent clay. Leavitt soils have a thick dark colored surface layer. The profile of Tine soils is more than 35 percent rock fragments. Roxal and Rogert soils have bedrock at a depth of 10 to 20 inches. Tamp soils have a weakly developed subsoil.

Typical pedon of Harsha loam, 6 to 15 percent slopes, about 6 miles northeast of Kremmling, 550 feet north and 100 feet east of southwest corner sec. 7, T. 2 N., R. 79 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; noncalcareous; mildly alkaline; clear smooth boundary.

B21t—5 to 13 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of peds; noncalcareous; mildly alkaline; clear smooth boundary.

B22t—13 to 33 inches; very pale brown (10YR 7/4) light clay loam, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; calcareous; moderately alkaline; clear smooth boundary.

B3ca—33 to 40 inches; light yellowish brown (10YR 6/4); loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; visible streaks of lime accumulations; calcareous; moderately alkaline; gradual smooth boundary.

C—40 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The thickness of the solum ranges from 15 to 40 inches. The depth to uniformly calcareous material ranges from 11 to 30 inches.

The A horizon has hue of 2.5Y through 7.5YR, value of 4 through 6 dry, 2 through 4 moist, and chroma of 2 or 3. The reaction is neutral or mildly alkaline. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 5 or 6 moist, and chroma of 2 through 4. Reaction is mildly alkaline or moderately alkaline. The C horizon has hue of 2.5Y through 7.5YR. The reaction is moderately alkaline or strongly alkaline.

Histic Cryaquolls

Histic Cryaquolls are moderately deep and deep, poorly drained soils formed in alluvium. Histic Cryaquolls are on nearly level valley floors adjacent to major streams and in mountain meadow depressions adjacent to streams.

Histic Cryaquolls are similar to and are near Cumulic Cryaquolls. Cumulic Cryaquolls lack a thick organic layer at the surface.

A reference profile of Histic Cryaquolls, about 6 miles north of Grand Lake, about 300 feet east and 100 feet south of northwest corner sec. 1, T. 4 N., R. 76 W.

Oe—11 inches to 0; very dark grayish brown (10YR 3/2) hemic material, very dark brown (10YR 2/2) moist; many fine and very fine roots; abrupt smooth boundary.

A1g—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; few fine distinct mottles of yellowish brown (10YR 5/6); weak fine granular structure; soft, very friable, sticky and plastic; strongly acid; clear wavy boundary.

ACg—10 to 21 inches; light gray (5Y 7/1) silty clay loam, dark gray (5Y 4/1) moist; gleyed and common medium distinct mottles of olive yellow (2.5Y 6/6); massive; slightly hard, very friable, sticky and very plastic; strongly acid, gradual wavy boundary.

C1g—21 to 33 inches; pale yellow (5Y 7/3) silty clay, olive (5Y 5/3) moist; many medium faint mottles of yellow (5Y 7/6); massive; hard, firm, sticky and very plastic; very strongly acid; abrupt wavy boundary.

IIC2g—33 to 60 inches; sand and gravel; few fine faint colored mottles.

The thickness of the organic layer is 8 to 14 inches. Some pedons are underlain by sand and gravel at depths of 24 to 48 inches. The texture ranges from sandy loam to clay throughout the pedon. The water table is at or near the surface when the soil temperature is 32 degrees F, or higher.

Irigul series

The Irigul series consists of shallow, well drained soils that formed in material weathered from slate. Irigul soils are on mountainsides and ridges. Slopes are 6 to 30 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 8,000 to 9,000 feet.

Irigul soils are similar to Rogert soils and are near Quander and Woodhall soils. The profile of Rogert soils is less than 18 percent clay. Woodhall and Quander soils lack bedrock above a depth of 20 inches.

Typical pedon of Irigul channery loam, 6 to 30 percent slopes, about 20 miles north of Kremmling, 500 feet north and 1,500 feet east of southwest corner sec. 7, T. 3 N., R. 81 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; 25 percent channery material; neutral; clear smooth boundary.

AC—6 to 8 inches; brown (7.5YR 5/4) very channery loam, dark brown (7.5YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; 55 percent channery material; mildly alkaline; abrupt wavy boundary.

R—8 to 12 inches; hard, highly fractured slate.

The depth to bedrock ranges from 5 to 20 inches. The contents of rock fragments ranges from 35 to 75 percent by volume throughout the pedon. The fragments are predominantly less than 4 inches in length. The reaction is neutral to mildly alkaline throughout the profile.

The A1 horizon has hue of 2.5Y or 10YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 2 or 3. The C horizon, if present, has hue of 2.5Y through 7.5YR.

Lake Creek series

The Lake Creek series consists of moderately deep, well drained soils that formed in material weathered from sandstone. Lake Creek soils are on mountainsides and ridges. Slopes are 15 to 50 percent. The average annual precipitation is about 20 inches, the average annual air temperature is about 36 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,500 to 9,500 feet.

Lake Creek soils are similar to Gateway, Leadville, Frisco, Peeler, Cowdrey, and Uinta soils and are near Leadville, Uinta, Woodhall, Frisco, and Peeler soils. Frisco, Peeler, Uinta, Leadville, and Cowdrey soils do not have bedrock above 40 inches. Woodhall soils have a thicker dark colored surface layer, and Gateway has more clay in the subsoil.

Typical pedon of Lake Creek loam, 15 to 50 percent slopes, about 9 miles northwest of Granby, 2,200 feet south and 1,600 feet west of northeast corner sec. 28, T. 3 N., R. 77 W.

O1—1 inch to 0; undecomposed needles and twigs.

A2—0 to 5 inches; pine (7.5YR 7/4) loam, light brown (7.5YR 6/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; 10 percent cobbles; slightly acid; clear wavy boundary.

B&A—5 to 12 inches; 80 percent reddish yellow (7.5YR 6/6), strong brown (7.5YR 5/6) moist; and 20 percent pink (7.5YR 7/4), light brown (7.5YR 6/4) moist, stony sandy clay loam; moderate medium subangular blocky structure parting to weak fine angular blocky; slightly hard, very friable, sticky and plastic; 20 percent stones, 10 percent cobbles; slightly acid; clear wavy boundary.

B2t—12 to 28 inches; reddish yellow (7.5YR 6/6) very stony sandy clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, sticky and plastic; common thin clay films on faces of peds; 40 percent stones, 15 percent cobbles; slightly acid; gradual wavy boundary.

B3—28 to 35 inches; reddish yellow (7.5YR 6/6) extremely stony sandy clay loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; 50 percent stones, 20 percent cobbles; slightly acid; clear smooth boundary.

R—35 inches; hard, highly fractured sandstone.

The content of rock fragments in the subsoil ranges from 35 to 80 percent by volume. The depth to bedrock ranges from 20 to 40 inches.

The A2 horizon has hue of 2.5Y through 7.5YR, value of 6 or 7 dry, 3 through 6 moist, and chroma of 2 through 4. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 or 6 dry, 3 through 5 moist, and chroma of 2 through 6.

Leadville series

The Leadville series consists of deep, well drained soils that formed in material weathered from sandstone. Leadville soils are on mountainsides and ridges. Slopes are 15 to 50 percent. The average annual precipitation is about 20 inches, the average annual air temperature is about 36 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,500 to 9,500 feet.

Leadville soils are similar to Gateway, Lake Creek, Frisco, Peeler, Cowdrey, and Uinta soils and are near Lake Creek, Uinta, and Upson soils. Frisco, Peeler, and Cowdrey soils are yellower in color. The subsoil of Uinta soils is less than 35 percent rock fragments. Gateway, Upson, and Lake Creek soils have bedrock above 40 inches.

Typical pedon of Leadville stony loam, 15 to 50 percent slopes, about 5 miles southeast of Granby, 200 feet south and 100 feet west of northeast corner sec. 21, T. 1 N., R. 76 W.

O1—2 inches to 0; partially decomposed needles and twigs.

A2—0 to 11 inches; pink (5YR 7/4) stony loam, reddish brown (5YR 5/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; 15 percent stones; slightly acid; gradual smooth boundary.

B&A—11 to 19 inches; reddish brown (2.5YR 5/4) stony loam, dark reddish brown (2.5YR 4/4) moist; pink (5YR 7/4) bleached sand grains on faces of peds; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; thin nearly continuous clay films on ped faces; 25 percent stones; slightly acid; gradual wavy boundary.

B2t—19 to 38 inches; red (10R 5/6) extremely stony clay loam, dark red (10R 4/6) moist; strong medium subangular blocky structure; hard, very friable, sticky and slightly plastic; thin nearly continuous clay films on faces of peds; 75 percent stones; slightly acid; gradual wavy boundary.

B3—38 to 43 inches; red (10R 5/6) extremely stony clay loam, red (10R 4/6) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; 75 percent stones; neutral; gradual wavy boundary.

C—43 to 60 inches; red (10R 5/6) extremely stony loam, red (10R 4/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 75 percent stones; neutral.

The content of rock fragments in the B horizon ranges from 35 to 80 percent by volume. The reaction ranges from neutral to medium acid.

The A2 horizon has hue of 10YR through 5YR, value of 5 through 8 dry, 4 through 7 moist, and chroma of 2 through 4. The B2t horizon has hue of 5YR through 10R, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 through 6. It is clay loam or sandy clay loam and is extremely stony or very stony. Some pedons have a thin A1 horizon.

Leavitt series

The Leavitt series consists of deep, well drained soils that formed in local alluvial material weathered from sedimentary rock. Leavitt soils are on fans, terraces, and mountainsides. Slopes are 0 to 55 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 7,500 to 8,500 feet.

Leavitt soils are similar to Lymanson, Mayoworth, Woodhall, Cimarron, Youga, and Quander soils and are near Harsha, Roxal, and Lymanson soils. Lymanson, Mayoworth, Roxal, and Woodhall soils have bedrock above a depth of 40 inches. Cimarron, Youga, and Quander soils lack secondary lime above 40 inches. The Harsha soil has a thinner dark colored surface layer.

Typical pedon of Leavitt loam, 0 to 6 percent slopes, about 0.5 mile east of Hot Sulphur Springs, 2,600 feet east and 500 feet north of southwest corner sec. 2, T. 1 N., R. 78 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium platy structure parting to weak fine granular; very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B1—6 to 10 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21t—10 to 17 inches; brown (10YR 5/3) light clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and plastic; thin nearly continuous clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—17 to 25 inches; brown (10YR 5/3) light clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium angular blocky; slightly hard, very friable, sticky and plastic; thin continuous clay films on faces of peds; noncalcareous; mildly alkaline; clear smooth boundary.

B3ca—25 to 34 inches; light yellowish brown (10YR 6/4) light clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, very friable, sticky and plastic; calcareous; moderately alkaline; visible lime seams, clear smooth boundary.

Cca—34 to 60 inches; pale brown (10YR 6/3) light clay loam, pale brown (10YR 6/3) moist; massive; hard, very friable, sticky and plastic; calcareous; moderately alkaline; visible lime seams and streaks.

The thickness of the solum ranges from 28 to 43 inches. The content of rock fragments ranges from 0 to 15 percent by volume. The depth to calcareous material ranges from 20 to 40 inches.

The A1 horizon has hue of 2.5Y through 7.5YR, value of 3 through 5 dry, 2 or 3 moist, and chroma of 1 or 2. Reaction is neutral or mildly alkaline. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 or 6 dry, 3 through 5 moist, and chroma of 2 through 4. Reaction is neutral or mildly alkaline. The C horizon has hue of 2.5Y through 7.5YR. Reaction is moderately or strongly alkaline.

Leighcan series

The Leighcan series consists of deep, well drained soils that formed in material weathered from granite and other igneous rocks. Leighcan are on mountainsides and ridges. Slopes are 15 to 70 percent. The average annual precipitation is about 32 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is about 10 to 50 days. Elevations are 9,500 to 11,400 feet.

Leighcan soils are similar to Grenadier, Scout, and Newcomb soils and are near Newcomb, Scout, Upson, Meredith, Bross, and Mirror soils. The subsoil of Grenadier soils is more than 18 percent clay. Newcomb, Scout, and Upson soils have a base saturation greater than 60 percent to a depth of 30 inches. Meredith, Bross, and Mirror soils all have a thick dark colored surface horizon.

Typical pedon of Leighcan gravelly sandy loam, 15 to 70 percent slopes, about 25 miles south of Parshall and 6 miles up the Kinney Creek road, sec. 21, T. 2 S., R. 77 W.

O1—2 inches to 0; undecomposed needles, twigs, and leaves.

A2—0 to 5 inches; pinkish gray (7.5YR 6/2) gravelly sandy loam, brown (7.5YR 4/2) moist; weak thin platy structure; soft, very friable, slightly sticky and nonplastic; 20 percent gravel, 10 percent cobbles; strongly acid; clear smooth boundary.

B2—5 to 25 inches; brown (7.5YR 5/4) very cobbly sandy loam, dark brown (7.5YR 4/4) moist; weak coarse subangular blocky structure parting to weak

fine subangular blocky; soft, very friable, slightly sticky and nonplastic; 40 percent cobbles and 20 percent gravel; strongly acid; gradual wavy boundary.

C—25 to 60 inches; brown (10YR 5/3) very cobbly loamy sand, brown (10YR 4/3) moist; massive; loose, very friable, nonsticky and nonplastic; 35 percent cobbles and 25 percent gravel; strongly acid.

The thickness of the solum ranges from 20 to 60 inches. The content of rock fragments ranges from 35 to 60 percent by volume throughout the pedon. The rock fragments are 3 to 48 inches in diameter. Reaction ranges from medium acid to very strongly acid throughout the pedon.

The A2 horizon has hue of 7.5YR or 10YR, value of 5 through 7 dry, 4 or 5 moist, and chroma of 2 or 3. The B2 horizon has hue of 10YR or 7.5YR, value of 4 through 6 dry, 4 or 5 moist, and chroma of 3 through 6. The C horizon has hue of 7.5YR or 10YR. The control section is typically sandy loam or loam that is less than 18 percent clay. It is very gravelly, very cobbly, very stony, or very bouldery.

Lymanson series

The Lymanson series consists of moderately deep, well drained soils that formed in material weathered from limestone. Lymanson soils are on mountainsides. Slopes are 6 to 40 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 8,000 to 9,000 feet.

Lymanson soils are similar to Leavitt, Mayoworth, Woodhall, Cimarron, Youga, and Quander soils and are near Leavitt, and Roxal soils. Mayoworth, Woodhall, Cimarron, and Youga soils lack secondary lime accumulations. Leavitt soils do not have bedrock at a depth of 20 to 40 inches. Roxal soils have bedrock above 20 inches.

Typical pedon of Lymanson loam, 6 to 15 percent slopes, about 18 miles north of Kremmling, 1,800 feet west and 2,600 feet south of northeast corner sec. 1, T. 3 N., R. 82 W.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

B1—2 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

B21t—5 to 12 inches; grayish brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; calcareous; moderately alkaline; clear smooth boundary.

B22t—12 to 20 inches; grayish brown (10TY 5/2) light clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; thin nearly continuous clay films on faces of peds; calcareous; moderately alkaline; clear smooth boundary.

B3—20 to 24 inches; light grayish brown (10YR 6/2) light clay loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual smooth boundary.

C1ca—24 to 26 inches; light grayish brown (10YR 6/2) light clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; visible lime seams and limestone chips; gradual wavy boundary.

C2r—26 inches; soft limestone.

The thickness of the solum ranges from 8 to 24 inches. The content of rock fragments ranges from 0 to 35 percent by volume. The fragments are predominantly less than 1 inch in diameter.

The depth to bedrock ranges from 20 to 40 inches. Some pedons are noncalcareous in the A1 and B2t horizons.

The A1 horizon has hue of 2.5Y or 10YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 2 or 3. The reaction is neutral through moderately alkaline. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 or 6 dry, 3 or 4 moist, and chroma of 2 through 4. It is loam or clay loam. Reaction is mildly or moderately alkaline. The Cca horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 or 3. Reaction is moderately or strongly alkaline.

Mayoworth series

The Mayoworth series consists of moderately deep, well drained soils that formed in material weathered from shale. Mayoworth soils are on mountainsides. Slopes are 6 to 50 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 8,000 to 9,000 feet.

Mayoworth soils are similar to Leavitt, Lymanson, Woodhall, Cimarron, Youga, and Quander soils and are near Cimarron, Cebone, and Mord soils. Cimarron, Mord, Youga, Quander, and Leavitt soils do not have bedrock within a depth of 40 inches. The subsoil of Lymanson and Woodhall soils is less than 35 percent clay.

Typical pedon of Mayoworth clay loam, 6 to 15 percent slopes, about 2 miles east of Hot Sulphur Springs, 1,300 feet east and 2,000 feet north of southwest corner sec. 7, T. 1 N., R. 77 W.

A1—0 to 10 inches; dark grayish brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium platy structure parting to moderate medium granular; hard, friable, sticky and plastic; neutral; gradual smooth boundary.

B1—10 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; neutral; gradual smooth boundary.

B2t—13 to 24 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; strong and moderate medium angular and subangular blocky structure; very hard, firm, very sticky and very plastic; thin continuous clay films on faces of peds; neutral; clear smooth boundary.

C1—24 to 28 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; massive; very hard, firm, very sticky and very plastic; neutral; gradual wavy boundary.

C2r—28 to 49 inches; soft, partially weathered shale.

The depth to bedrock ranges from 20 to 40 inches. The content of rock fragments ranges from 0 to 15 percent by volume. The fragments are dominantly less than 1 inch in diameter. The thickness of the solum ranges from 21 to 31 inches.

The A1 horizon has hue of 5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 2 or 3. The reaction is slightly acid to mildly alkaline. The B2t horizon has hue of 5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 6. It is heavy clay loam or clay. Reaction is slightly acid to mildly alkaline. The C horizon has hue of 5Y through 7.5YR. It is a heavy clay loam or clay. Reaction is slightly acid to mildly alkaline.

Meredith series

The Meredith series consists of deep, well drained soils that formed in deeply weathered residuum from igneous rocks. Meredith soils are on alpine mountainsides. Slopes are 50 to 70 percent. The average annual precipitation is about 35 inches, the average annual air temperature is less than 32 degrees F, and the average frost-free season is 0 to 10 days. Elevations are 11,400 to 13,500 feet.

Meredith soils are similar to and are near Bross and Mirror soils. Bross soils lack a fragmental substratum. Mirror soils are 20 to 40 inches deep over bedrock.

Typical pedon of Meredith extremely stony sandy loam, 50 to 70 percent slopes, about 4 miles west of Berthoud Falls, about 300 feet west of the summit of Jones Pass; sec. 22, T. 3 S., R. 76 W.

O1—1 inch to 0; root mat.

A1—0 to 9 inches; grayish brown (10YR 5/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; very strongly acid; abrupt wavy boundary.

B21—9 to 14 inches; very pale brown (10YR 7/3) very gravelly loam; dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 20 percent angular cobbles, 40 percent fine gravel, very strongly acid; clear wavy boundary.

B22—14 to 18 inches; yellow (10YR 7/6) very gravelly loam, yellowish brown (10YR 5/6) moist; pockets of reddish yellow (7.5YR 6/6) moist; and brownish yellow (10YR 6/6) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 40 percent fine gravel and 20 percent angular cobbles; very strongly acid; clear wavy boundary.

C1—18 to 26 inches; very pale brown (10YR 8/4) very gravelly coarse sandy loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; 40 percent gravel, 20 percent angular cobbles; very strongly acid; clear wavy boundary.

IIC2—26 to 60 inches; fragmental accumulations of fractured bedrock; 90 percent angular cobbles and stones with interstices that are not filled with finer material.

Surface stoniness is 10 to 15 percent. The content of rock fragments ranges from 40 to 60 percent by volume. The depth to the fragmental material is 20 to 40 inches.

The A1 horizon has hue of 2.5Y through 7.5YR, value of 3 through 5 dry, 2 or 3 moist, and chroma of 1 through 3. Reaction ranges from strongly acid to very strongly acid. The B2 horizon has hue of 2.5Y through 5YR, value of 5 through 7 dry, 4 or 5 moist, and chroma of 3 through 6. Reaction ranges from strongly acid to very strongly acid. The C horizon, when present, has hue of 2.5Y through 7.5YR. Reaction ranges from strongly acid to very strongly acid. The control section—the B2 horizon and the upper part of the C horizon—is 18 to 35 percent clay.

Mirror series

The Mirror series consists of moderately deep, well drained soils that formed in weathered residuum from igneous rocks. Mirror soils are on alpine mountainsides. Slopes are 20 to 50 percent. The average annual precipitation is about 35 inches, the average annual air temperature is less than 32 degrees F, and the frost-free

season is 0 to 10 days. Elevations are 11,400 to 13,500 feet.

Mirror soils are similar to and are near Bross and Meredith soils. Bross soils lack bedrock within 40 inches. Meredith soils have a fragmental substratum.

Typical pedon of Mirror extremely stony sandy loam, 20 to 50 percent slopes; about 4 miles west of Berthoud Falls, along Jones Pass Road, about one-fourth mile west of the summit; sec. 27, T. 3 S., R. 76 W.

O1—1 inch to 0; organic mat of roots.
A1—0 to 8 inches; grayish brown (10YR 5/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; 20 percent stones and 40 percent gravel; very strongly acid; clear wavy boundary.
B2—8 to 20 inches; light yellowish brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 40 percent gravel and 20 percent angular cobbles; very strongly acid; gradual wavy boundary.
B3—20 to 26 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blockly structure; soft, very friable, nonsticky and nonplastic; 40 percent gravel and 20 percent angular cobbles; very strongly acid; gradual wavy boundary.
C—26 to 31 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (l0YR 5/4) moist; massive, soft, very friable, nonsticky and nonplastic; 40 percent gravel and 20 percent angular cobbles; very strongly acid; abrupt irregular boundary.
R—31 inches; hard bedrock fractured in the upper part.

Thickness of the solum ranges from 15 to 39 inches. The content of rock fragments ranges from 35 to 75 percent by volume. The rock fragments range from fine gravel to angular cobbles in size. Stones cover from 10 to 15 percent of the surface. The depth to bedrock is 20 to 40 inches.

The A1 horizon has hue of 2.5Y through 7.5YR, value of 2 through 5 dry, 2 or 3 moist, and chroma of 1 through 3. Reaction ranges from very strongly acid to strongly acid. The B2 horizon has hue of 2.5Y through 5YR, value of 5 through 7 dry, 4 or 5 moist, and chroma of 3 through 6. It is loam or sandy loam that is less than 18 percent clay. Reaction ranges from very strongly acid to strongly acid. The C horizon has hue of 2.5Y through 7.5YR. Reaction ranges from very strongly acid to strongly acid.

Mord series

The Mord series consists of deep, well drained soils that formed in glacial drift. Mord soils are on mountainsides. Slopes are 3 to 30 percent. The average annual precipitation is about 20 inches, the average annual air temperature is about 36 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,500 to 9,500 feet.

Mord soils are similar to Anvik and Cebone soils and are located near Anvik, Cebone, Mayoworth, and Cimarron soils. Cimarron soils lack an A2 horizon. The subsoil of Anvik soils is less than 35 percent clay. Cebone and Mayoworth soils have bedrock at 20 to 40 inches.

Typical pedon of Mord loam, 3 to 15 percent slopes, about 23 miles north of Kremmling and about 1,800 feet south and 1,100 feet west of northeast corner sec. 25, T. 4 N., R. 81 W.

A11—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; slightly acid; clear smooth boundary.
A12—7 to 13 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate coarse subangular blocky parting to weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; slightly acid; clear wavy boundary.
A2—13 to 18 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; slightly acid; gradual wavy boundary.
B&A—18 to 24 inches; 70 percent yellowish brown (10YR 5/4), 10 percent brown (10YR 4/3), and 20 percent very pale brown (10YR 7/3) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; thin patchy clay films on faces of peds; 15 percent fine gravel; slightly acid; gradual wavy boundary.
B2t—24 to 47 inches; yellowish brown (10YR 5/4) gravelly heavy clay loam, dark yellowish brown (10YR 4/4) moist; strong medium subangular blocky structure; hard, firm, sticky and plastic; thin nearly continuous clay films on faces of peds; 15 percent fine gravel; slightly acid; gradual wavy boundary.
B3—47 to 55 inches; light yellowish brown (10YR 6/4) gravelly clay, yellowish brown (10YR 5/4) moist; strong coarse subangular blocky structure; very hard, firm, very sticky and very plastic; thin patchy clay films on faces of peds; 25 percent gravel, 5 percent cobbles; slightly acid; gradual wavy boundary.
C—55 to 65 inches; light yellowish brown (10YR 6/4) gravelly clay, yellowish brown (10YR 5/4) moist; massive; very hard, very firm, very sticky and very plastic; 20 percent gravel; 5 percent cobbles; slightly acid.

The content of rock fragments ranges from 0 to 35 percent by volume. The A1 horizon has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 1 through 3. It is slightly acid or neutral. The A2 horizon has hue of 2.5Y through 7.5YR, value of 5 through 8 dry, 4 through 7 moist, and chroma of 1 through 4. It is slightly acid or neutral. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 through 6. It is a gravelly heavy clay loam or clay. Reaction is slightly acid or neutral. The C horizon has hue of 2.5Y through 7.5YR. Reaction is slightly acid to mildly alkaline.

Mulstay series

The Mulstay series consists of deep, well drained soils that formed in material weathered from basalt over material weathered from shale. Mulstay soils are on mountainsides. Slopes are 10 to 50 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 8,000 to 9,000 feet.

Mulstay soils are similar to Harsha, Forelle, Dahlquist, Stunner, and Boettcher soils and are near Harsha, Clayburn, and Mord soils. The subsoil of Harsha, Stunner, Forelle, and Clayburn soils averages less than 35 percent clay. Mord soils have a thick, dark colored surface layer. Boettcher soils have bedrock at a depth of 20 to 40 inches. The subsoil of Dahlquist soils is more than 35 percent rock fragments.

Typical pedon of Mulstay stony loam, 10 to 50 percent slopes, about 18 miles north of Kremmling and about 1.5 miles northeast of highway 40 on Chimney Rock Road, 1,000 feet south and 700 feet east of northwest corner of sec. 35, T. 4 N., R. 81 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) stony loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to moderate fine granular; soft, friable, slightly sticky and slightly plastic; 5 percent large basalt stones; neutral; clear wavy boundary.

B21t—4 to 11 inches; pale brown (10YR 6/3) heavy clay loam, brown (10YR 5/3) moist; strong coarse subangular structure parting to strong medium subangular blocky; hard, firm, very sticky and very plastic; thin continuous clay films on faces of peds; 2 to 5 percent angular basalt cobbles; neutral; gradual wavy boundary.

B22t—11 to 21 inches; pale brown (10YR 6/3) heavy clay loam, brown (10YR 5/3) moist; strong coarse angular blocky structure parting to strong medium subangular; very hard, very firm, very sticky and very plastic; thin continuous clay films on faces of peds; 2 to 5 percent angular basalt stones; neutral; gradual wavy boundary.

IIB23t—21 to 55 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; strong coarse angular blocky structure parting to moderate medium angular blocky; very hard, firm, very sticky and very plastic; thin nearly continuous clay films on faces of peds; few fine shale chips; noncalcareous; mildly alkaline; gradual smooth boundary.

IIB3—55 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common, medium, predominantly brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; few fine shale chips; noncalcareous; mildly alkaline; gradual smooth boundary.

IIC—60 to 72 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; many medium predominantly brownish yellow (10YR 6/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; many fine shale chips; noncalcareous; mildly alkaline.

The solum ranges from 40 to 80 inches thick. The content of rock fragments in the upper 2 feet of the pedon ranges from 0 to 10 percent by volume. The rock fragments are predominantly basalt cobbles and stones in the upper part and predominantly shale chips in the lower part.

The A horizon has hue of 10YR through 5Y, value of 4 through 6 dry, 4 or 5 moist, and chroma of 2 or 3. The B2t horizon has hue of 10YR through 5Y, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 through 5. It is heavy clay loam or clay. The C horizon has hue of 10YR through 5Y. Reaction ranges from mildly alkaline to neutral in the A1 and B2t horizons. Reaction ranges from mildly alkaline to moderately alkaline in the IIB2t and IIC.

Newcomb series

The Newcomb series consists of deep, somewhat excessively drained soils that formed in glacial drift derived mainly from granite and schist. Newcomb soils are on mountainsides and stream terraces. Slopes are 0 to 75 percent. The average annual precipitation is about 25 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is 20 to 50 days. Elevations are 8,500 to 10,000 feet.

Newcomb soils are similar to Scout, Grenadier, and Leighcan soils and are near Leighcan and Frisco soils. Grenadier and Leighcan soils are more acid. The subsoil of Scout and Frisco soils contains more clay.

Typical pedon of Newcomb gravelly sandy loam, 20 to 50 percent slopes, about 12 miles south of Parshall, 2,000 feet south and 500 feet west of northeast corner sec. 11, T. 2 S., R. 78 W.

O1—2 inches to 0; undecomposed organic material, mostly needles and twigs.
A2—0 to 12 inches; very pale brown (10YR 7/4) gravelly sandy loam, light yellowish brown (10YR 6/4) moist; weak medium granular structure; soft, very friable; 30 percent gravel; slightly acid; clear wavy boundary.
B1—12 to 22 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, yellowish brown (10YR 5/4) moist; 5 percent light brown (7.5YR 6/4) sandy loam and sandy clay loam lamellae 0.5 to 1.0 cm thick; weak medium subangular blocky structure; soft, very friable; 30 percent gravel; slightly acid; clear wavy boundary.
B2—22 to 34 inches; 80 percent light yellowish brown (10YR 6/4) very gravelly loamy sand, yellowish brown (10YR 5/4) moist; 20 percent light brown (7.5YR 6/4) sandy clay loam lamellae 0.5 to 1.5 cm thick; weak fine subangular blocky structure; soft, very friable; 50 percent gravel; medium acid; gradual wavy boundary.
B3—34 to 46 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, yellowish brown (10YR 5/4) moist; 5 percent light brown (7.5YR 6/4) sandy loam and sandy clay loam lamellae 0.5 to 1.0 cm thick; weak fine subangular blocky structure; soft, very friable; slightly acid; clear wavy boundary.
C—46 to 60 inches; light brownish gray (10YR 6/2) very gravelly sand, grayish brown (10YR 5/2) moist; single grained; soft, very friable; 60 percent gravel; slightly acid.

The content of rock fragments ranges from 35 to 80 percent by volume. The rock fragments are a half-inch to 10 inches in diameter.

The A1 horizon, if present, has hue of 5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 1 through 3. It is medium acid to neutral. The A2 horizon has hue of 5Y through 7.5YR, value of 5 through 8 dry, 4 through 7 moist, and chroma of 2 through 6. Reaction ranges from medium acid to neutral. The B2 horizon has hue of 5Y through 7.5YR, value of 5 through 8 dry, 4 through 7 moist, and chroma of 2 through 6. Reaction is medium acid to neutral. The B2 horizon has a matrix texture of loamy sand with sandy clay loam lamellae, but the texture of the B2 horizon after mixing the lamellae with the matrix is sandy loam. The C horizon has hue of 5Y through 7.5YR. Reaction ranges from medium acid to neutral.

Peeler series

The Peeler series consists of deep, well drained soils that formed in glacial drift. Peeler soils are on mountainsides, fans, and ridges. Slopes are 2 to 65 percent. The average annual precipitation is about 25 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 8,000 to 10,500 feet.

Peeler soils are similar to Frisco, Uinta, Cowdrey, Gateway, Leadville, and Lake Creek soils and are near Frisco, Uinta, Grenadier, Lake Creek, Anvik, Quander, Cowdrey, Youga, and Clayburn soils. The profile of Frisco soils is more than 35 percent rock fragments. Uinta and Leadville soils are redder in color. Gateway and Lake Creek soils have bedrock at 20 to 40 inches. Grenadier soils lack a well developed subsoil. Anvik, Quander, Youga, and Clayburn soils have a thick dark colored surface horizon. The subsoil of Cowdrey soils is more than 35 percent clay.

Typical pedon of Peeler gravelly sandy loam, 25 to 65 percent slopes, about 3 miles northeast of Granby, 1,200 feet west of 1,100 feet north of southeast corner sec. 28, T. 2 N., R. 76 W.

O2—2 inches to 0; decomposing needles and twigs.
A2—0 to 5 inches; light gray (10YR 7/2) gravelly sandy loam, grayish brown (10YR 5/2) moist; weak thin platy structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; 15 percent gravel; medium acid; gradual smooth boundary.
B&A—5 to 17 inches; brown (10YR 5/3) gravelly sandy clay loam, 65 percent dark yellowish brown (10YR 4/4), 35 percent grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, very friable, sticky and plastic; 20 percent gravel; medium acid; gradual wavy boundary.
B21t—17 to 33 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; 20 percent gravel; thin patchy clay films on faces of peds; medium acid; gradual wavy boundary.
B22t—33 to 57 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; 20 percent gravel; thin patchy clay films on faces of peds; medium acid; gradual wavy boundary.
C—57 to 65 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, sticky and plastic; medium acid.

The content of rock fragments ranges from 0 to 25 percent by volume.

The A2 horizon has hue of 2.5Y through 7.5YR, value of 5 through 8 dry, 4 through 7 moist, and chroma of 2 through 4. Reaction is medium acid to neutral. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 2 through 6. The C horizon has hue of 2.5Y through 7.5YR. Reaction is medium acid to neutral.

Pergelic Cryorthents

Pergelic Cryorthents are deep to shallow, well drained soils formed in material weathered from granite, gneiss, schist, and other metamorphic rock. Pergelic Cryorthents are on steep to extremely steep alpine mountain slopes. The average annual precipitation is 30 to 35 inches, and the average annual air temperature is 26 to 29 degrees F.

Pergelic Cryorthents are near Bross, Mirror, and Meredith soils. Bross, Mirror, and Meredith soils have a deep, dark colored surface layer.

A reference profile of Pergelic Cryorthents, about 15 miles south of Fraser along Jones Pass Road, sec. 27, T. 3 S., R. 76 W.

C1—0 to 2 inches; very pale brown (10YR 7/4) gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 25 percent gravel; very strongly acid; clear wavy boundary.

C2—2 to 10 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; soft, very friable, nonsticky and nonplastic; 30 percent gravel, 10 percent cobbles; very strongly acid; clear wavy boundary.

C3—10 to 24 inches; very pale brown (10YR 8/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; 30 percent gravel, 15 percent cobbles; very strongly acid; abrupt wavy boundary.

R—24 inches; weathered bedrock.

The depth to bedrock ranges from 5 to 60 inches or more. The content of rock fragments ranges from 15 to 80 percent by volume. The rock fragments are a half inch to 24 inches in diameter. The texture throughout the profile ranges from gravelly loam to extremely stony sandy loam.

Quander series

The Quander series consists of deep, well drained soils that formed in glacial drifts and colluvium. Quander soils are on mountainsides, ridges, and fans. Slopes are 2 to 55 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 8,000 to 9,000 feet.

Quander soils are similar to Leavitt, Lymanson, Mayoworth, Woodhall, Cimarron, and Youga soils and are near Youga, Clayburn, Woodhall, Irigul, Anvik, Cimarron, Frisco, and Peeler soils. Lymanson, Mayoworth, Woodhall, and Irigul soils have bedrock above 40 inches. The subsoil of Cimarron, Peeler, Leavitt, Anvik, Clayburn, and Youga soils is less than 35 percent rock fragments. Frisco soil has a subsurface horizon.

Typical pedon of Quander stony loam, 15 to 50 percent slopes, about 21 miles north of Kremmling, 2,640 feet east and 800 feet south of the northwest corner sec. 16, T. 4 N., R. 81 W.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) stony loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; 10 percent stones and 5 percent cobbles; neutral; clear smooth boundary.

B21t—10 to 28 inches; pale brown (10YR 6/3) very stony sandy clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; thin patchy clay films on faces of peds; 20 percent stones and 20 percent cobbles; slightly acid; clear wavy boundary.

B22t—28 to 50 inches; light yellowish brown (10YR 6/4) very stony sandy clay loam, yellowish brown (10YR 5/4) moist; strong medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, very sticky and very plastic; thin patchy clay films on faces of peds; 35 percent stones and 10 percent cobbles; slightly acid; gradual wavy boundary.

B3—50 to 57 inches; light yellowish brown (10YR 6/4) extremely stony loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; 65 percent stones and 15 percent cobbles; neutral; clear wavy boundary.

C—57 to 65 inches, light yellowish brown (10YR 6/4) extremely stony loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 65 percent stones; neutral.

Rock fragments range from 35 to 80 percent by volume in the solum and the C horizon. They are 1 to 15 inches in diameter.

The A horizon has hue of 2.5Y through 10YR, value of 3 through 5 dry, 2 or 3 moist, and chroma of 2 or 3. Reaction is slightly acid or neutral. The B2t horizon has hue of 2.5Y or 10YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 6. Reaction is slightly acid or neutral. The C horizon has hue of 5Y through 10YR. Reaction is slightly acid or neutral.

Rogert series

The Rogert series consists of shallow, well drained soils that formed in residuum from granite and gneiss. Rogert soils are on mountainsides and ridges. Slopes are 15 to 60 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 60 days. Elevations are 7,500 to 9,000 feet.

Rogert soils are similar to Irigul soils and are near Tamp, Quander, Harsha, and Leavitt soils. Tamp,

Quander, Harsha, and Leavitt soils do not have bedrock above 40 inches. The profile of Irigul soils is more than 18 percent clay.

Typical pedon of Rogert gravelly sandy loam, 15 to 60 percent slopes, about 1.5 miles east of Kremmling, 1,200 feet north and 1,100 feet west of southeast corner sec. 10, T. 1 N., R. 80 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, very friable, nonsticky and nonplastic; 20 percent gravel; noncalcareous, mildly alkaline; clear smooth boundary.

AC—5 to 8 inches; dark grayish brown (2.5Y 4/2) very gravelly sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 40 percent gravel; noncalcareous, mildly alkaline; clear smooth boundary.

C—8 to l4 inches; grayish brown (2.5Y 5/2) very gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 45 percent gravel; noncalcareous, mildly alkaline; abrupt wavy boundary.

R—14 inches; hard, partially weathered gneiss bedrock.

The depth to bedrock ranges from 10 to 20 inches. The content of rock fragments ranges from 35 to 60 percent by volume. The rock fragments are predominantly less than 1 inch in diameter.

The A horizon has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 1 through 3. Reaction is slightly acid to mildly alkaline. The C horizon has hue of 2.5Y through 7.5YR. Reaction is slightly acid to mildly alkaline.

Roxal series

The Roxal series consists of shallow, well drained soils that formed in material weathered from sandy shale. Roxal soils are on mountainsides and ridges. Slopes are 6 to 50 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the frost-free season is about 45 to 75 days. Elevations are 7,500 to 8,500 feet.

Roxal soils are similar to Upson and Waybe soils and are near Harsha and Leavitt soils. Upson, Harsha, and Leavitt soils do not have bedrock above 20 inches. The profile of Waybe soils averages more than 35 percent clay.

Typical pedon of Roxal loam, 6 to 15 percent slopes, about 1 mile north of Kremmling, 1,000 feet south of northeast corner sec. 7, T. 1 N., R. 80 W.

A1—0 to 6 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure parting to weak medium granular; soft, very friable, slightly sticky and slightly plastic; calcareous, mildly alkaline; clear smooth boundary.

AC—6 to 10 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C1—10 to 15 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive, slightly hard, very friable, slightly sticky and slightly plastic; 10 percent shale chips; lime coatings on faces of some peds; calcareous; moderately alkaline; clear wavy boundary.

Cr—15 to 20 inches; soft, partly weathered calcareous sandy shale.

The depth to bedrock ranges from 10 to 20 inches. The content of rock fragments ranges from 0 to 25 percent by volume. The rock fragments are predominantly less than 2 inches in diameter. The A horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 or 3. Reaction ranges from mildly alkaline to moderately alkaline. The C horizon has hue of 2.5Y through 7.5YR. Reaction ranges from moderately alkaline to strongly alkaline. The texture of the pedon is loam or clay loam.

Scout series

The Scout series consists of deep, well drained soils that formed in glacial drift and colluvium. Scout soils are on mountainsides, ridges, and fans. Slopes are 2 to 65 percent. The average annual precipitation is about 24 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 9,500 to 11,400 feet.

Scout soils are similar to Leighcan, Newcomb, and Grenadier soils and are near Frisco, Peeler, and Upson soils. The subsoil of Grenadier, Frisco, and Peeler soils is more than 18 percent clay. Upson soils have bedrock at a depth of 20 to 40 inches. Leighcan soils are more acid. Newcomb soils are more sandy throughout.

Typical pedon of Scout cobbly sandy loam, 15 to 65 percent slopes, about 5 miles west of Fraser, 1,800 feet west and 100 feet north of southeast corner sec. 21, T. 1 S., R. 76 W.

O1—2 inches to 0; undecomposed needles and twigs.

A1—0 to 2 inches; grayish brown (10YR 5/2) cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; 20 percent cobbles; strongly acid; clear smooth boundary.

A2—2 to 15 inches; pink (7.5YR 7/4) very cobbly loam, dark brown (7.5YR 4/4) moist; weak fine and medium granular structure; soft, very friable, non-

sticky and nonplastic; 40 percent cobbles, 10 percent gravel; strongly acid; gradual smooth boundary.

B2—15 to 42 inches; light yellowish brown (10YR 6/4) very cobbly sandy loam, yellowish brown (10YR 5/4) moist; weak moderate subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 50 percent cobbles, 10 percent gravel; strongly acid; gradual smooth boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) extremely cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 55 percent cobbles, 20 percent gravel; strongly acid.

The content of rock fragments ranges from 35 to 75 percent by volume. The rock fragments are predominantly less than 10 inches in diameter.

The A2 horizon has hue of 7.5YR or 10YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 4. Reaction is slightly acid to strongly acid. The B2 horizon has hue of 10YR through 5YR, value of 6 or 7 dry, 4 through 6 moist, and chroma of 3 through 8. Reaction is slightly acid to strongly acid.

Stunner series

The Stunner series consists of deep, well drained soils that formed in calcareous old landslide alluvium and local alluvium. Stunner soils are on toeslopes and mountainsides. Slopes are 3 to 50 percent. The average annual precipitation is about 12 inches, the average annual temperature is about 43 degrees F, the average summer air temperature is about 61 degrees F, and the frost-free season is about 80 to 110 days. Elevations are 6,600 to 7,300 feet.

Stunner soils are similar to Boettcher, Dahlquist, Forelle, Mulstay, and Harsha soils and are near Forelle, Dahlquist, and Boettcher soils. Forelle soils do not have a calcic horizon. The profile of Dahlquist soils is more than 35 percent rock fragments. Boettcher soils are 20 to 40 inches to shale. Mulstay and Harsha have a colder summer soil temperature.

Typical pedon of Stunner very cobbly loam, 15 to 55 percent slopes, about 17 miles southwest of Kremmling, 1,600 feet north and 175 feet west of southeast corner sec. 26, T. 1 S., R. 82 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure parting to weak fine granular; soft, very friable, sticky and slightly plastic; noncalcareous, mildly alkaline; 25 percent cobbles and 10 percent gravel; clear smooth boundary.

B2t—6 to 11 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; hard, friable, sticky and plastic; calcareous, moderately alkaline; few, thin clay films in faces of peds; clear smooth boundary.

B3ca—11 to 22 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; calcareous, moderately alkaline, visible seams of secondary calcium carbonate; clear wavy boundary.

C1ca—22 to 32 inches; pale brown (10YR 6/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; soft, very friable, sticky and plastic; calcareous, moderately alkaline, visible streaks and seams of secondary calcium carbonate; gradual wavy boundary.

C2ca—32 to 65 inches; very pale brown (10YR 8/2) loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; moderately alkaline; segregated and secondary lime accumulations.

The content of rock fragments ranges from 0 to 15 percent by volume in the solum and C horizon and from 35 to 50 percent in the surface layer.

The A1 horizon has hue of 2.5Y through 7.5YR, value of 4 through 7 dry, 3 through 5 moist, and chroma of 2 or 3. Reaction is neutral or mildly alkaline. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 or 5 moist, and chroma of 2 through 6. Reaction is mildly alkaline to moderately alkaline. The C horizon has hue of 2.5Y through 7.5YR. Reaction is mildly alkaline to strongly alkaline.

Sudduth series

The Sudduth series consists of deep, well drained soils that formed in local alluvial sediments from shale and basalt. Sudduth soils are on mountainsides, swales, and depressions. Slopes are 6 to 30 percent. The average annual precipitation is about 25 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,000 to 9,500 feet.

Sudduth soils are similar to Clayburn and Benteen soils and are near Clayburn, Cimarron, Mord, and Cowdrey soils. The subsoil of Clayburn soils averages less than 35 percent clay. Benteen soils have bedrock at 20 to 40 inches. Cimarron and Cowdrey soils do not have a thick, dark colored surface layer. Mord soils have a subsurface horizon.

Typical pedon of Sudduth loam, 15 to 30 percent slopes, about 29 miles north of Kremmling near Arapahoe Pass, 2,560 feet south and 700 feet east of northwest corner sec. 29, T. 5 N., R. 81 W.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, slightly sticky

and slightly plastic; slightly acid; clear wavy boundary.

A12—5 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky parting to weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B1—13 to 19 inches; brown (10YR 5/3) light clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; hard, firm, sticky and plastic; few basaltic stones scattered throughout horizon; slightly acid; clear wavy boundary.

IIB21t—19 to 28 inches; brown (10YR 5/3) heavy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few moderate thick clay films on faces of peds; few small slickensides on faces of peds; neutral; gradual wavy boundary.

IIB22t—28 to 43 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; strong medium subangular blocky structure parting to moderate medium angular blocky; very hard, very firm, very sticky and very plastic; common moderately thick clay films on faces of peds; few small slickensides on faces of peds; neutral; gradual wavy boundary.

IIB3—43 to 50 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; very hard, very firm, very sticky and very plastic; cracks between ped faces when dry; neutral; gradual wavy boundary.

IIC—50 to 60 inches; light olive brown (2.5Y 5/4) channery clay loam, olive brown (2.5Y 4/4) moist; massive; hard, very firm, sticky and plastic; 25 percent shale chips; neutral.

The content of rock fragments ranges from 0 to 35 percent by volume. The rock fragments are predominantly less than 3 inches in diameter.

The A horizon has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 1 through 3. Reaction is slightly acid or neutral. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 6. It is loam or clay loam in the upper part and clay in the lower part. Reaction is slightly acid or neutral. The C horizon has hue of 5Y through 7.5YR. Reaction is slightly acid to mildly alkaline.

The Sudduth soils in this survey area do not have an A2 or a B&A horizon. Also, the contrast in texture between the upper part and lower part of the pedon is not so marked as is typical of the Sudduth series.

Tamp series

The Tamp series consists of deep, well drained soils that formed in material weathered from metamorphic rock and granite. Tamp soils are on mountainsides and ridges. Slopes are 3 to 60 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 7,500 to 8,500 feet.

Tamp soils are similar to Tine soils and are near Harsha, Quander, Youga, Rogert, and Leavitt soils. The profile of Tine and Quander soils is more than 35 percent rock fragments. Harsha, Youga, and Leavitt soils have a well developed subsoil. Rogert soils have bedrock at a depth of 10 to 20 inches.

Typical pedon of Tamp gravelly sandy loam, 15 to 60 percent slopes, about 5 miles south of Granby, 1,200 feet north and 1,000 feet west of southeast corner sec. 20, T. 1 N., R. 76 W.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky parting to weak fine granular structure; soft, very friable, nonsticky and nonplastic; 20 percent gravel; slightly acid; clear smooth boundary.

B2—10 to 22 inches; brown (10YR 5/3) gravelly sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20 percent gravel; neutral; clear smooth boundary.

C—22 to 60 inches; brown (7.5YR 5/4) gravelly sandy clay loam, dark brown (7.5YR 4/4) moist; massive, hard, very friable, nonsticky and nonplastic; 20 percent gravel; neutral.

The thickness of the solum ranges from 18 to 36 inches. The content of rock fragments ranges from 15 to 35 percent by volume in the solum and C horizon. The rock fragments are predominantly less than 1 inch in diameter. Reaction is slightly acid or neutral throughout.

The A horizon has hue of 2.5Y through 7.5YR, value of 3 through 5 dry, 2 or 3 moist, and chroma of 1 through 3. The B horizon has hue of 2.5Y through 7.5YR, value of 4 through 6 dry, 3 through 5 moist, and chroma of 3 through 6. It is typically a gravelly sandy clay loam or gravelly clay loam. The C horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 4 through 6 moist, and chroma of 3 through 6. It ranges from gravelly sandy loam through gravelly clay loam.

Tine series

The Tine series consists of deep, well drained soils that formed in alluvial outwash. Tine soils are on fans and terraces. Slopes are 0 to 55 percent. The average annual precipitation is about 14 inches, the average

annual air temperature is about 39 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 7,500 to 8,500 feet.

Tine soils are similar to Tamp soils and are near Cumulic Cryaquolls, Harsha, and Leavitt soils. The profile of Tamp, Harsha, and Leavitt soils is less than 35 percent rock fragments. Cumulic Cryaquolls are poorly drained.

Typical pedon of Tine gravelly sandy loam, 0 to 3 percent slopes, about 3 miles south of Kremmling and 0.7 mile south of Yust Ranch, about 800 feet east and 750 feet north of southwest corner sec. 29, T. 1 N., R. 81 W.

A1—0 to 9 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak thin platy structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; 15 percent gravel; noncalcareous, mildly alkaline; clear smooth boundary.

AC—9 to 14 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent cobbles, 25 percent gravel; noncalcareous, mildly alkaline; clear smooth boundary.

C1—14 to 23 inches; pale brown (10YR 6/3) very cobbly loamy sand, dark brown (10YR 4/3) moist; single grain; soft, very friable, nonsticky and nonplastic; 20 percent cobbles, 35 percent gravel; noncalcareous, mildly alkaline; clear smooth boundary.

IIC2—23 to 60 inches; pale brown (10YR 6/3) extremely cobbly sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; 45 percent cobbles, 30 percent gravel; noncalcareous, mildly alkaline.

The thickness of the A and AC horizons ranges from 12 to 22 inches. The content of rock fragments ranges from 20 to 80 percent. The rock fragments are predominantly less than 6 inches in diameter. Reaction is neutral to mildly alkaline throughout.

The A horizon has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 1 through 3. The C horizon has hue of 2.5Y through 7.5YR.

Tolman series

The Tolman series consists of shallow, well drained soils that formed in granite. Tolman soils are on mountainsides. Slopes are 15 to 50 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, the average annual summer air temperature is about 61 degrees F, and the frost-free season is about 80 to 110 days. Elevations are 6,600 to 7,800 feet.

Tolman soils are similar to Rogert soils and are near Dahlquist, Stunner, and Forelle soils. Rogert soils have colder summer soil temperatures. Dahlquist, Forelle, and Stunner do not have bedrock within 60 inches.

Typical pedon of Tolman stony loam, 15 to 50 percent slopes, about 16 miles southwest of Kremmling, about 1,600 feet west and 400 feet south of northeast corner sec. 24, T. 1 S., R. 82 W.

A1—0 to 7 inches; brown (7.5YR 5/2) stony loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B1—7 to 11 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent gravel, 5 percent angular cobbles; neutral; clear wavy boundary.

B2t—11 to 17 inches; brown (7.5YR 4/2) very gravelly sandy clay loam, dark brown (7.5YR 4/2) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slighty plastic; few moderately thick clay films on faces of peds; 35 percent gravel and 10 percent angular cobbles; neutral; abrupt smooth boundary.

R—17 inches; unweathered schist and granite.

The thickness of the solum is 12 to 20 inches. The depth to bedrock is 10 to 20 inches. Rock fragments range from 35 to 75 percent by volume.

The A1 horizon has hue of 5YR through 10YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 2 or 3. Reaction is neutral or mildly alkaline. The B2t horizon has hue of 10YR or 7.5YR, value of 4 through 6 dry, 2 through 4 moist, and chroma of 2 through 4. It is very gravelly sandy clay loam or very gravelly clay loam. Reaction is neutral or mildly alkaline.

Torriorthents

Torriorthents are shallow to deep, well drained soils formed in colluvium and residuum. Torriorthents are on steep and very steep mountainsides. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free season is 80 to 110 days.

Torriorthents are near Tolman, Forelle, Dahlquist, and Stunner soils. Tolman, Forelle, Dahlquist, and Stunner soils have a well developed subsoil.

A reference profile of Torriorthents, about 10 miles southwest of Kremmling, along the Trough Road, in northwest quarter of sec. 18, T. 1 S., R. 81 W.

A1—0 to 2 inches; light yellowish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate fine granular structure; hard, firm, very sticky and very plastic; calcareous, moderately alkaline; abrupt smooth boundary.

C1ca—2 to 13 inches; light gray (2.5Y 7/2) channery silty clay, light brownish gray (2.5Y 6/2) moist; massive, hard, firm, very sticky and very plastic; 30 percent shale chips; many soft masses of secondary calcium carbonate; moderately alkaline; clear wavy boundary.

C2—13 to 21 inches; light gray (2.5Y 7/2) very channery silty clay, light brownish gray (2.5Y 6/2) moist; massive; very hard, very firm, very sticky and very plastic; 60 percent shale chips; calcareous, moderately alkaline; clear wavy boundary.

C3r—21 inches; weathered shale.

The depth to sandstone or shale ranges from 10 to 60 inches or more. The texture of the control section ranges from sandy loam to silty clay. The content of rock fragments ranges from 15 to 60 percent by volume. The rock fragments range from one-fourth inch shale chips to 10-inch-diameter stones.

Uinta series

The Uinta series consists of deep, well drained soils that formed in glacial drift and material weathered from metamorphic rock. Uinta soils are on fans, mountainsides, and ridges. Slopes are 2 to 50 percent. The average annual precipitation is about 25 inches, the average annual air temperature is about 35 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,500 to 9,500 feet.

Uinta soils are similar to Gateway, Lake Creek, Leadville, Frisco, Peeler, and Cowdrey soils and are near Upson, Frisco, Peeler, Anvik, and Youga soils. The profile of Frisco and Leadville soils is more than 35 percent rock fragments. Anvik, Youga, Cowdrey, Upson, Peeler, Gateway, Lake Creek, and Peeler soils are yellower than Uinta soils.

Typical pedon of Uinta sandy loam, 15 to 50 percent slopes, about 8 miles north of Granby, 50 feet north and 20 feet east of southwest corner sec. 14, T. 3 N., R. 76 W.

O1—2 inches to 0; decomposed needles and twigs.

A2—0 to 7 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to moderate fine granular; soft, very friable, nonsticky and nonplastic; 10 percent gravel and cobbles; medium acid; gradual smooth boundary.

A&B—7 to 18 inches; 60 percent light gray (10YR 7/2), 40 percent reddish brown (5YR 5/3) sandy clay loam, reddish brown (5YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 10 percent gravel and cobbles; medium acid; gradual wavy boundary.

B2t—18 to 45 inches; reddish brown (5YR 5/3) sandy clay loam, reddish brown (5YR 4/3) moist; moderate and strong subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of peds; 10 percent gravel and cobbles; slightly acid; gradual wavy boundary.

C—45 to 60 inches; reddish brown (5YR /54) very cobbly sandy loam, reddish brown (5YR 4/4) moist; massive; hard, very friable, nonsticky and nonplastic; 25 percent gravel and 15 percent cobbles; slightly acid.

The thickness of the solum ranges from 36 to 52 inches. The content of rock fragments ranges from 5 to 25 percent by volume in the solum. The fragments are predominantly less than 1 inch in diameter. The content of rock fragments ranges from 20 to 50 percent by volume in the C horizon. The rock fragments are 1 to 6 inches in diameter.

Typically, reaction throughout the pedon is slightly acid or neutral. In some pedons it is medium to slightly acid.

The A2 horizon has hue of 10YR or 7.5YR, value of 6 through 8 dry, 5 through 7 moist, and chroma of 2 through 4. The B2t horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 through 5. It is sandy clay loam or clay loam. The C horizon has hue of 7.5YR through 2.5YR.

Upson series

The Upson series consists of moderately deep, well drained soils that formed in weathered granite. Upson soils are on mountainsides and ridges. Slopes are 6 to 65 percent. The average annual precipitation is about 20 inches, the average annual air temperature is about 40 degrees F, and the frost-free season is about 30 to 50 days. Elevations are 8,500 to 10,000 feet.

Upson soils are similar to Roxal and Waybe soils and are near Scout, Frisco, Peeler, and Grenadier soils. Scout, Frisco, Peeler, and Grenadier soils do not have bedrock above 40 inches. Roxal and Waybe soils have bedrock above 20 inches.

Typical pedon of Upson stony sandy loam, 15 to 65 percent slopes, about 10 miles southeast of Granby, 2,640 feet west and 50 feet south of northeast corner sec. 34, T. 1 N., R. 75 W.

O1—1 inch to 0; undecomposed needles and twigs.

A1—0 to 18 inches; pale brown (10YR 6/3) stony sandy loam, dark brown (10YR 4/3) moist; weak coarse granular structure; soft, very friable, nonsticky and nonplastic; 10 percent stones, 15 percent gravel; slightly acid; clear wavy boundary.

AC—18 to 33 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist, weak medium and coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 10 percent gravel; slightly acid; gradual wavy boundary.

C1—33 to 36 inches; grayish brown (10YR 5/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 10 percent gravel; slightly acid; gradual wavy boundary.
C2r—36 to 60 inches; highly weathered granite rock.

The depth to bedrock ranges from 20 to 40 inches. Stones ranging from 10 inches to more than 25 inches in diameter cover 20 to 25 percent of the surface. The content of rock fragments ranges from 0 to 25 percent by volume in the major part of the pedon. The rock fragments range from one-fourth to 1 inch in diameter.

The A horizon has hue of 2.5Y through 7.5YR, value of 6 through 8 dry, 4 or 5 moist, and chroma of 2 through 4. The C horizon has hue of 2.5Y through 7.5YR. Reaction ranges from medium acid to neutral throughout the pedon.

Waybe series

The Waybe series consists of shallow, well drained soils that formed in shale and mudstone. Waybe soils are on mountain ridges. Slopes are 10 to 55 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 39 degrees F, and the frost-free season is about 45 to 75 days. Elevations are 7,500 to 8,500 feet.

Waybe soils are similar to Roxal and Upson soils and are near Aaberg and Binco soils. The profile of the Roxal soil averages less than 35 percent clay. Aaberg and Upson soils have bedrock at a depth of 20 to 40 inches. Binco soil lacks bedrock above 40 inches.

Typical pedon of Waybe clay loam, 10 to 55 percent slopes, about 12 miles north of Kremmling, 2,000 feet west and 100 feet south of northeast corner sec. 20, T. 3 N., R. 81 W.

A1—0 to 5 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, sticky and plastic; calcareous, moderately alkaline; clear smooth boundary.
AC—5 to 11 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; calcareous, moderately alkaline; clear smooth boundary.
C1—11 to 16 inches; light grayish brown (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; calcareous, moderately alkaline; 25 percent shale chips; abrupt smooth boundary.
C2r—16 to 24 inches; soft, partly weathered shale.

The depth to bedrock is 10 to 20 inches. The content of shale fragments ranges from 0 to 35 percent by volume. The shale fragments are predominantly less than 1 inch in diameter.

The A1 horizon has hue of 5Y through 10YR, value of 5 through 7 dry, 4 or 5 moist, and chroma of 2 or 3. Reaction is mildly alkaline or moderately alkaline. The C horizon has hue of 5Y through 10YR, value of 6 through 8 dry, 4 through 6 moist, and chroma of 2 or 3. Reaction is moderately alkaline or strongly alkaline.

Woodhall series

The Woodhall series consists of moderately deep, well drained soils that formed in material weathered from sandstone and basalt. Woodhall soils are on mountainsides, ridges, and foot slopes. Slopes are 6 to 50 percent. The average annual precipitation is about 15 inches, the average annual air temperature is about 40 degrees F, and the frost-free season is about 35 to 75 days. Elevations are 8,000 to 9,000 feet.

Woodhall soils are similar to Leavitt, Lymanson, Mayoworth, Cimarron, Youga, and Quander soils and are near Quander, Irigul, Youga, and Lake Creek soils. Leavitt, Cimarron, Youga, and Quander soils do not have bedrock at a depth of 20 to 40 inches. The subsoil of Mayoworth soils is more than 35 percent clay. Irigul soils have bedrock at a depth of 5 to 20 inches. Lake Creek soils lack a dark colored surface layer. Lymanson soils are calcareous and their profile is less than 35 percent rock fragments.

Typical pedon of Woodhall loam, 15 to 50 percent slopes, about 5 miles southeast of Granby, 1,000 feet south and 50 feet west of northeast corner sec. 16, T. 1 N., R. 75 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; 10 percent gravel; neutral; clear smooth boundary.
B1—8 to 12 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; 10 percent gravel; neutral; clear smooth boundary.
B2t—12 to 18 inches; brown (7.5YR 5/4) very stony clay loam, dark brown (7.5YR 4/4/) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of peds; 40 percent stones, 5 percent cobbles, 5 percent gravel; neutral; clear smooth boundary.
C—18 to 30 inches; brown (7.5YR 5/4) very stony loam, dark brown (7.5YR 4/4) moist; massive; very hard, friable, nonsticky and nonplastic; 50 percent stones,

5 percent cobbles, 5 percent gravel; neutral; abrupt smooth boundary.
R—30 to 40 inches; hard, highly fractured sandstone.

The depth to bedrock ranges from 20 to 40 inches. The content of rock fragments ranges from 35 to 75 percent by volume in the B2 and C horizons. The rock fragments are predominantly more than 10 inches in diameter. Reaction is slightly acid to neutral throughout.

The A horizon has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 2 or 3. The B2t horizon has hue of 2.5Y through 7.5YR, value of 4 through 6 dry, 2 through 5 moist, and chroma of 2 through 5. The C horizon has hue of 2.5Y through 7.5YR.

Youga series

The Youga series consists of deep, well drained soils that formed in glacial drift and colluvium. Youga soils occupy mountain fans, swales, and depressions. Slopes are 2 to 45 percent. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is about 30 to 60 days. Elevations are 8,000 to 9,000 feet.

Youga soils are similar to Leavitt, Lymanson, Mayoworth, Woodhall, Cimarron, and Quander soils and are near Leavitt, Woodhall, Cimarron, Clayburn, Anvik, and Quander soils. Leavitt and Lymanson soils have a secondary lime accumulation in the subsoil. Mayoworth and Woodhall soils have bedrock above 40 inches. The subsoil of Cimarron soils averages more than 35 percent clay. Clayburn soils have a dark colored surface layer more than 16 inches thick. The subsoil of Quander soils is more than 35 percent rock fragments. Anvik soils have a light colored A2 horizon below the surface layer.

Typical pedon of Youga loam, 6 to 15 percent slopes, about 3.5 miles south of Kremmling about 1,000 feet east and 750 feet south of northwest corner sec. 31, T. 1 N., R. 80 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; soft, friable, nonsticky and nonplastic; 5 percent fine gravel; noncalcareous, mildly alkaline; clear smooth boundary.
B1—4 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; 5 percent fine gravel; thin patchy clay films on faces of peds; noncalcareous, mildly alkaline; clear smooth boundary.
B2t—14 to 40 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; 5 percent fine gravel; thin continuous clay films on faces of peds; noncalcareous, mildly alkaline; gradual wavy boundary.
B3—40 to 56 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate coarse subangular blocky structure parting to weak fine subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; 10 percent fine gravel; thin patchy clay films on faces of peds; neutral; gradual wavy boundary.
C—56 to 60 inches; reddish yellow (7.5YR 6/7) clay loam, strong brown (7.5YR 5/6) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; 10 percent fine gravel; neutral.

The content of rock fragments ranges from 0 to 25 percent by volume. The rock fragments are predominantly less than 3 inches in diameter. Reaction is slightly acid to mildly alkaline.

The A horizon has hue of 2.5Y through 7.5YR, value of 3 through 5 dry, 2 or 3 moist, and chroma of 1 through 3. The B2t horizon has hue of 2.5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 2 through 6. The C horizon has hue of 2.5Y through 7.5YR.

Formation of the soils

The paragraphs that follow describe the factors and processes of soil formation as they are related to the soils in the survey area.

Soils vary according to variations in the factors of soil formation, that is, the climate, living organisms, time, relief, and parent material. As a result of these varying factors in the survey area, many different kinds of soils have formed.

Climate

The climate of the survey area is highly diverse. The average annual precipitation ranges from 11 inches at Kremmling to 41 inches near Corona Pass. The average annual temperature ranges from 41 degrees F, at Radium to 27.8 degrees F, near Corona Pass. In addition to these large scale variations in climate, there are also local variations. North- and east-facing slopes tend to be colder than south- and west-facing slopes. Areas of locally higher relief, such as Junction Butte and Wolford Mountain, tend to receive greater amounts of precipitation than surrounding areas at lower elevation.

Soils that receive more precipitation show a greater degree of leaching. In grassland areas, a greater accumulation of organic matter in the surface is a result of more precipitation. This is one reason that Harsha soils are developed to a lesser degree than Youga soils.

The temperature of the soil affects the rate of biological activity and chemical reaction. Clay formation tends

to be slower in a cold soil, such as Newcomb, than in a warmer soil, such as Forelle. The production of organic matter is small and the breakdown of organic material into organic acids is slow in a cold soil like Mirror. The action of microorganisms is very slow when the soil temperature is below 41 degrees F. The temperature is below 41 degrees F for approximately 6 months in Harsha and Leavitt soils and for approximately 9 months in Newcomb soils.

Living organisms

Of all the living organisms in or on the soil, plants have had the greatest influence on the formation of the different kinds of soils in the survey area. On soils in the grassland and aspen areas, the surface layer is high in organic-matter content. In the coniferous forest areas, the surface layer is leached of bases and is low in organic-matter content. For example, Quander soils formed under grass and Frisco soils under trees. Soils supporting greater amounts of grassland vegetation contain more organic matter. The Clayburn soil, for example, has an organic rich horizon 16 or more inches thick.

Earthworms have had some influence on soil formation in soils that are rich in organic matter and are moist most of the time. Earthworm activity in mixing the soil horizons is evident in Cumulic Cryaquolls and in Mord and Anvik soils.

Man has influenced soil formation through irrigation and fertilization. In irrigating, man has hastened the leaching process. Haying on irrigated fields sometimes results in an increase in the return of organic matter to the surface layer because additional leaves and stems are left on the surface to decay.

Time

To determine which soils are the oldest, one must rely on the relative age of the landscape upon which the soils formed. Since the genetic development of some soils has been slowed down by cold temperatures and of others by low precipitation, the degree of horizonation cannot always be used in determining soil age.

The youngest soils are the alluvial fans and flood plains. Cumulic Cryaquolls is an example of a young soil. High terrace soils, such as Tine soils, are older than Cumulic Cryaquolls but are younger than upland soils, such as Harsha and Leavitt soils. Harsha soils of the upland and Newcomb soils of the high mountains are approximately the same age. Because the Newcomb soil has coarse textured parent material and a cold soil temperature, however, it shows a lesser degree of soil development.

Mulstay and Mord soils, which are older than Harsha soils, occur on old mountainsides. Because little information is available on the relative landscape age of Frisco, Peeler, and Uinta soils, it is difficult to estimate their age. They are probably as old as Mulstay or Mord soils, or older.

Relief

Slope, aspect, elevation, and position on the landscape affect soil development.

Steep soils lose some of the precipitation they receive to runoff. They are also subject to erosion resulting in loss of topsoil. Gently sloping soils are not subject to so great a loss of soil and water. Thus, they commonly have a thicker surface layer and are leached to a greater depth.

Soils having west and south aspects are warmer than soils having north and east aspects. On the west- and south-facing slopes, therefore, some precipitation is lost through evaporation, and the soils are not leached to so great a depth as those on north- and east-facing slopes. They also contain less organic matter.

Soils at the lower elevations are warmer and receive less precipitation than those at higher elevations.

Soils on flood plains are subject to a high water table. A high water table inhibits leaching but may result in a soil rich in organic matter, such as Cumulic Cryaquolls. Soils in drainageways, for example, Leavitt and Clayburn soils, commonly have a thicker, darker surface layer than the adjacent soils. Soils on toe slopes commonly receive additional moisture as runoff from soils that occupy higher positions on the slope.

Parent material

The chemical and physical characteristics of parent material have an affect on the rate of soil formation. A long time is needed for parent material that is hard, is coarse textured, or contains minerals that break down slowly. A long time is needed also for parent material that contains high amounts of salts to develop into a soil suitable for the growth of plants other than salt tolerant species. The parent material in the Grand County survey area includes sedimentary rocks, igneous rocks, metamorphic rocks, volcanic ash, landslide deposits, glacial till, and mixed alluvium.

Types of sedimentary rocks in the survey area are hard sandstone, sandy shale, clayey shale, and limestone. Irigul soils and Woodhall soils developed in hard slate and sandstone. Because slate and sandstone break down very slowly, these soils have a high content of rock fragments and are shallow or moderately deep to bedrock. They reflect the yellowish brown color of the rock. The Roxal soil developed in sandy shale. Because the sandy shale breaks down easily, this soil has only a few rock fragments. The underlying bedrock has weathered to a depth of only 10 or 20 inches. The sandy shale weathers to loam or sandy loam. The yellowish brown color of the Roxal soil is inherited from the sandy shale. Binco, Aaberg, Waybe, and Mayoworth soils formed in

clayey shale. These soils have a clay texture and the grayish color of shale. The shale parent material of the Binco, Aaberg, and Waybe soils had a high content of gypsum and sodium salts. Consequently, those soils are strongly alkaline. The underlying bedrock has weathered to a depth of only 10 to 20 inches in the Waybe soil and 20 to 40 inches in the Aaberg soil. The Lymanson soil developed in limestone. Thus, it has a high content of calcium carbonate.

Newcomb, Upson, and Leighcan soils developed in igneous parent material. Upson soils developed in granite, which is high in quartz. Newcomb and Leighcan soils developed in mixed granite, gneiss, and schist. They reflect the highly micaceous nature of the gneiss and schist. They are coarse textured and acidic in reaction.

The volcanic ash in the survey area forms medium and fine textured soils. Harsha, Leavitt, and Youga soils formed in medium textured hard volcanic ash. Gateway and Cowdrey formed in fine textured volcanic ash. In some areas the volcanic ash is hard and resistant to weathering. The moderately deep, fine textured Gateway soil formed in this material.

Frisco and Quander soils formed in landslide deposits. They have a high content of sandstone and basalt stones.

Glacial activity was mainly confined to the higher mountains. Newcomb and Leighcan soils formed in glacial deposits.

Tine soils formed in coarse textured alluvium from the Colorado River and its major tributaries. The Tine soil is sandy and has a high content of rounded cobbles and gravel. Soils formed in local alluvium on toe slopes and in small drainageways are the Clayburn, Youga, Peeler, and Leavitt soils. These soils reflect the texture of the adjacent soils and contain few rock fragments.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

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 coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Compressible. Excessive decrease in volume of soft soil under load.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer

within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called

the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Landslide. The rapid downhill movement of a mass of soil and loose rock generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

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 wind.

Low strength. Inadequate strength for supporting loads.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

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 the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
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

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

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. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally, refers to a leached horizon lighter in color and lower

in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.
Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.
Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

ILLUSTRATIONS

Figure 1.—Lodgepole pine on Scout-Upson unit. Approximately 45 percent of the Grand County Area is lodgepole pine, Engelmann spruce, and subalpine fir woodland.

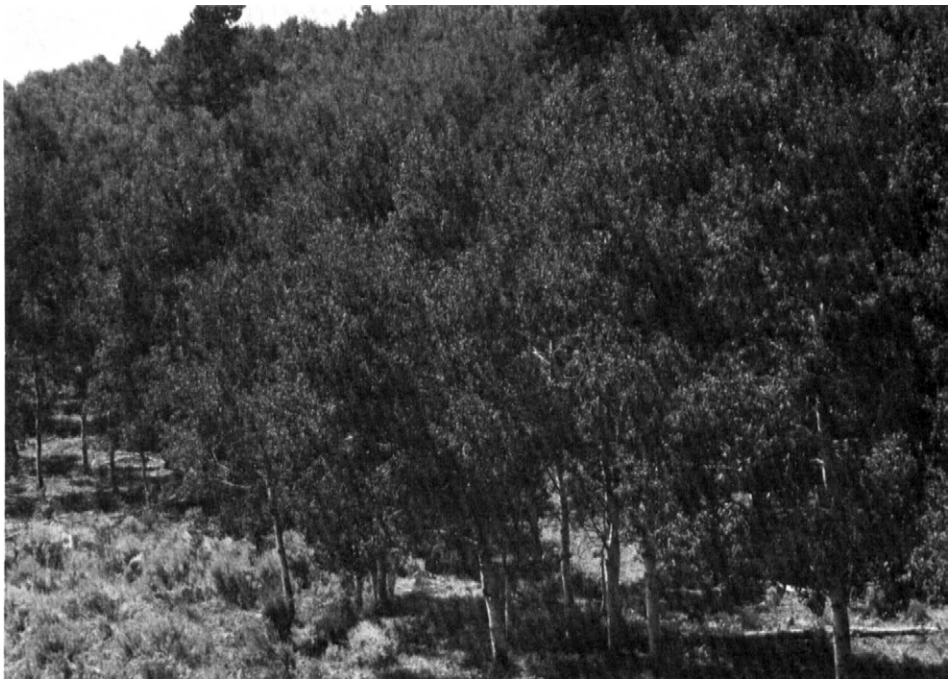

Figure 2.—Overstory of aspen and understory of abundant grasses and forbs on Anvik loam. These areas provide good summer range for cattle

Figure 3.—Subalpine Loam range site on Benteen loam. The small amount of sagebrush indicates that this site is in good condition and has not been highly overgrazed.

Figure 4.—Subalpine Loam range site on Benteen loam. This highly productive site is used for livestock grazing in summer and by big game in spring and fall. Sagebrush control is needed to improve grass production.

Figure 5.—Deep Clay Loam range site on Binco clay loam. The background shows high erosion and sparse vegetation on Cryorthents-Rock outcrop complex.

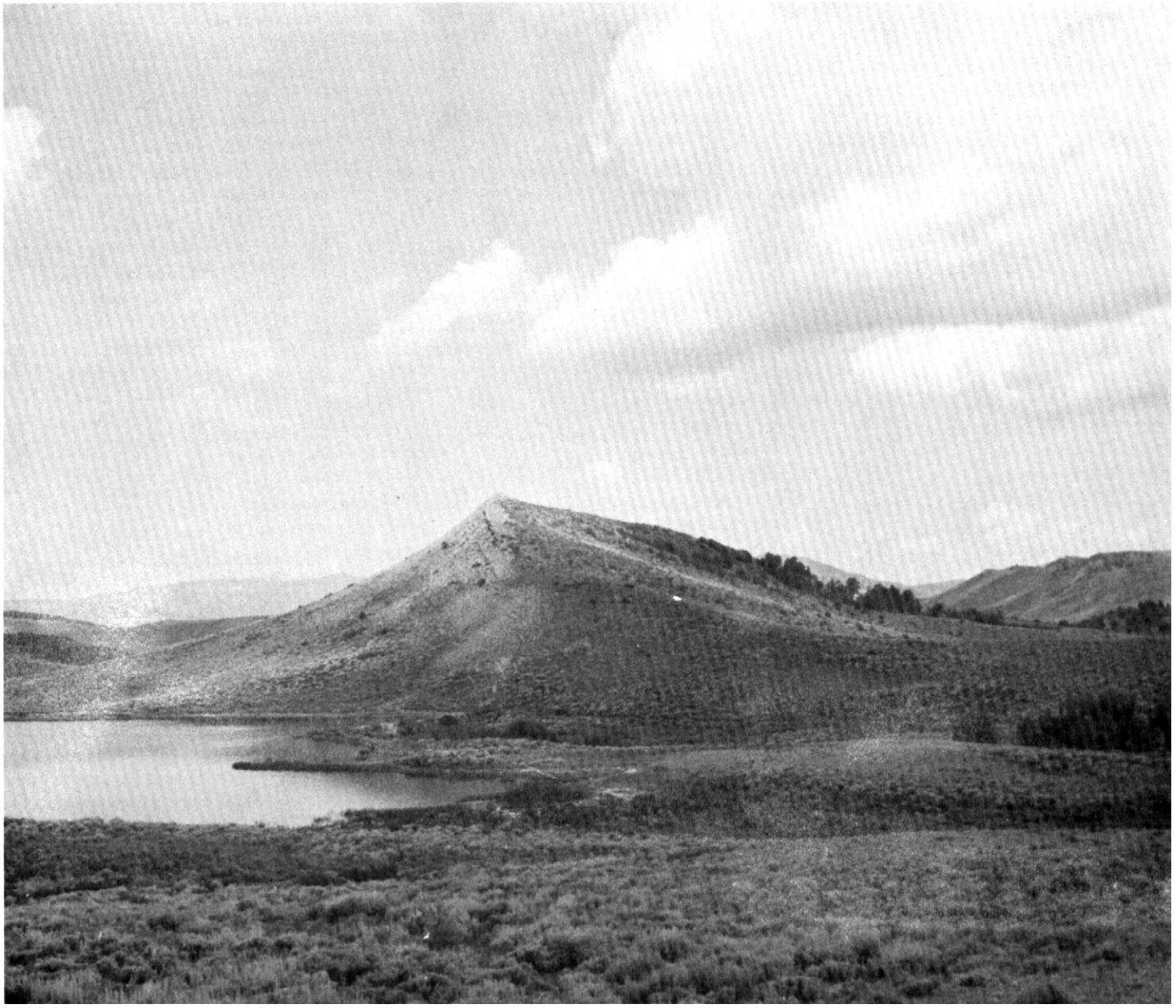

Figure 6.—Cimarron loam in foreground and typical landscape of Cryorthents-Rock outcrop complex in background. The slow permeability of the Cimarron loam makes this a good soil for stockwater ponds and small irrigation reservoirs.

Figure 7.—Subalpine Loam range site on Clayburn loam in foreground, Anvik loam under the aspens, and Rock outcrop-Cryoborolls complex in background.

Figure 8.—Irrigated hay on Cumulic Cryaquolls. These soils are on the nearly level terraces along the Colorado River and its tributaries.

Figure 9.—Profile of stony Dahlquist soil.

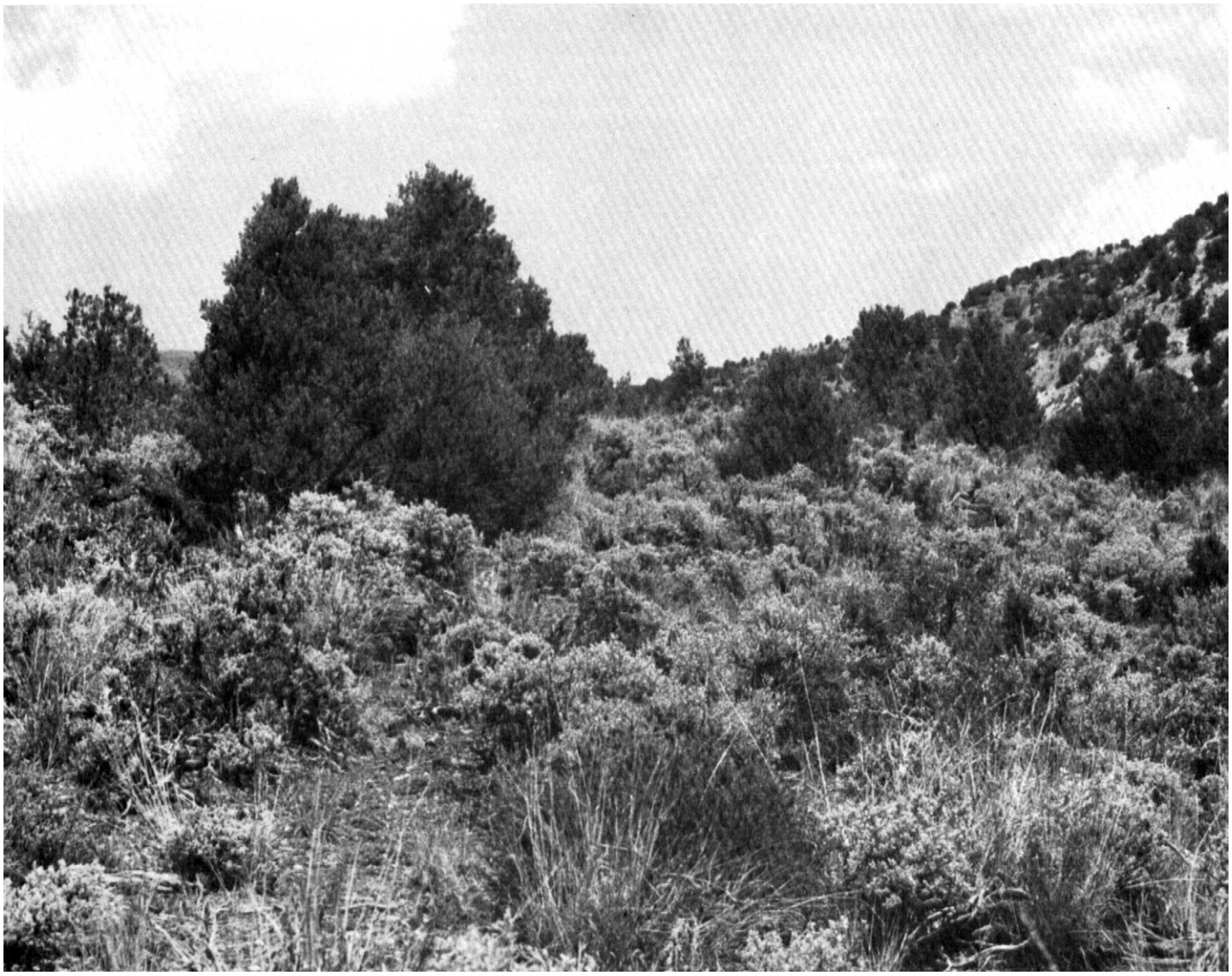

Figure 10.—Browse species on Dahlquist-Stunner soils provide good winter range for big game.

Figure 11.—Lodgepole pine on Frisco-Peeler complex. The lodgepole pine in the Grand County Area provides telephone poles and saw timber.

Figure 12.—Typical vegetation and landscape of Histic Cryaquolls in foreground and Upson stony sandy loam in background.

Figure 13.—Stand of lodgepole pine on Leighcan bouldery sandy loam. The native stand of spruce-fir was destroyed by fire.

Figure 14.—Highly productive Subalpine Loam range site and small scattered patches of aspen on Mord loam. These areas provide summer habitat for big game.

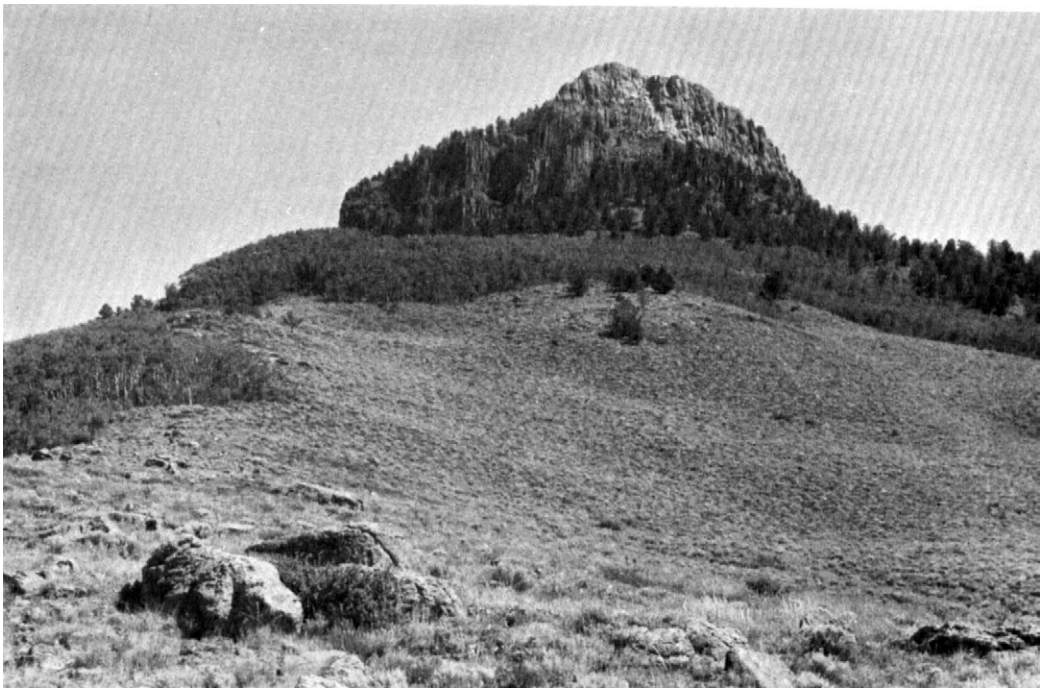

Figure 15.—Typical landscape of Quander Stony Loam range site in foreground, Anvik loam under the aspens, and Rock outcrop-Cryoboralfs complex in background.

Figure 16.—Stony Loam range site in fair condition on Quander stony loam. In the area where sagebrush was removed, grasses and forbs are abundant.

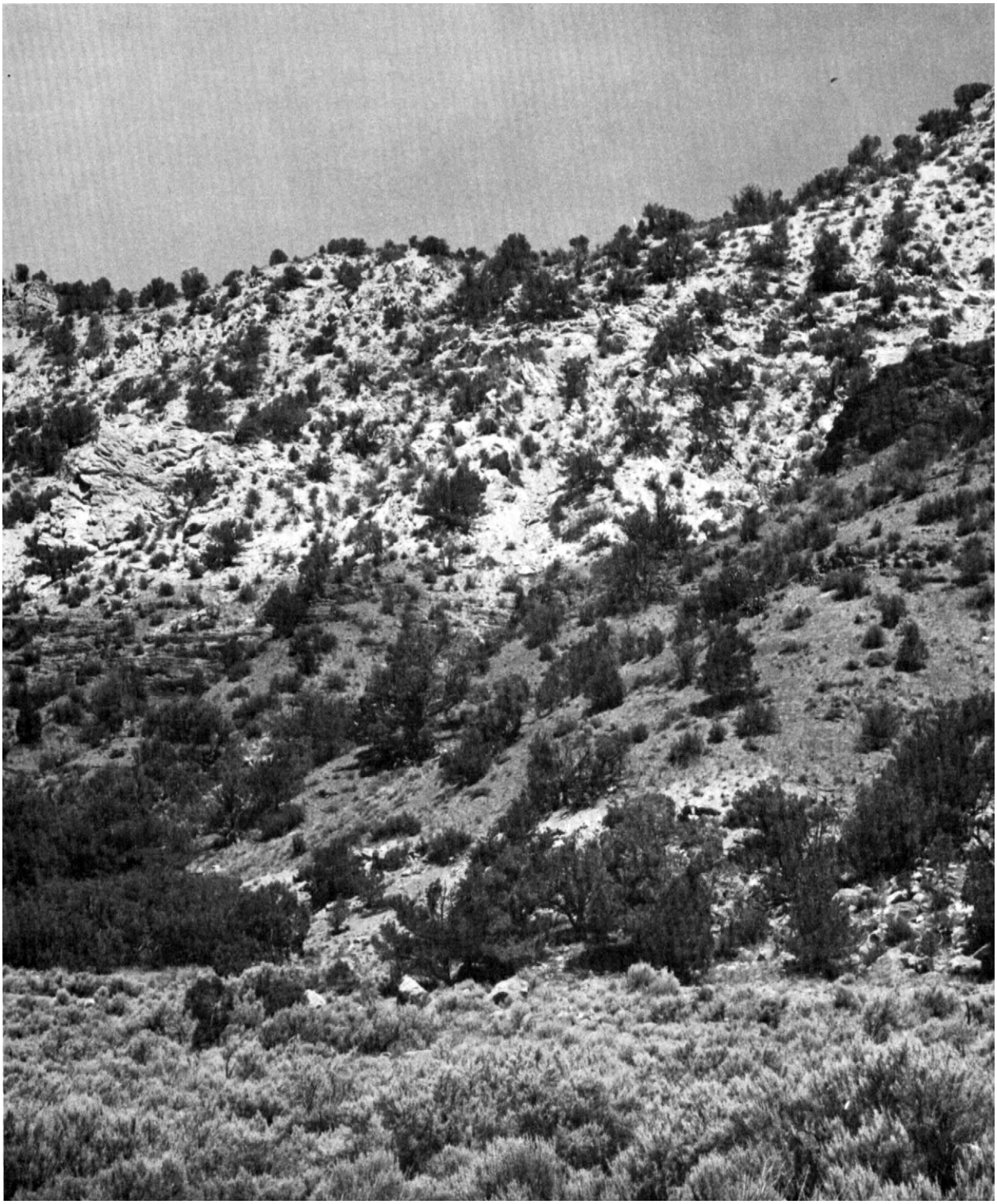

Figure 17.—Sparse vegetation on Torriorthents-Rock outcrop complex. These soils produce large quantities of sediment.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA FOR THREE WEATHER STATIONS

Data recorded in the period 1951-73 at Fraser, Colo.

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F		In	In	In		In
January----	28.5	-6.1	11.2	45	-42	0	1.79	.93	2.48	6	18.9
February---	32.1	-4.8	13.7	49	-40	0	1.44	.85	1.96	5	15.4
March------	36.8	1.5	19.2	54	-33	8	1.70	1.07	2.25	6	19.0
April------	45.8	14.8	30.3	65	-13	14	1.87	1.22	2.45	6	17.3
May--------	58.7	23.6	41.2	75	6	84	1.69	.87	2.35	5	5.1
June-------	68.1	29.1	48.6	81	18	261	1.71	.85	2.41	5	.3
July-------	74.3	33.7	54.0	83	24	434	1.63	.84	2.26	5	.0
August-----	72.1	31.9	52.0	82	18	372	1.83	1.04	2.47	5	.0
September--	65.2	22.6	43.9	79	5	137	1.76	.49	2.78	4	2.0
October----	54.7	15.3	35.0	71	-7	30	1.17	.41	1.77	4	7.0
November---	38.8	4.2	21.5	58	-30	0	1.36	.82	1.84	5	15.5
December---	29.4	-5.7	11.9	47	-39	0	1.80	.95	2.49	5	19.6
Year-----	50.4	13.3	31.9	85	-45	1,340	19.75	16.17	23.14	61	120.1

Data recorded in the period 1951-73 at Grand Lake 1 NW, Colo.

January----	30.3	.7	15.5	48	-33	0	1.71	.91	2.35	6	29.2
February---	33.1	2.0	17.6	50	-29	0	1.38	.88	1.83	5	22.2
March------	38.0	7.3	22.7	55	-23	0	1.55	.91	2.11	6	22.9
April------	47.4	17.5	32.5	64	-7	24	1.87	1.05	2.52	7	19.6
May--------	58.9	25.9	42.4	74	11	104	1.82	1.04	2.44	6	5.5
June-------	68.7	31.2	50.0	81	21	300	1.74	.84	2.47	5	.1
July-------	74.8	36.0	55.4	84	26	477	2.16	1.24	2.90	6	.0
August-----	73.0	35.6	54.3	83	24	443	2.32	1.47	3.08	7	.0
September--	66.7	27.9	47.3	81	13	227	1.65	.69	2.42	5	2.0
October----	56.4	20.6	38.6	71	3	65	1.10	.37	1.69	3	6.2
November---	40.4	10.1	25.3	58	-20	8	1.29	.82	1.70	4	18.0
December---	31.5	2.3	17.0	49	-27	0	1.72	.91	2.38	6	29.6
Year-----	51.6	18.1	34.9	85	-34	1,648	20.31	17.58	22.91	66	155.3

TABLE 1.--TEMPERATURE AND PRECIPITATION FOR THREE WEATHER STATIONS--Continued

Data recorded in the period 1965-74 at Kremmling, Colo.

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F		In	In	In		In
January----	28.5	.2	14.4	50	-39	16	.86	.38	1.24	3	15.6
February---	31.1	.0	15.6	49	-29	0	.40	.18	.57	2	10.9
March------	43.0	12.1	27.6	68	-17	69	.57	.22	.84	3	10.1
April------	55.3	20.8	38.0	72	1	67	.83	.53	1.08	3	8.4
May--------	67.3	27.3	47.3	82	12	229	.94	.30	1.44	3	1.0
June-------	76.4	35.3	55.9	89	20	477	1.44	.62	2.09	4	.0
July-------	82.2	41.0	61.6	91	28	670	1.57	.76	2.22	5	.0
August-----	80.5	37.7	59.2	92	23	595	1.41	.86	1.89	5	.0
September--	71.3	30.2	50.8	85	14	324	1.26	.59	1.80	4	.8
October----	61.1	21.1	41.1	79	2	119	1.11	.31	1.74	3	4.8
November---	42.8	12.8	27.8	64	-17	20	.72	.38	.98	3	10.6
December---	28.8	-1.3	13.8	53	-32	0	.80	.50	1.05	3	17.6
Year-----	55.7	19.8	37.8	93	-39	2,586	11.91	9.72	13.94	41	79.8

[1]A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL
FOR THREE WEATHER STATIONS

Data recorded in the period 1951-73 at Fraser, Colo.

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	June 23	July 04	July 06
2 years in 10 later than--	June 19	July 01	July 03
5 years in 10 later than--	June 13	June 24	June 28
First freezing temperature in fall:			
1 year in 10 earlier than--	July 10	June 21	June 23
2 years in 10 earlier than--	July 20	June 28	June 27
5 years in 10 earlier than--	August 08	July 09	July 04

Data recorded in the period 1951-73 at Grand Lake 1 NW, Colo.

Last freezing temperature in spring:			
1 year in 10 later than--	June 20	July 01	July 02
2 years in 10 later than--	June 15	June 28	June 30
5 years in 10 later than--	June 04	June 21	June 28
First freezing temperature in fall:			
1 year in 10 earlier than--	August 01	June 27	June 23
2 years in 10 earlier than--	August 12	July 08	June 29
5 years in 10 earlier than--	August 31	July 30	July 08

TABLE 2.--FREEZE DATES IN SPRING AND FALL
FOR THREE WEATHER STATIONS--Continued

Data recorded in the period 1965-74 at Kremmling, Colo.

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	June 22	June 23	July 02
2 years in 10 later than--	June 16	June 19	June 28
5 years in 10 later than--	June 05	June 12	June 21
First freezing temperature in fall:			
1 year in 10 earlier than--	August 19	July 26	June 25
2 years in 10 earlier than--	August 25	August 05	July 02
5 years in 10 earlier than--	September 06	August 26	July 16

TABLE 3.--GROWING SEASON LENGTH FOR THREE WEATHER STATIONS

Data recorded in the period 1951-73 at Fraser, Colo.

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	24	0	0
8 years in 10	35	0	0
5 years in 10	55	14	5
2 years in 10	76	29	16
1 year in 10	87	38	21

Data recorded in the period 1951-73 at Grand Lake 1 NW, Colo.

9 years in 10	50	0	0
8 years in 10	63	12	0
5 years in 10	87	39	9
2 years in 10	111	66	20
1 year in 10	124	80	25

Data recorded in the period 1965-74 at Kremmling, Colo.

9 years in 10	66	33	0
8 years in 10	75	47	8
5 years in 10	92	74	24
2 years in 10	109	101	40
1 year in 10	118	115	49

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Aaberg clay loam, 6 to 15 percent slopes	2,471	0.4
2	Aaberg clay loam, 15 to 30 percent slopes	8,059	1.3
3	Anvik loam, 6 to 15 percent slopes	3,796	0.6
4	Anvik loam, 15 to 50 percent slopes	10,787	1.7
5	Benteen loam, 6 to 15 percent slopes	750	0.1
6	Benteen loam, 15 to 40 percent slopes	988	0.2
7	Binco clay loam, 2 to 6 percent slopes	1,713	0.3
8	Binco clay loam, 6 to 15 percent slopes	2,817	0.4
9	Binco clay loam, 15 to 35 percent slopes	2,274	0.4
10	Bross-Mirror extremely stony sandy loams, 20 to 50 percent slopes	5,913	0.9
11	Cebone loam, 15 to 50 percent slopes	1,931	0.3
12	Cimarron loam, 2 to 6 percent slopes	2,461	0.4
13	Cimarron loam, 6 to 15 percent slopes	16,528	2.6
14	Cimarron loam, 15 to 35 percent slopes	15,854	2.5
15	Clayburn loam, 2 to 6 percent slopes	1,316	0.2
16	Clayburn loam, 6 to 15 percent slopes	3,474	0.5
17	Clayburn loam, 15 to 25 percent slopes	5,413	0.9
18	Clayburn loam, 25 to 50 percent slopes	3,659	0.6
19	Cowdrey loam, 2 to 6 percent slopes	4,462	0.7
20	Cowdrey loam, 6 to 15 percent slopes	14,415	2.3
21	Cowdrey loam, 15 to 45 percent slopes	12,102	1.9
22	Cryaquepts, sloping	3,111	0.5
23	Cryoborolls-Rock outcrop complex, very steep	5,347	0.8
24	Cryorthents-Rock outcrop complex, extremely steep	13,749	2.2
25	Cumulic Cryaquolls, nearly level	29,343	4.6
26	Dahlquist-Boettcher complex, 6 to 30 percent slopes	1,473	0.2
27	Dahlquist-Stunner very cobbly loams, 3 to 15 percent slopes	777	0.1
28	Dahlquist-Stunner very cobbly loams, 15 to 50 percent slopes	2,699	0.4
29	Forelle loam, 3 to 15 percent slopes	1,099	0.2
30	Forelle loam, 15 to 30 percent slopes	897	0.1
31	Frisco-Peeler gravelly sandy loams, 2 to 6 percent slopes	1,055	0.2
32	Frisco-Peeler gravelly sandy loams, 6 to 25 percent slopes	10,392	1.6
33	Frisco-Peeler gravelly sandy loams, 25 to 65 percent slopes	38,968	6.1
34	Gateway loam, 6 to 15 percent slopes	1,018	0.2
35	Gateway loam, 15 to 50 percent slopes	6,627	1.0
36	Grenadier gravelly loam, 15 to 55 percent slopes	1,945	0.3
37	Harsha loam, 0 to 6 percent slopes	6,577	1.0
38	Harsha loam, 6 to 15 percent slopes	16,596	2.6
39	Harsha loam, 15 to 50 percent slopes, eroded	23,504	3.7
40	Harsha cobbly loam, 15 to 50 percent slopes	2,109	0.3
41	Histic Cryaquolls, nearly level	5,221	0.8
42	Irigul channery loam, 6 to 30 percent slopes	2,094	0.3
43	Lake Creek loam, 15 to 50 percent slopes	4,611	0.7
44	Leadville stony loam, 15 to 50 percent slopes	1,060	0.2
45	Leavitt loam, 0 to 6 percent slopes	8,934	1.4
46	Leavitt loam, 6 to 15 percent slopes	12,334	1.9
47	Leavitt loam, 15 to 55 percent slopes	6,139	1.0
48	Leighcan gravelly sandy loam, 15 to 70 percent slopes	9,829	1.5
49	Leighcan bouldery sandy loam, 15 to 70 percent slopes	24,630	3.9
50	Lymanson loam, 6 to 15 percent slopes	1,272	0.2
51	Lymanson loam, 15 to 40 percent slopes	2,255	0.4
52	Mayoworth clay loam, 6 to 15 percent slopes	1,584	0.2
53	Mayoworth clay loam, 15 to 50 percent slopes	3,716	0.6
54	Meredith extremely stony sandy loam, 50 to 70 percent slopes	4,966	0.8
55	Mord loam, 3 to 15 percent slopes	2,770	0.4
56	Mord loam, 15 to 30 percent slopes	2,650	0.4
57	Mulstay stony loam, 10 to 50 percent slopes	4,498	0.7
58	Newcomb gravelly sandy loam, 0 to 20 percent slopes	682	0.1
59	Newcomb gravelly sandy loam, 20 to 50 percent slopes	7,197	1.1
60	Newcomb-Rock outcrop complex, 20 to 50 percent slopes	3,370	0.5
61	Newcomb-Rock outcrop complex, 50 to 70 percent slopes	5,976	0.9
62	Peeler sandy loam, 3 to 15 percent slopes	883	0.1
63	Peeler sandy loam, 15 to 50 percent slopes	3,616	0.6
64	Pergelic Cryorthents-Rock outcrop complex, extremely steep	3,125	0.5
65	Quander cobbly loam, 2 to 15 percent slopes	6,250	1.0
66	Quander stony loam, 15 to 55 percent slopes	29,032	4.6
67	Rock outcrop-Cryoboralfs complex, very steep	5,186	0.8
68	Rock outcrop-Cryoborolls complex, extremely steep	20,592	3.3
69	Rock outcrop-Haploborolls complex, extremely steep	964	0.2
70	Rogert gravelly sandy loam, 15 to 60 percent slopes	9,430	1.5
71	Roxal loam, 6 to 15 percent slopes	992	0.2
72	Roxal loam, 15 to 50 percent slopes	4,270	0.7

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
73	Rubble land	3,944	0.6
74	Scout cobbly sandy loam, 2 to 6 percent slopes	1,569	0.2
75	Scout cobbly sandy loam, 6 to 15 percent slopes	3,702	0.6
76	Scout cobbly sandy loam, 15 to 65 percent slopes	19,112	3.0
77	Sudduth loam, 6 to 15 percent slopes	684	0.1
78	Sudduth loam, 15 to 30 percent slopes	644	0.1
79	Tamp gravelly sandy loam, 3 to 15 percent slopes	1,072	0.2
80	Tamp gravelly sandy loam, 15 to 60 percent slopes	6,970	1.1
81	Tine gravelly sandy loam, 0 to 3 percent slopes	6,932	1.1
82	Tine cobbly sandy loam, 3 to 15 percent slopes	2,260	0.4
83	Tine cobbly sandy loam, 15 to 55 percent slopes	6,041	1.0
84	Tolman stony loam, 15 to 50 percent slopes	1,012	0.2
85	Torriorthents-Rock outcrop complex, steep	3,965	0.6
86	Uinta sandy loam, 2 to 15 percent slopes	3,745	0.6
87	Uinta sandy loam, 15 to 50 percent slopes	16,855	2.7
88	Upson stony sandy loam, 6 to 15 percent slopes	1,522	0.2
89	Upson stony sandy loam, 15 to 65 percent slopes	16,833	2.7
90	Waybe clay loam, 10 to 55 percent slopes	9,688	1.5
91	Woodhall loam, 6 to 15 percent slopes	1,327	0.2
92	Woodhall loam, 15 to 50 percent slopes	6,553	1.0
93	Youga loam, 2 to 6 percent slopes	5,214	0.8
94	Youga loam, 6 to 15 percent slopes	9,676	1.5
95	Youga loam, 15 to 45 percent slopes	12,727	2.0
	Water	4,781	0.8
	Total	635,425	100.0

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1---------- Aaberg	Mountain Shale----------	Favorable	900	Western wheatgrass----------	25
		Normal	750	Letterman needlegrass----------	20
		Unfavorable	400	Sagebrush----------	15
				Muttongrass----------	15
				Bluebunch wheatgrass----------	5
2---------- Aaberg	Mountain Shale----------	Favorable	800	Western wheatgrass----------	35
		Normal	600	Bluebunch wheatgrass----------	15
		Unfavorable	300	Sagebrush----------	10
				Muttongrass----------	10
				Low rabbitbrush----------	5
				Letterman needlegrass----------	5
				Bottlebrush squirreltail------	5
3, 4---------- Anvik	Subalpine Loam----------	Favorable	3,500	Thurber fescue----------	45
		Normal	2,500	Parry oatgrass----------	10
		Unfavorable	2,000	Idaho fescue----------	10
				Nodding bromegrass----------	5
				Muttongrass----------	5
				Bearded wheatgrass----------	5
5, 6---------- Benteen	Subalpine Loam----------	Favorable	3,200	Thurber fescue----------	30
		Normal	2,500	Nodding bromegrass----------	20
		Unfavorable	1,800	Idaho fescue----------	10
				Big sagebrush----------	10
				Parry danthonia----------	10
				Columbia needlegrass----------	5
7, 8---------- Binco	Mountain Shale----------	Favorable	1,000	Western wheatgrass----------	25
		Normal	800	Letterman needlegrass----------	20
		Unfavorable	500	Muttongrass----------	15
				Big sagebrush----------	10
				Bottlebrush squirreltail------	5
				Bluebunch wheatgrass----------	5
9---------- Binco	Mountain Shale----------	Favorable	900	Western wheatgrass----------	35
		Normal	700	Bluebunch wheatgrass----------	15
		Unfavorable	400	Muttongrass----------	10
				Big sagebrush----------	5
				Bottlebrush squirreltail------	5
				Douglas rabbitbrush----------	5
				Letterman needlegrass----------	5
10*:					
Bross----------	Alpine Slopes----------	Favorable	1,200	Kobresia----------	40
		Normal	700	Alpine clover----------	10
		Unfavorable	500	Wheatgrass----------	10
				Tufted hairgrass----------	10
				Alpine bluegrass----------	5
				American bistort----------	5
Mirror----------	Alpine Slopes----------	Favorable	1,200	Kobresia----------	30
		Normal	800	Tufted hairgrass----------	10
		Unfavorable	500	Parry clover----------	10
				Sedge----------	10
				American bistort----------	5
				Showy cinquefoil----------	5
				Alpine bluegrass----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
11---------- Cebone	Subalpine Loam----------	Favorable	3,200	Thurber fescue----------	45
		Normal	2,800	Idaho fescue----------	10
		Unfavorable	2,000	Columbia needlegrass----------	10
				Nodding bromegrass----------	5
				Silver sagebrush----------	5
				Bluegrass----------	5
				Kinnikinnick----------	5
12, 13, 14--------- Cimarron	Mountain Loam----------	Favorable	1,500	Idaho fescue----------	25
		Normal	1,300	Western wheatgrass----------	10
		Unfavorable	1,000	Big sagebrush----------	10
				Muttongrass----------	10
				Bearded wheatgrass----------	5
				Slender wheatgrass----------	5
				Needlegrass----------	5
				Nodding bromegrass----------	5
				Mountain brome----------	5
15, 16, 17, 18----- Clayburn	Subalpine Loam----------	Favorable	3,500	Thurber fescue----------	40
		Normal	2,800	Idaho fescue----------	10
		Unfavorable	2,000	Nodding bromegrass----------	10
				Muttongrass----------	5
				Columbia needlegrass----------	5
				Silver sagebrush----------	5
26*:					
Dahlquist---------	Stony Foothills----------	Favorable	800	Bluebunch wheatgrass----------	30
		Normal	600	Big sagebrush----------	15
		Unfavorable	400	Bottlebrush squirreltail------	10
				Western wheatgrass----------	10
				Needleandthread----------	5
				Prairie junegrass----------	5
Boettcher---------	Stony Foothills----------	Favorable	800	Bluebunch wheatgrass----------	30
		Normal	600	Big sagebrush----------	15
		Unfavorable	400	Western wheatgrass----------	10
				Bottlebrush squirreltail------	10
				Indian ricegrass----------	5
				Needleandthread----------	5
27*, 28*:					
Dahlquist---------	Stony Foothills----------	Favorable	800	Bluebunch wheatgrass----------	30
		Normal	600	Big sagebrush----------	15
		Unfavorable	400	Bottlebrush squirreltail------	10
				Western wheatgrass----------	10
				Needleandthread----------	5
				Prairie junegrass----------	5
Stunner----------	Stony Foothills----------	Favorable	800	Bluebunch wheatgrass----------	30
		Normal	600	Western wheatgrass----------	15
		Unfavorable	400	Big sagebrush----------	15
				Bottlebrush squirreltail------	10
				Needleandthread----------	5
				Indian ricegrass----------	5
29, 30---------- Forelle	Clayey Foothills----------	Favorable	1,200	Western wheatgrass----------	40
		Normal	900	Green needlegrass----------	20
		Unfavorable	600	Big sagebrush----------	15
				Indian ricegrass----------	5
				Douglas rabbitbrush----------	5
37, 38---------- Harsha	Dry Mountain Loam----------	Favorable	1,000	Bluebunch wheatgrass----------	20
		Normal	750	Muttongrass----------	20
		Unfavorable	500	Big sagebrush----------	15
				Needleandthread----------	10
				Bottlebrush squirreltail------	10
				Indian ricegrass----------	10

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
39---------- Harsha	Dry Exposure----------	Favorable	500	Bluebunch wheatgrass----------	20
		Normal	400	Needleandthread----------	15
		Unfavorable	200	Prairie junegrass----------	10
				Indian ricegrass----------	10
				Bottlebrush squirreltail------	5
				Douglas rabbitbrush----------	5
40---------- Harsha	Stony Loam----------	Favorable	1,500	Bluebunch wheatgrass----------	25
		Normal	1,200	Big sagebrush----------	15
		Unfavorable	1,000	Antelope bitterbrush----------	15
				Idaho fescue----------	15
				Muttongrass----------	10
				Indian ricegrass----------	5
42---------- Irigul	Rocky Loam----------	Favorable	1,200	Columbia needlegrass----------	15
		Normal	900	Western wheatgrass----------	10
		Unfavorable	500	Bluebunch wheatgrass----------	10
				Mutton bluegrass----------	10
				Prairie junegrass----------	10
				Utah serviceberry----------	10
				Antelope bitterbrush----------	10
				Threetip sagebrush----------	10
				Mountainmahogany----------	10
				Big sagebrush----------	10
				Bottlebrush squirreltail------	5
				Indian ricegrass----------	5
45, 46, 47--------- Leavitt	Mountain Loam----------	Favorable	1,500	Wheatgrass----------	30
		Normal	1,200	Idaho fescue----------	15
		Unfavorable	1,000	Muttongrass----------	15
				Big sagebrush----------	10
				Sandberg bluegrass----------	5
				Needlegrass----------	5
				Bottlebrush squirreltail------	5
				Brome----------	5
				Prairie junegrass----------	5
50, 51---------- Lymanson	Dry Mountain Loam----------	Favorable	1,000	Western wheatgrass----------	20
		Normal	750	Mutton bluegrass----------	20
		Unfavorable	500	Big sagebrush----------	15
				Indian ricegrass----------	10
				Needleandthread----------	10
52, 53---------- Mayoworth	Deep Clay Loam----------	Favorable	2,000	Western wheatgrass----------	25
		Normal	1,700	Letterman needlegrass---------	20
		Unfavorable	1,400	Big sagebrush----------	10
				Mutton bluegrass----------	10
				Bluebunch wheatgrass----------	5
				Serviceberry----------	5
				Snowberry----------	5
54---------- Meredith	Alpine Slopes----------	Favorable	1,000	Kobresia----------	40
		Normal	700	Sedge----------	10
		Unfavorable	500	Tufted hairgrass----------	10
				Wheatgrass----------	10
				Alpine clover----------	10
				Willow----------	5
				American bistort----------	5
				Alpine bluegrass----------	5
55, 56---------- Mord	Subalpine Loam----------	Favorable	3,500	Thurber fescue----------	25
		Normal	3,000	Idaho fescue----------	15
		Unfavorable	2,000	Big bluegrass----------	10
				Silver sagebrush----------	10
				Columbia needlegrass----------	10
				American vetch----------	5
				Slender wheatgrass----------	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
57---------- Mulstay	Dry Mountain Loam----------	Favorable Normal Unfavorable	1,500 1,000 800	Bluebunch wheatgrass---------- Muttongrass---------- Needleandthread---------- Big sagebrush---------- Bottlebrush squirreltail------ Indian ricegrass---------- Prairie junegrass----------	20 20 15 15 10 10 5
65, 66---------- Quander	Stony Loam----------	Favorable Normal Unfavorable	1,500 1,200 1,000	Bluebunch wheatgrass---------- Big sagebrush---------- Idaho fescue---------- Antelope bitterbrush---------- Muttongrass---------- Common snowberry---------- Saskatoon serviceberry--------	25 15 15 15 10 5 5
70---------- Rogert	Rocky Loam----------	Favorable Normal Unfavorable	1,000 900 500	Pine needlegrass---------- Bluegrass---------- Bluebunch wheatgrass---------- Big sagebrush---------- Prairie junegrass---------- Bottlebrush squirreltail------	15 15 10 10 5 5
71, 72---------- Roxal	Dry Mountain Loam----------	Favorable Normal Unfavorable	1,000 700 500	Bluebunch wheatgrass---------- Mutton bluegrass---------- Big sagebrush---------- Western wheatgrass----------	20 20 10 5
77, 78---------- Sudduth	Subalpine Loam----------	Favorable Normal Unfavorable	3,200 2,800 2,000	Thurber fescue---------- Idaho fescue---------- Big bluegrass---------- Silver sagebrush---------- Columbia needlegrass---------- Slender wheatgrass----------	35 10 10 10 10 5
79, 80---------- Tamp	Stony Loam----------	Favorable Normal Unfavorable	1,500 1,200 1,000	Bluebunch wheatgrass---------- Idaho fescue---------- Big sagebrush---------- Antelope bitterbrush---------- Muttongrass----------	25 15 15 15 10
81, 82, 83--------- Tine	Dry Mountain Loam----------	Favorable Normal Unfavorable	1,000 750 500	Bluebunch wheatgrass---------- Muttongrass---------- Big sagebrush---------- Indian ricegrass---------- Needleandthread---------- Pine needlegrass----------	20 20 15 10 10 5
84---------- Tolman	Stony Foothills----------	Favorable Normal Unfavorable	800 600 400	Bluebunch wheatgrass---------- Big sagebrush---------- Western wheatgrass---------- Bottlebrush squirreltail------ Prairie junegrass----------	30 15 10 10 5
90---------- Waybe	Mountain Shale----------	Favorable Normal Unfavorable	800 600 300	Western wheatgrass---------- Bluebunch wheatgrass---------- Richardson needlegrass-------- Big sagebrush---------- Muttongrass----------	35 15 10 10 10
91, 92---------- Woodhall	Mountain Loam----------	Favorable Normal Unfavorable	1,500 1,200 900	Wheatgrass---------- Big sagebrush---------- Idaho fescue---------- Antelope bitterbrush---------- Muttongrass---------- Nodding bromegrass----------	30 10 10 10 10 5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
93, 94, 95--------- Youga	Mountain Loam----------	Favorable Normal Unfavorable	1,500 1,200 1,000	Wheatgrass---------- Bluegrass---------- Idaho fescue---------- Sagebrush---------- Nodding bromegrass---------- Needlegrass----------	20 15 15 10 5 5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
3---------- Anvik	3o	Slight	Moderate	Slight	Slight	Quaking aspen------- Lodgepole pine------	63 50	Lodgepole pine.
4---------- Anvik	3r	Moderate	Moderate	Slight	Slight	Quaking aspen------- Lodgepole pine------	63 50	Lodgepole pine.
19, 20---------- Cowdrey	4o	Slight	Moderate	Slight	Slight	Lodgepole pine------ Engelmann spruce----	72 57	Lodgepole pine, Engelmann spruce.
21---------- Cowdrey	4r	Severe	Slight	Slight	Slight	Lodgepole pine------ Engelmann spruce----	72 57	Lodgepole pine, Engelmann spruce.
31*, 32*: Frisco----------	4f	Slight	Moderate	Slight	Slight	Engelmann spruce---- Lodgepole pine------	--- 67	Engelmann spruce, Lodgepole pine.
Peeler----------	4o	Slight	Slight	Slight	Slight	Lodgepole pine------ Engelmann spruce----	74 55	Lodgepole pine, Engelmann spruce.
33*: Frisco----------	4f	Severe	Moderate	Slight	Slight	Lodgepole pine------	75	Lodgepole pine.
Peeler----------	4r	Severe	Slight	Slight	Slight	Lodgepole pine------ Engelmann spruce----	74 55	Lodgepole pine, Engelmann spruce.
34---------- Gateway	5c	Moderate	Moderate	Slight	Moderate	Lodgepole pine------ Subalpine fir-------	55 ---	Lodgepole pine.
35---------- Gateway	5c	Severe	Moderate	Slight	Moderate	Lodgepole pine------	62	Lodgepole pine.
36---------- Grenadier	7f	Moderate	Moderate	Slight	Slight	Lodgepole pine------ Subalpine fir-------	40 ---	Lodgepole pine.
43---------- Lake Creek	6f	Moderate	Severe	Slight	Slight	Lodgepole pine------	55	Lodgepole pine.
44---------- Leadville	6f	Moderate	Severe	Slight	Slight	Lodgepole pine------	55	Lodgepole pine.
48, 49---------- Leighcan	5x	Severe	Severe	Slight	Slight	Engelmann spruce---- Lodgepole pine------	60 55	Englemann spruce, Lodgepole pine.
58---------- Newcomb	5s	Slight	Moderate	Slight	Slight	Lodgepole pine------ Subalpine fir-------	57 ---	Lodgepole pine, Subalpine fir.
59---------- Newcomb	6r	Severe	Moderate	Slight	Slight	Lodgepole pine------ Subalpine fir-------	46 ---	Lodgepole pine, Subalpine fir.
60*, 61*: Newcomb----------	6r	Severe	Moderate	Slight	Slight	Lodgepole pine------ Subalpine fir-------	40 ---	Lodgepole pine, Subalpine fir.
Rock outcrop.								
62---------- Peeler	4o	Slight	Moderate	Slight	Slight	Lodgepole pine------ Engelmann spruce----	74 55	Lodgepole pine, Engelmann spruce.
63---------- Peeler	4r	Severe	Moderate	Slight	Slight	Lodgepole pine------ Engelmann spruce----	74 55	Lodgepole pine, Engelmann spruce.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
74, 75---------- Scout	4f	Slight	Moderate	Slight	Slight	Lodgepole pine------	66	Lodgepole pine.
76---------- Scout	4f	Severe	Moderate	Slight	Slight	Lodgepole pine------	66	Lodgepole pine.
86---------- Uinta	5o	Slight	Slight	Slight	Slight	Lodgepole pine------ Subalpine fir-------	57 ---	Lodgepole pine.
87---------- Uinta	5r	Moderate	Slight	Slight	Slight	Lodgepole pine------ Subalpine fir-------	63 ---	Lodgepole pine.
88---------- Upson	5o	Slight	Severe	Moderate	Slight	Lodgepole pine------ Quaking aspen-------	60 ---	Lodgepole pine.
89---------- Upson	5r	Moderate	Severe	Moderate	Slight	Lodgepole pine------ Quaking aspen-------	60 ---	Lodgepole pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1---------- Aaberg	Moderate: too clayey, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.
2---------- Aaberg	Severe: slope.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength, slope.
3---------- Anvik	Moderate: slope.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Moderate: slope, low strength, frost action.
4---------- Anvik	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
5---------- Benteen	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, low strength.
6---------- Benteen	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
7---------- Binco	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
8---------- Binco	Moderate: too clayey, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength.
9---------- Binco	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.
10*:					
Bross----------	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, permafrost.
Mirror----------	Severe: slope, large stones, permafrost.	Severe: large stones, slope, permafrost.	Severe: depth to rock, permafrost, slope.	Severe: large stones, slope, permafrost.	Severe: slope, large stones, permafrost.
11---------- Cebone	Severe: depth to rock, slope.	Severe: shrink-swell, slope, low strength.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.
12---------- Cimarron	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
13---------- Cimarron	Moderate: too clayey, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.
14---------- Cimarron	Severe: slope.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.
15---------- Clayburn	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Moderate: low strength, shrink-swell, frost action.
16---------- Clayburn	Moderate: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: low strength, slope, shrink-swell.
17, 18---------- Clayburn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
19---------- Cowdrey	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
20---------- Cowdrey	Moderate: too clayey, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.
21---------- Cowdrey	Severe: slope.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.
22*. Cryaquepts					
23*: Cryoborolls.					
Rock outcrop.					
24*: Cryorthents.					
Rock outcrop.					
25*. Cumulic Cryaquolls					
26*: Dahlquist--------	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Boettcher--------	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: slope, shrink-swell, low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
27*:					
Dahlquist	Severe: large stones, cutbanks cave.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
Stunner	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: slope, shrink-swell, low strength.
28*:					
Dahlquist	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Stunner	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
29--- Forelle	Moderate: slope.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Moderate: slope, low strength, shrink-swell.
30--- Forelle	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
31*:					
Frisco	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
Peeler	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
32*, 33*:					
Frisco	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Peeler	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
34--- Gateway	Moderate: too clayey, slope, depth to rock.	Severe: shrink-swell, low strength.	Severe: depth to rock, shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.
35--- Gateway	Severe: slope.	Severe: shrink-swell, slope, low strength.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength, slope.
36--- Grenadier	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
37--- Harsha	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
38--- Harsha	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.
39--- Harsha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
40---------- Harsha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
41*. Histic Cryaquolls					
42---------- Irigul	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
43---------- Lake Creek	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
44---------- Leadville	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
45---------- Leavitt	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, frost action.
46---------- Leavitt	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: slope, shrink-swell, low strength.
47---------- Leavitt	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
48, 49---------- Leighcan	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
50---------- Lymanson	Moderate: slope, depth to rock.	Moderate: slope, shrink-swell.	Moderate: slope, depth to rock, shrink-swell.	Severe: slope.	Moderate: slope, frost action, low strength.
51---------- Lymanson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
52---------- Mayoworth	Moderate: slope, depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
53---------- Mayoworth	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
54---------- Meredith	Severe: large stones, slope, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.
55---------- Mord	Moderate: slope, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.
56---------- Mord	Severe: slope.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
57---------- Mulstay	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
58---------- Newcomb	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
59---------- Newcomb	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
60*, 61*: Newcomb----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
62---------- Peeler	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
63---------- Peeler	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
64*: Pergelic Cryorthents.					
Rock outcrop.					
65---------- Quander	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
66---------- Quander	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
67*: Rock outcrop.					
Cryoboralfs.					
68*: Rock outcrop.					
Cryoborolls.					
69*: Rock outcrop.					
Haploborolls.					
70---------- Rogert	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
71---------- Roxal	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, low strength.
72---------- Roxal	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
73*. Rubble land					
74---------- Scout	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
75---------- Scout	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
76---------- Scout	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
77---------- Sudduth	Moderate: too clayey, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.
78---------- Sudduth	Severe: slope.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.
79---------- Tamp	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.
80---------- Tamp	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
81---------- Tine	Severe: cutbanks cave, large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
82---------- Tine	Severe: cutbanks cave, large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
83---------- Tine	Severe: slope, cutbanks cave, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
84---------- Tolman	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock
85*: Torriorthents. Rock outcrop.					
86---------- Uinta	Moderate: slope.	Moderate slope, low strength, shrink-swell.	Moderate slope, shrink-swell, low strength.	Severe: slope.	Moderate: low strength, slope.
87---------- Uinta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
88---------- Upson	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
89---------- Upson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
90---------- Waybe	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, low strength.
91---------- Woodhall	Severe: depth to rock, large stones.	Severe: large stones.	Severe: depth to rock, large stones.	Severe: slope, large stones.	Severe: large stones.
92---------- Woodhall	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
93---------- Youga	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
94---------- Youga	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.
95---------- Youga	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1--- Aaberg	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey, area reclaim, thin layer.
2--- Aaberg	Severe: percs slowly, depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: too clayey, slope, area reclaim.
3--- Anvik	Moderate: slope, percs slowly.	Severe: slope.	Moderate: large stones.	Moderate: slope.	Fair: slope, too clayey, large stones.
4--- Anvik	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
5--- Benteen	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
6--- Benteen	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
7--- Binco	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
8--- Binco	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
9--- Binco	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, slope.
10*:					
Bross	Severe: slope, permafrost.	Severe: seepage, slope, permafrost.	Severe: slope, seepage, permafrost.	Severe: slope, seepage, permafrost.	Poor: slope, large stones, permafrost.
Mirror	Severe: depth to rock, slope, permafrost.	Severe: permafrost, slope, depth to rock.	Severe: slope, depth to rock, permafrost.	Severe: seepage, slope, permafrost.	Poor: large stones, slope, permafrost.
11--- Cebone	Severe: slope, depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope, thin layer, area reclaim.
12--- Cimarron	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
13--- Cimarron	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
14--- Cimarron	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, slope.

See footnote at end of table.

TABLE 8.--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--Clayburn	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
16--Clayburn	Moderate: percs slowly, slope.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
17--Clayburn	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
18--Clayburn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
19--Cowdrey	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
20--Cowdrey	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
21--Cowdrey	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, slope.
22*. Cryaquepts					
23*: Cryoborolls.					
Rock outcrop.					
24*: Cryorthents.					
Rock outcrop.					
25*. Cumulic Cryaquolls					
26*: Dahlquist	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.
Boettcher	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, thin layer.
27*: Dahlquist	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
Stunner	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
28*: Dahlquist	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.

See footnote at end of table.

TABLE 8.--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
28*: Stunner	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
29--- Forelle	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
30--- Forelle	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
31*: Frisco	Severe: large stones.	Severe: large stones, seepage.	Severe: large stones.	Slight	Poor: large stones.
Peeler	Slight	Moderate: large stones.	Moderate: large stones.	Slight	Poor: small stones.
32*: Frisco	Severe: large stones, slope.	Severe: slope, large stones,	Severe: large stones.	Severe: slope.	Poor: large stones, slope.
Peeler	Severe: slope.	Severe: slope.	Moderate: large stones.	Severe: slope.	Poor: slope, small stones.
33*: Frisco	Severe: large stones, slope.	Severe: slope, large stones, seepage.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Peeler	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, small stones.
34--- Gateway	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: thin layer, area reclaim, too clayey.
35--- Gateway	Severe: depth to rock, percs slowly, slope.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey, slope.	Severe: slope.	Poor: thin layer, slope, area reclaim.
36--- Grenadier	Severe: large stones, slope.	Severe: slope, seepage, large stones.	Severe: large stones, slope, seepage.	Severe: slope, seepage.	Poor: large stones, slope.
37--- Harsha	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: too clayey.
38--- Harsha	Moderate: percs slowly, slope.	Severe: slope.	Slight	Moderate: slope.	Fair: too clayey, slope.
39, 40--- Harsha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
41*. Histic Cryaquolls					

See footnote at end of table.

TABLE 8.--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
42---------- Irigul	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
43---------- Lake Creek	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope.	Poor: slope, large stones, area reclaim.
44---------- Leadville	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
45---------- Leavitt	Moderate: percs slowly.	Moderate: slope, seepage.	Slight----------	Slight----------	Fair: too clayey.
46---------- Leavitt	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.	Fair: slope, too clayey.
47---------- Leavitt	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
48---------- Leighcan	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.
49---------- Leighcan	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
50---------- Lymanson	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
51---------- Lymanson	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, area reclaim, thin layer.
52---------- Mayoworth	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, too clayey, area reclaim.
53---------- Mayoworth	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
54---------- Meredith	Severe: large stones, slope, permafrost.	Severe: large stones, slope, permafrost.	Severe: slope, large stones, permafrost.	Severe: seepage, slope, permafrost.	Poor: slope, large stones, permafrost.
55---------- Mord	Severe: percs slowly.	Severe: slope.	Slight----------	Moderate: slope.	Fair: slope, too clayey.
56---------- Mord	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 8.--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
57---------- Mulstay	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
58---------- Newcomb	Moderate: slope.	Severe: seepage, slope, small stones.	Severe: seepage.	Severe: seepage.	Poor: small stones.
59---------- Newcomb	Severe: slope.	Severe: seepage, slope, small stones.	Severe: seepage, slope.	Severe: slope, seepage.	Poor: slope, small stones.
60*, 61*: Newcomb----------	Severe: slope.	Severe: seepage, slope, small stones.	Severe: seepage, slope.	Severe: slope, seepage.	Poor: slope, small stones.
Rock outcrop.					
62---------- Peeler	Moderate: slope.	Severe: slope.	Moderate: large stones.	Moderate: slope, large stones.	Poor: small stones.
63---------- Peeler	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, small stones.
64*: Pergelic Cryorthents.					
Rock outcrop.					
65---------- Quander	Moderate: slope, percs slowly, large stones.	Severe: slope.	Moderate: large stones.	Moderate: slope.	Poor: large stones.
66---------- Quander	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: large stones, slope.
67*: Rock outcrop.					
Cryoboralfs.					
68*: Rock outcrop.					
Cryoborolls.					
69*: Rock outcrop.					
Haploborolls.					
70---------- Rogert	Severe: depth to rock, slope.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: seepage, slope.	Poor: small stones, thin layer, slope.
71---------- Roxal	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.

See footnote at end of table.

TABLE 8.--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
72---------- Roxal	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
73*. Rubble land					
74---------- Scout	Severe: large stones.	Severe: seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
75---------- Scout	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
76---------- Scout	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: large stones, slope.
77---------- Sudduth	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
78---------- Sudduth	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: too clayey, slope.
79---------- Tamp	Moderate: percs slowly, slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: too clayey, small stones, slope.
80---------- Tamp	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
81---------- Tine	Severe: large stones.	Severe: seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: seepage, large stones.
82---------- Tine	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: seepage, large stones.
83---------- Tine	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, seepage, large stones.
84---------- Tolman	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
85*: Torriorthents. Rock outcrop.					
86---------- Uinta	Moderate: slope.	Severe: slope,	Severe: seepage.	Severe: seepage.	Fair: small stones.
87---------- Uinta	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.

See footnote at end of table.

TABLE 8.--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
88---------- Upson	Severe: depth to rock.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer, area reclaim.
89---------- Upson	Severe: slope, depth to rock.	Severe: slope, seepage, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage.	Poor: slope, area reclaim, thin layer.
90---------- Waybe	Severe: slope, depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: slope, thin layer, area reclaim.
91---------- Woodhall	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Moderate: slope.	Poor: area reclaim, large stones.
92---------- Woodhall	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope.	Poor: slope, area reclaim, large stones.
93---------- Youga	Severe: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Fair: too clayey.
94---------- Youga	Severe: percs slowly.	Severe: slope.	Slight----------	Moderate: slope.	Fair: slope, too clayey.
95---------- Youga	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1--- Aaberg	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Poor: too clayey.
2--- Aaberg	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Poor: too clayey, slope.
3--- Anvik	Fair: low strength, large stones.	Unsuited	Unsuited	Fair: slope, thin layer.
4--- Anvik	Poor: slope.	Unsuited	Unsuited	Poor: slope.
5--- Benteen	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: small stones.
6--- Benteen	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, small stones.
7, 8--- Binco	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey.
9--- Binco	Poor: low strength, shrink-swell, slope.	Unsuited	Unsuited	Poor: too clayey, slope.
10*: Bross	Poor: slope, permafrost, large stones.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones, permafrost.
Mirror	Poor: thin layer, permafrost, slope.	Unsuited	Unsuited	Poor: slope, large stones. permafrost.
11--- Cebone	Poor: thin layer, slope, low strength.	Unsuited	Unsuited	Poor: slope.
12, 13--- Cimarron	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
14--- Cimarron	Poor: shrink-swell, slope, low strength.	Unsuited	Unsuited	Poor: slope, too clayey.
15--- Clayburn	Fair: low strength, shrink-swell, frost action.	Unsuited	Unsuited	Fair: thin layer, small stones.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
16--- Clayburn	Fair: low strength, shrink-swell, frost action.	Unsuited---	Unsuited---	Fair: thin layer, slope, small stones.
17--- Clayburn	Fair: low strength, slope, shrink-swell.	Unsuited---	Unsuited---	Poor: slope.
18--- Clayburn	Poor: slope.	Unsuited---	Unsuited---	Poor: slope.
19, 20--- Cowdrey	Poor: shrink-swell, low strength.	Unsuited---	Unsuited---	Poor: too clayey.
21--- Cowdrey	Poor: shrink-swell, slope, low strength.	Unsuited---	Unsuited---	Poor: slope, too clayey.
22*. Cryaquepts				
23*: Cryoborolls.				
Rock outcrop.				
24*: Cryorthents.				
Rock outcrop.				
25*. Cumulic Cryaquolls				
26*: Dahlquist---	Poor: large stones.	Unsuited---	Poor: excess fines. large stones.	Poor: slope, large stones.
Boettcher---	Poor: thin layer, low strength, shrink-swell.	Unsuited---	Unsuited---	Poor: slope, too clayey.
27*: Dahlquist---	Poor: large stones.	Unsuited---	Poor: excess fines, large stones.	Poor: large stones.
Stunner---	Fair: low strength.	Unsuited---	Unsuited---	Poor: large stones.
28*: Dahlquist---	Poor: large stones.	Unsuited---	Poor: excess fines, large stones.	Poor: slope, large stones.
Stunner---	Severe: slope.	Unsuited---	Unsuited---	Poor: slope, large stones.
29--- Forelle	Fair: low strength.	Unsuited---	Unsuited---	Fair: slope.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
30--- Forelle	Fair: slope, low strength.	Unsuited---	Unsuited---	Poor: slope.
31*: Frisco---	Poor: large stones.	Unsuited---	Unsuited---	Poor: small stones.
Peeler---	Fair: frost action.	Unsuited---	Unsuited---	Poor: small stones.
32*: Frisco---	Poor: large stones.	Unsuited---	Unsuited---	Poor: small stones, slope.
Peeler---	Fair: slope, frost action.	Unsuited---	Unsuited---	Poor: small stones, slope.
33*: Frisco---	Poor: slope, large stones.	Unsuited---	Unsuited---	Poor: small stones, slope.
Peeler---	Poor: slope.	Unsuited---	Unsuited---	Poor: small stones, slope.
34--- Gateway	Poor: low strength, shrink-swell, thin layer.	Unsuited---	Unsuited---	Fair: too clayey, slope.
35--- Gateway	Poor: slope, low strength, thin layer.	Unsuited---	Unsuited---	Poor: slope.
36--- Grenadier	Poor: slope.	Unsuited---	Unsuited---	Poor: large stones, slope.
37--- Harsha	Poor: low strength.	Unsuited---	Unsuited---	Fair: too clayey.
38--- Harsha	Poor: low strength.	Unsuited---	Unsuited---	Fair: too clayey, slope.
39--- Harsha	Poor: low strength, slope.	Unsuited---	Unsuited---	Poor: slope.
40--- Harsha	Poor: slope.	Unsuited---	Unsuited---	Poor: slope.
41*. Histic Cryaquolls				
42--- Irigul	Poor: thin layer, area reclaim.	Unsuited---	Unsuited---	Poor: slope, small stones, area reclaim.
43--- Lake Creek	Poor: slope, thin layer, large stones.	Unsuited---	Unsuited---	Poor: slope, thin layer.
44--- Leadville	Poor: slope, large stones.	Unsuited---	Unsuited---	Poor: slope, large stones, area reclaim.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
45--- Leavitt	Fair: shrink-swell, low strength, frost action.	Unsuited	Unsuited	Fair: too clayey.
46--- Leavitt	Fair: shrink-swell, low strength, frost action.	Unsuited	Unsuited	Fair: slope, too clayey.
47--- Leavitt	Poor: slope.	Unsuited	Unsuited	Poor: slope.
48--- Leighcan	Poor: slope, large stones.	Poor: excess fines, large stones.	Unsuited	Poor: slope, large stones.
49--- Leighcan	Poor: slope, large stones.	Unsuited	Unsuited	Poor: large stones, slope.
50--- Lymanson	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Fair: slope, small stones.
51--- Lymanson	Poor: thin layer, slope, area reclaim.	Unsuited	Unsuited	Poor: slope.
52--- Mayoworth	Poor: thin layer, shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
53--- Mayoworth	Poor: slope, thin layer, shrink-swell.	Unsuited	Unsuited	Poor: slope, too clayey.
54--- Meredith	Poor: slope, permafrost, large stones.	Unsuited	Unsuited	Poor: large stones, slope, permafrost.
55--- Mord	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: small stones, slope.
56--- Mord	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
57--- Mulstay	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: large stones, slope, too clayey.
58--- Newcomb	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones, area reclaim.
59--- Newcomb	Poor: slope.	Fair: excess fines.	Fair: excess fines.	Poor: slope. small stones, area reclaim.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
60*, 61*: Newcomb	Poor: slope.	Fair: excess fines.	Fair: excess fines.	Poor: slope, small stones, area reclaim.
Rock outcrop.				
62---- Peeler	Fair: frost action.	Unsuited----	Unsuited----	Poor: small stones.
63---- Peeler	Poor: slope.	Unsuited----	Unsuited----	Poor: small stones, slope.
64*: Pergelic Cryorthents.				
Rock outcrop.				
65---- Quander	Fair: large stones.	Unsuited----	Unsuited----	Poor: large stones.
66---- Quander	Poor: slope.	Unsuited----	Unsuited----	Poor: large stones, slope.
67*: Rock outcrop.				
Cryoboralfs.				
68*: Rock outcrop.				
Cryoborolls.				
69*: Rock outcrop.				
Haploborolls.				
70---- Rogert	Poor: thin layer, slope, area reclaim.	Unsuited----	Unsuited----	Poor: small stones, slope, area reclaim.
71---- Roxal	Poor: thin layer, area reclaim.	Unsuited----	Unsuited----	Poor: area reclaim, thin layer.
72---- Roxal	Poor: slope, thin layer, area reclaim.	Unsuited----	Unsuited----	Poor: slope, area reclaim, thin layer.
73*. Rubble land				
74, 75---- Scout	Poor: large stones.	Poor: large stones, excess fines.	Poor: large stones, excess fines.	Poor: large stones.
76---- Scout	Poor: slope, large stones.	Poor: large stones, excess fines.	Poor: large stones, excess fines.	Poor: slope, large stones.
77---- Sudduth	Poor: shrink-swell, low strength.	Unsuited----	Unsuited----	Fair: too clayey, slope.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
78--- Sudduth	Poor: shrink-swell, low strength.	Unsuited---	Unsuited---	Poor: slope.
79--- Tamp	Fair: low strength, frost action.	Poor: excess fines.	Poor: excess fines.	Poor: small stones, area reclaim.
80--- Tamp	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: small stones, slope, area reclaim.
81, 82--- Tine	Poor: large stones.	Fair: large stones.	Fair: large stones.	Poor: small stones.
83--- Tine	Poor: slope.	Fair: large stones.	Fair: large stones.	Poor: slope, large stones.
84--- Tolman	Poor: slope, thin layer, area reclaim.	Unsuited---	Unsuited---	Poor: slope, thin layer, large stones.
85*: Torriorthents.				
Rock outcrop.				
86--- Uinta	Fair: slope, frost action.	Unsuited---	Unsuited---	Fair: slope, small stones.
87--- Uinta	Poor: slope.	Unsuited---	Unsuited---	Poor: slope.
88--- Upson	Poor: thin layer, area reclaim.	Unsuited---	Unsuited---	Poor: large stones.
89--- Upson	Poor: slope, thin layer, area reclaim.	Unsuited---	Unsuited---	Poor: slope, large stones.
90--- Waybe	Poor: slope, thin layer, low strength.	Unsuited---	Unsuited---	Poor: slope, too clayey, area reclaim.
91--- Woodhall	Poor: thin layer, area reclaim, large stones.	Unsuited---	Unsuited---	Poor: small stones, area reclaim.
92--- Woodhall	Poor: slope, thin layer, large stones.	Unsuited---	Unsuited---	Poor: slope, small stones, area reclaim.
93, 94--- Youga	Poor: low strength.	Unsuited---	Unsuited---	Poor: small stones.
95--- Youga	Poor: slope, low strength.	Unsuited---	Unsuited---	Poor: slope, small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1, 2--Aaberg	Slope, depth to rock.	Thin layer, hard to pack.	Slope, percs slowly, depth to rock.	Slow intake, percs slowly, rooting depth.	Depth to rock, percs slowly, slope.	Percs slowly, slope, rooting depth.
3, 4--Anvik	Seepage, slope.	Favorable	Slope	Slope	Slope	Slope.
5, 6--Benteen	Slope, seepage.	Thin layer	Depth to rock, slope.	Rooting depth, slope, erodes easily.	Slope, depth to rock.	Slope, erodes easily, rooting depth.
7--Binco	Slope	Hard to pack	Percs slowly, slope.	Slope, percs slowly.	Percs slowly	Percs slowly.
8, 9--Binco	Slope	Hard to pack	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
10*:						
Bross	Seepage, slope, permafrost.	Seepage, large stones, permafrost.	Cutbanks cave, permafrost, slope.	Slope, permafrost, large stones.	Slope, large stones, permafrost.	Slope, droughty, large stones.
Mirror	Slope, depth to rock, permafrost.	Thin layer, slope, permafrost.	Slope, depth to rock, permafrost.	Slope, permafrost, large stones.	Large stones, depth to rock, permafrost.	Slope, large stones, rooting depth.
11--Cebone	Depth to rock, slope.	Hard to pack	Depth to rock, percs slowly, slope.	Percs slowly, slope, rooting depth.	Percs slowly, slope, depth to rock.	Slope, percs slowly, rooting depth.
12--Cimarron	Slope	Hard to pack	Slope, percs slowly.	Percs slowly, slope.	Percs slowly	Percs slowly.
13, 14--Cimarron	Slope	Hard to pack	Slope, percs slowly.	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
15--Clayburn	Seepage	Favorable	Slope	Slope	Favorable	Favorable.
16, 17, 18--Clayburn	Seepage	Favorable	Slope	Slope	Slope	Slope.
19--Cowdrey	Slope	Hard to pack	Slope, percs slowly.	Slope, percs slowly.	Percs slowly	Percs slowly.
20, 21--Cowdrey	Slope	Hard to pack	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
22*. Cryaquepts						
23*: Cryoborolls.						
Rock outcrop.						
24*: Cryorthents.						
Rock outcrop.						
25*. Cumulic Cryaquolls						

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
26*:						
Dahlquist	Slope, seepage.	Seepage, large stones.	Slope, large stones.	Slope, droughty, large stones.	Slope, large stones.	Slope, large stones.
Boettcher	Slope, depth to rock.	Thin layer, hard to pack.	Slope, percs slowly, depth to rock.	Slope, large stones, percs slowly.	Slope, percs slowly, depth to rock.	Slope, percs slowly, rooting depth.
27*, 28*:						
Dahlquist	Slope, seepage.	Seepage, large stones.	Slope, large stones.	Slope, droughty, large stones.	Slope, large stones.	Slope, large stones, droughty.
Stunner	Slope, seepage.	Favorable	Slope, large stones.	Slope, large stones.	Slope, large stones.	Slope, large stones.
29, Forelle	Slope, seepage.	Favorable	Slope	Slope	Favorable	Slope.
30, Forelle	Slope, seepage.	Favorable	Slope	Slope	Slope	Slope.
31*:						
Frisco	Slope, seepage.	Large stones	Large stones, slope.	Slope, droughty, large stones.	Large stones	Droughty, large stones.
Peeler	Slope, seepage.	Favorable	Slope	Slope	Favorable	Favorable.
32*, 33*:						
Frisco	Slope, seepage.	Large stones	Large stones, slope.	Slope, droughty, large stones.	Slope, large stones.	Slope, droughty, large stones.
Peeler	Slope, seepage.	Favorable	Slope	Slope	Slope	Slope.
34, 35, Gateway	Slope, depth to rock.	Hard to pack	Slope, depth to rock, percs slowly.	Slope, percs slowly, rooting depth.	Slope, depth to rock, percs slowly.	Slope, percs slowly, rooting depth.
36, Grenadier	Seepage, slope.	Large stones	Large stones, slope.	Slope, large stones.	Slope, large stones.	Slope, large stones.
37, Harsha	Seepage, slope.	Favorable	Slope	Slope	Favorable	Favorable.
38, 39, Harsha	Seepage, slope.	Favorable	Slope	Slope	Slope	Slope.
40, Harsha	Slope, seepage.	Favorable	Slope	Slope	Slope	Slope.
41*. Histic Cryaquolls						
42, Irigul	Slope, depth to rock.	Thin layer	Depth to rock, slope.	Slope, rooting depth, droughty.	Depth to rock, slope.	Slope, rooting depth, droughty.
43, Lake Creek	Slope, depth to rock, seepage.	Thin layer, large stones.	Large stones, depth to rock, slope.	Large stones, slope, rooting depth.	Slope, large stones, depth to rock.	Slope, large stones, rooting depth.
44, Leadville	Slope, seepage.	Large stones, seepage.	Slope, large stones.	Slope, large stones.	Slope, large stones.	Slope, large stones.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
45---------- Leavitt	Seepage---------	Piping---------	Slope----------	Slope, erodes easily.	Favorable------	Favorable.
46, 47---------- Leavitt	Slope, seepage.	Piping---------	Slope----------	Slope, erodes easily.	Slope----------	Slope, erodes easily.
48---------- Leighcan	Slope, seepage.	Large stones, seepage.	Large stones---	Slope, large stones, droughty.	Slope, large stones.	Slope, droughty, large stones.
49---------- Leighcan	Large stones, slope.	Large stones, slope, seepage.	Slope, large stones.	Large stones, droughty, slope.	Large stones, slope, too sandy.	Large stones, slope, droughty.
50, 51---------- Lymanson	Slope, depth to rock.	Thin layer, piping.	Depth to rock, slope.	Slope, rooting depth.	Slope, depth to rock.	Slope, rooting depth.
52, 53---------- Mayoworth	Slope, depth to rock.	Thin layer-----	Depth to rock, percs slowly, slope.	Slope, rooting depth, percs slowly.	Slope, percs slowly, depth to rock.	Slope, percs slowly, rooting depth.
54---------- Meredith	Slope, seepage, permafrost.	Large stones, seepage, permafrost.	Slope, large stones, permafrost.	Slope, droughty, permafrost.	Large stones, slope, permafrost.	Large stones, droughty, slope.
55, 56---------- Mord	Slope----------	Hard to pack, low strength.	Percs slowly, slope.	Slope, percs slowly.	Percs slowly, slope.	Percs slowly, slope.
57---------- Mulstay	Slope----------	Hard to pack, low strength.	Percs slowly, slope.	Percs slowly, slope.	Complex slope, percs slowly.	Percs slowly, slope.
58, 59---------- Newcomb	Slope, seepage.	Seepage---------	Cutbanks cave, slope.	Droughty, slope.	Slope, too sandy.	Droughty, slope.
60*, 61*: Newcomb----------	Slope, seepage.	Seepage---------	Cutbanks cave, slope.	Droughty, slope.	Slope, too sandy.	Droughty, slope.
Rock outcrop.						
62, 63---------- Peeler	Slope, seepage.	Favorable------	Slope----------	Slope----------	Slope----------	Slope.
64*: Pergelic Cryorthents.						
Rock outcrop.						
65, 66---------- Quander	Slope, seepage.	Large stones---	Large stones, slope.	Large stones, slope.	Slope, large stones.	Slope, large stones.
67*: Rock outcrop.						
Cryoboralfs.						
68*: Rock outcrop.						
Cryoborolls.						
69*: Rock outcrop.						
Haploborolls.						
70---------- Rogert	Depth to rock, slope, seepage.	Thin layer, piping, seepage.	Slope, depth to rock.	Rooting depth, droughty, slope.	Depth to rock, slope.	Droughty, slope, rooting depth.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
71, 72---------- Roxal	Slope, depth to rock.	Thin layer-----	Depth to rock	Slope, rooting depth, droughty.	Slope, depth to rock.	Slope, rooting depth, droughty.
73*. Rubble land						
74, 75, 76-------- Scout	Seepage, slope.	Large stones---	Large stones---	Slope, large stones, droughty.	Slope, large stones.	Slope, droughty, large stones.
77, 78---------- Sudduth	Slope----------	Hard to pack---	Percs slowly, slope.	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
79, 80---------- Tamp	Slope, seepage.	Favorable------	Slope----------	Soil blowing, slope.	Slope, soil blowing.	Slope.
81---------- Tine	Seepage--------	Seepage, piping, large stones.	Large stones, cutbanks cave.	Droughty, large stones.	Large stones, too sandy.	Droughty, large stones.
82, 83---------- Tine	Slope, seepage.	Seepage, piping, large stones.	Slope, large stones, cutbanks cave.	Slope, droughty, large stones.	Slope, large stones, too sandy.	Slope, droughty, large stones.
84---------- Tolman	Depth to rock	Thin layer-----	Depth to rock	Rooting depth, slope, large stones.	Slope, depth to rock, large stones.	Slope, rooting depth, large stones.
85*: Torriorthents. Rock outcrop.						
86---------- Uinta	Seepage--------	Seepage--------	Slope----------	Slope----------	Favorable------	Favorable.
87---------- Uinta	Seepage--------	Seepage--------	Slope----------	Slope----------	Slope----------	Slope.
88, 89---------- Upson	Slope, seepage.	Thin layer-----	Depth to rock, slope.	Rooting depth, slope.	Slope, depth to rock.	Slope, rooting depth.
90---------- Waybe	Depth to rock, slope.	Thin layer-----	Depth to rock, slope, percs slowly.	Rooting depth, slope, percs slowly.	Slope, depth to rock, percs slowly.	Percs slowly, slope, rooting depth.
91, 92---------- Woodhall	Slope, depth to rock.	Thin layer, large stones.	Depth to rock, large stones.	Rooting depth, droughty, slope.	Slope, large stones, depth to rock.	Slope, large stones, rooting depth.
93---------- Youga	Slope----------	Favorable------	Slope----------	Slope----------	Favorable------	Favorable.
94, 95---------- Youga	Slope----------	Favorable------	Slope----------	Slope----------	Slope----------	Slope

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1--- Aaberg	Moderate: too clayey, slope.	Moderate: too clayey, slope.	Severe: slope.	Moderate: too clayey.
2--- Aaberg	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
3--- Anvik	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
4--- Anvik	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
5--- Benteen	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
6--- Benteen	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
7--- Binco	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
8--- Binco	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
9--- Binco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
10*: Bross	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: large stones, slope, permafrost.	Severe: slope, large stones, permafrost.
Mirror	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.	Severe: slope, large stones, permafrost.
11--- Cebone	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
12--- Cimarron	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Slight.
13--- Cimarron	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
14--- Cimarron	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
15--- Clayburn	Slight	Slight	Moderate: slope, small stones.	Slight.
16--- Clayburn	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
17--- Clayburn	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
18--- Clayburn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
19--- Cowdrey	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Moderate: too clayey.
20--- Cowdrey	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey.
21--- Cowdrey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
22*. Cryaquepts				
23*: Cryoborolls.				
Rock outcrop.				
24*: Cryorthents.				
Rock outcrop.				
25*. Cumulic Cryaquolls				
26*: Dahlquist---	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones.
Boettcher---	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
27*: Dahlquist---	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
Stunner---	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
28*: Dahlquist---	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Stunner---	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
29--- Forelle	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
30--- Forelle	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
31*: Frisco---	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
31*: Peeler	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
32*: Frisco	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Peeler	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
33*: Frisco	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Peeler	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
34--- Gateway	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
35--- Gateway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
36--- Grenadier	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
37--- Harsha	Slight	Slight	Moderate: slope.	Slight.
38--- Harsha	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
39--- Harsha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
40--- Harsha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
41*. Histic Cryaquolls				
42--- Irigul	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope, small stones.
43--- Lake Creek	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44--- Leadville	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.
45--- Leavitt	Slight	Slight	Moderate: slope.	Slight.
46--- Leavitt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
47--- Leavitt	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
48--Leighcan	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.
49--Leighcan	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
50--Lymanson	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
51--Lymanson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
52--Mayoworth	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
53--Mayoworth	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
54--Meredith	Severe: large stones, slope, permafrost.	Severe: large stones, slope, permafrost.	Severe: large stones, slope, permafrost.	Severe: large stones, slope, permafrost.
55--Mord	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
56--Mord	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
57--Mulstay	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.
58--Newcomb	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
59--Newcomb	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
60*, 61*: Newcomb	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
62--Peeler	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope.	Moderate: small stones.
63--Peeler	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
64*: Pergelic Cryorthents.				
Rock outcrop.				
65--Quander	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Severe: large stones.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
66--- Quander	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.
67*: Rock outcrop.				
Cryoboralfs.				
68*: Rock outcrop.				
Cryoborolls.				
69*: Rock outcrop.				
Haploborolls.				
70--- Rogert	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope.
71--- Roxal	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
72--- Roxal	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
73*. Rubble land				
74--- Scout	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Moderate: large stones.
75--- Scout	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
76--- Scout	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.
77--- Sudduth	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
78--- Sudduth	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
79--- Tamp	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
80--- Tamp	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
81--- Tine	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
82--- Tine	Severe: large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Severe: large stones.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
83--- Tine	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.
84--- Tolman	Severe: slope, large stones, depth to rock.	Severe: slope, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones.
85*: Torriorthents.				
Rock outcrop.				
86--- Uinta	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
87--- Uinta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
88--- Upson	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
89--- Upson	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.
90--- Waybe	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
91--- Woodhall	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
92--- Woodhall	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
93--- Youga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
94--- Youga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
95--- Youga	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Woodland wildlife	Rangeland wildlife
1, 2--Aaberg	Poor	Fair	---	Fair	---	Fair.
3--Anvik	Poor	Good	Good	Good	Good	---
4--Anvik	Very poor	Good	Good	Good	Fair	---
5, 6--Benteen	Poor	Good	---	Good	---	Good.
7, 8, 9--Binco	Poor	Fair	---	Fair	---	Fair.
10*:						
Bross	Very poor	Poor	---	Poor	---	Poor.
Mirror	Very poor	Fair	---	Fair	---	Fair.
11--Cebone	Very poor	Good	Good	Fair	Fair	---
12, 13, 14--Cimarron	Poor	Fair	---	Fair	---	Fair.
15, 16, 17, 18--Clayburn	Very poor	Good	---	Good	---	Good.
19, 20--Cowdrey	Poor	Good	Good	Fair	Good	---
21--Cowdrey	Very poor	Good	Good	Fair	Fair	---
22*. Cryaquepts						
23*: Cryoborolls.						
Rock outcrop.						
24*: Cryorthents.						
Rock outcrop.						
25*. Cumulic Cryaquolls						
26*:						
Dahlquist	Poor	Fair	---	Fair	---	Fair.
Boettcher	Poor	Fair	---	Fair	---	Fair.
27*, 28*:						
Dahlquist	Poor	Fair	---	Fair	---	Fair.
Stunner	Very poor	Fair	---	Fair	---	Fair.
29, 30--Forelle	Poor	Fair	---	Fair	---	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Woodland wildlife	Rangeland wildlife
31*, 32*:						
Frisco	Poor	Fair	Fair	Fair	Fair	---
Peeler	Poor	Good	Good	Fair	Good	---
33*:						
Frisco	Very poor	Fair	Fair	Fair	Fair	---
Peeler	Very poor	Good	Good	Fair	Good	---
34---- Gateway	Poor	Good	Good	Fair	Good	---
35---- Gateway	Very poor	Good	Good	Fair	Fair	---
36---- Grenadier	Very poor	Good	Good	Fair	Good	---
37, 38, 39---- Harsha	Poor	Fair	---	Fair	---	Fair.
40---- Harsha	Very poor	Fair	---	Fair	---	Fair.
41*. Histic Cryaquolls						
42---- Irigul	Very poor	Fair	---	Fair	---	Fair.
43---- Lake Creek	Poor	Fair	Fair	Fair	Fair	---
44---- Leadville	Poor	Good	Fair	Fair	Fair	---
45, 46---- Leavitt	Fair	Fair	---	Fair	---	Fair.
47---- Leavitt	Very poor	Fair	---	Fair	---	Fair.
48---- Leighcan	Very poor	Fair	Poor	Fair	Poor	---
49---- Leighcan	Very poor	Fair	Fair	Fair	Fair	---
50, 51---- Lymanson	Poor	Fair	---	Fair	---	Fair.
52---- Mayoworth	Poor	Good	---	Good	---	Good.
53---- Mayoworth	Very poor	Good	---	Good	---	Good.
54---- Meredith	Very poor	Fair	---	Fair	---	Fair.
55, 56---- Mord	Poor	Good	Good	Fair	Good	Fair.
57---- Mulstay	Very poor	Fair	---	Fair	---	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Woodland wildlife	Rangeland wildlife
58, 59---------- Newcomb	Poor	Fair	Fair	Fair	Fair	---
60*, 61*: Newcomb----------	Poor	Fair	Fair	Fair	Fair	---
Rock outcrop.						
62---------- Peeler	Poor	Good	Good	Fair	Good	---
63---------- Peeler	Very poor	Good	Good	Fair	Good	---
64*: Pergelic Cryorthents.						
Rock outcrop.						
65---------- Quander	Poor	Good	---	Good	---	Good.
66---------- Quander	Very poor	Good	---	Good	---	Good.
67*: Rock outcrop.						
Cryoboralfs.						
68*: Rock outcrop.						
Cryoborolls.						
69*: Rock outcrop.						
Haploborolls.						
70---------- Rogert	Very poor	Poor	---	Fair	---	Fair.
71, 72---------- Roxal	Very poor	Fair	---	Fair	---	Fair.
73*. Rubble land						
74, 75, 76--------- Scout	Very poor	Good	Good	Good	Fair	Good.
77, 78---------- Sudduth	Poor	Good	---	Good	---	Good.
79---------- Tamp	Fair	Good	---	Good	---	Good.
80---------- Tamp	Very poor	Good	---	Good	---	Good.
81, 82, 83--------- Tine	Poor	Fair	---	Fair	---	Fair.
84---------- Tolman	Poor	Good	---	Good	---	Good.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Woodland wildlife	Rangeland wildlife
85*: Torriorthents. Rock outcrop.						
86---------- Uinta	Poor	Fair	Fair	Fair	Fair	---
87---------- Uinta	Very poor	Fair	Fair	Fair	Fair	---
88, 89---------- Upson	Very poor	Fair	Good	Fair	Fair	---
90---------- Waybe	Poor	Fair	---	Fair	---	Fair.
91, 92---------- Woodhall	Poor	Good	---	Fair	---	Fair.
93, 94---------- Youga	Poor	Good	---	Fair	---	Fair.
95---------- Youga	Poor	Good	---	Fair	---	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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	
1, 2	0-4	Clay loam	CL, CH	A-7	0	90-100	75-100	70-95	60-85	40-55	20-35
Aaberg	4-22	Clay, clay loam	CL, CH	A-7	0	95-100	75-100	70-95	60-85	40-55	20-35
	22	Weathered bedrock.	---	---	---	---	---	---	---	---	---
3, 4	0-23	Loam	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	50-70	20-40	5-15
Anvik	23-40	Clay loam, cobbly clay loam, cobbly loam.	CL	A-6	5-30	90-100	75-95	70-90	55-75	30-40	10-20
	40-60	Very cobbly clay loam.	CL	A-6	35-50	65-80	60-75	55-70	50-65	30-40	10-20
5, 6	0-7	Loam	ML, CL-ML	A-4	0-5	90-95	90-95	85-95	60-75	25-35	5-10
Benteen	7-38	Clay loam, gravelly clay loam, gravelly silty clay loam.	CL, SC, GC	A-6	5-15	70-95	60-95	55-90	45-85	30-40	10-15
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
7, 8, 9	0-24	Clay loam	CL	A-6, A-7	0	100	95-100	90-95	80-90	35-50	15-25
Binco	24-60	Clay	CH, CL	A-7	0	100	95-100	90-100	80-95	40-60	20-35
10*:											
Bross	0-12	Extremely stony sandy loam.	SM, GM	A-2, A-1	40-50	50-90	35-75	30-55	15-35	15-25	NP-5
	12-22	Very cobbly sandy loam, very gravelly sandy loam.	SM, GM	A-2, A-1	20-60	60-90	40-55	30-50	15-25	---	NP-5
	22-60	Very gravelly, very coarse sand, very gravelly loamy sand, very cobbly loamy sand.	SM, GM, SP-SM, GP-GM	A-1	30-50	35-80	30-70	20-30	5-15	---	NP
Mirror	0-8	Extremely stony sandy loam.	SM, GM	A-2, A-1	15-50	55-75	35-75	25-30	15-30	25-35	NP-5
	8-31	Very stony sandy loam, very gravelly sandy loam, very gravelly loam.	SM, GM	A-1, A-2	25-50	45-75	40-60	25-50	15-30	20-30	NP-5
	31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
11	0-16	Loam	ML, SM	A-4	0	75-100	75-100	75-100	40-70	15-20	NP-5
Cebone	16-36	Clay loam, clay	CL, CH	A-7	0	75-100	75-100	75-100	60-80	40-60	20-35
	36	Weathered bedrock.	---	---	---	---	---	---	---	---	---
12, 13, 14	0-10	Loam	ML	A-4	0	90-100	90-100	85-95	60-75	20-30	NP-5
Cimarron	10-32	Clay, clay loam, silty clay.	CH, CL	A-7	0-10	95-100	95-100	90-100	75-90	45-70	30-45
	32-60	Clay loam, silty clay loam, clay.	CH, CL	A-7	0-10	95-100	95-100	90-100	75-90	40-60	20-35
15, 16, 17, 18	0-9	Loam	CL-ML	A-4	0-5	85-100	80-95	70-90	50-65	20-30	5-10
Clayburn	9-47	Clay loam, loam	CL-ML, CL	A-4, A-6	5-15	85-100	80-95	70-90	50-75	20-35	5-15
	47-60	Gravelly clay loam, gravelly loam, loam.	GM-GC, CL-ML, CL, GC	A-4, A-6	0-15	60-100	60-100	45-70	35-55	20-35	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
19, 20, 21--------- Cowdrey	0-8	Loam----------	ML, CL-ML	A-4	0-5	80-100	80-95	75-85	50-70	20-35	5-10
	8-46	Clay, clay loam.	CH	A-7	0-10	80-100	75-100	65-85	50-75	55-70	30-45
	46-60	Clay, clay loam	CH, CL	A-7	0-10	85-95	80-95	60-85	50-75	40-60	15-30
22*. Cryaquepts											
23*: Cryoborolls.											
Rock outcrop.											
24*: Cryorthents.											
Rock outcrop.											
25*. Cumulic Cryaquolls											
26*: Dahlquist---------	0-6	Very cobbly loam	SM, GM	A-2	30-45	60-80	60-70	35-50	20-30	20-30	NP-5
	6-30	Very gravelly sandy clay loam, very cobbly sandy clay loam.	GM, GM-GC	A-2	15-40	25-65	20-50	15-45	10-30	25-35	5-10
	30-60	Very cobbly sandy loam, very cobbly loamy sand, very cobbly loam.	GP-GM, GM	A-1	55-80	20-35	20-35	10-25	5-20	20-30	NP-5
Boettcher---------	0-2	Stony loam------	CL-ML	A-4	10-20	95-100	90-100	85-100	60-75	20-30	5-10
	2-33	Clay loam, clay	CL, CH	A-7	0-5	85-100	80-100	75-100	65-85	40-60	25-40
	33	Weathered bedrock.	---	---	---	---	---	---	---	---	---
27*: Dahlquist---------	0-6	Very cobbly loam	SM, GM	A-2	30-45	60-80	60-70	35-50	20-30	20-30	NP-5
	6-30	Very gravelly sandy clay loam, very cobbly sandy clay loam.	GM, GM-GC	A-2	15-40	25-65	20-50	15-45	10-30	25-35	5-10
	30-60	Very cobbly sandy loam, very cobbly loamy sand, very cobbly loam.	GP-GM, GM	A-1	55-80	20-35	20-35	10-25	5-20	20-30	NP-5
Stunner----------	0-6	Very cobbly loam	ML	A-4	35-60	75-95	75-85	70-85	50-75	20-30	NP-5
	6-22	Clay loam-------	CL-ML, CL	A-6, A-4	0-5	90-100	85-100	75-100	60-80	25-35	5-15
	22-60	Sandy clay loam, loam.	SM-SC, CL-ML	A-4	0-10	85-100	75-100	65-95	45-75	20-30	5-10

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
28*:											
Dahlquist	0-6	Very cobbly loam	SM, GM	A-2	30-45	60-80	60-70	35-50	20-30	20-30	NP-5
	6-30	Very gravelly sandy clay loam, very cobbly sandy clay loam.	GM, GM-GC	A-2	15-40	25-65	20-50	15-45	10-30	25-35	5-10
	30-60	Very cobbly sandy loam, very cobbly loamy sand, very cobbly loam.	GP-GM, GM	A-1	55-80	20-35	20-35	10-25	5-20	20-30	NP-5
Stunner	0-6	Very cobbly loam	ML	A-4	35-60	75-95	75-85	70-85	50-75	20-30	NP-5
	6-22	Clay loam	CL-ML, CL	A-6, A-4	0-5	90-100	85-100	75-100	60-80	25-35	5-15
	22-60	Sandy clay loam, loam.	SM-SC, CL-ML	A-4	0-10	85-100	75-100	65-95	45-75	20-30	5-10
29, 30 Forelle	0-5	Loam	CL-ML, ML	A-4	0-10	85-100	85-100	75-100	55-75	25-35	5-10
	5-60	Clay loam, loam, sandy clay loam.	CL	A-6	0-10	85-100	85-100	80-100	50-80	25-40	10-15
31*, 32*, 33*:											
Frisco	0-14	Gravelly sandy loam.	GM, SM, ML	A-2, A-4	0-5	55-90	50-75	45-65	30-60	15-20	NP-5
	14-60	Very stony sandy clay loam, very cobbly sandy clay loam, very gravelly loam.	GC	A-2	35-80	50-75	35-60	30-40	20-35	25-35	10-15
Peeler	0-5	Gravelly sandy loam.	SM	A-1	0-5	65-85	50-75	20-30	15-25	15-20	NP-5
	5-60	Gravelly sandy clay loam, gravelly clay loam, cobbly sandy clay loam.	SC	A-2, A-6	0-30	65-90	60-75	30-45	20-40	30-35	10-15
34, 35 Gateway	0-8	Loam	ML	A-4	0	100	90-100	85-100	60-85	20-35	NP-10
	8-30	Silty clay, clay, clay loam.	CL, CH	A-7	0	85-100	85-100	85-100	80-95	40-70	20-40
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
36 Grenadier	0-7	Gravelly loam	ML, GM, SM	A-4	0-15	50-95	50-75	45-65	40-60	25-35	NP-10
	7-15	Stony loam, stony sandy clay loam, gravelly sandy clay loam.	SM, ML	A-4	5-40	80-95	75-85	45-75	40-55	25-35	NP-10
	15-60	Very stony loam, very stony sandy loam.	SM, GM	A-2, A-4, A-1	50-80	50-75	50-75	45-65	20-50	25-35	NP-10
37, 38 Harsha	0-5	Loam	ML, CL-ML	A-4	0	90-100	90-100	60-90	50-65	25-35	5-10
	5-40	Clay loam, loam	CL	A-6	0	85-100	85-100	75-95	55-80	30-40	10-20
	40-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	75-100	75-100	65-95	50-75	25-40	5-20
39 Harsha	0-2	Loam	ML, CL-ML	A-4	0	90-100	90-100	60-90	50-65	25-35	5-10
	2-37	Clay loam, loam	CL	A-6	0	85-100	85-100	75-95	55-80	30-40	10-20
	37-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	75-100	75-100	65-95	50-75	25-40	5-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
40---------- Harsha	0-5	Cobbly loam-----	CL-ML, SM-SC	A-4	10-25	85-100	85-95	55-90	45-65	20-30	5-10
	5-40	Clay loam, loam	CL, CL-ML	A-6, A-4	0-5	85-100	85-100	70-95	50-80	20-35	5-15
	40-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	75-100	75-100	60-90	50-75	20-35	5-15
41*. Histic Cryaquolls											
42---------- Irigul	0-6	Channery loam---	GM-GC,	A-4	5-10	55-75	50-70	50-65	35-50	20-30	5-10
	6-8	Very channery loam.	GM-GC	A-2, A-4	5-25	20-60	30-55	25-50	20-45	20-30	5-10
	8	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
43---------- Lake Creek	0-5	Loam----------	CL-ML, ML	A-4	0	100	100	85-95	60-75	25-35	5-10
	5-35	Very stony loam, extremely stony sandy clay loam.	GM-GC, CL-ML, GM, ML	A-4	50-80	65-100	65-100	60-85	35-70	25-35	5-10
	35	Weathered bedrock.	---	---	---	---	---	---	---	---	---
44---------- Leadville	0-19	Stony loam------	ML, GM	A-4	5-20	70-100	70-95	55-80	40-60	20-35	NP-10
	19-43	Very stony clay loam, very cobbly clay loam, extremely stony clay loam.	GC, SC	A-2, A-6	35-70	30-80	25-70	25-50	20-45	30-40	10-20
	43-60	Very stony loam, very cobbly loam.	GM, SM	A-2, A-1	45-75	25-70	25-60	20-50	15-35	20-35	NP-10
45, 46, 47--------- Leavitt	0-6	Loam----------	ML, SM	A-4	0	75-100	75-100	70-90	40-60	25-35	NP-5
	6-60	Clay loam, loam	CL	A-6	0	75-100	75-100	70-100	55-80	30-40	10-15
48---------- Leighcan	0-5	Gravelly sandy loam.	SM	A-1, A-2, A-4	0-20	70-80	70-75	45-55	20-30	15-25	NP-5
	5-25	Very gravelly sandy loam, very cobbly sandy loam.	SM	A-1, A-2	30-55	60-80	60-70	40-55	20-30	15-25	NP-5
	25-60	Very cobbly loamy sand, very cobbly sandy loam.	SM, SP-SM	A-1, A-2	35-50	60-70	50-70	30-50	5-15	---	NP
49---------- Leighcan	0-5	Bouldery sandy loam.	SM	A-2	10-25	75-95	70-90	50-60	20-35	20-25	NP-5
	5-25	Very bouldery sandy loam, very stony sandy loam.	SM	A-1, A-2	50-75	65-80	60-75	35-50	20-30	20-25	NP-5
	25-60	Very bouldery loamy sand, very stony loamy sand.	SP-SM, SM	A-1	35-60	55-65	50-60	25-40	5-15	---	NP
50, 51---------- Lymanson	0-2	Loam----------	CL-ML, ML	A-4	0-15	75-100	80-100	65-85	50-65	25-35	5-10
	2-26	Loam, clay loam	CL	A-6	0-15	75-100	80-100	70-95	55-75	25-35	10-15
	26	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
52, 53---------- Mayoworth	0-10	Clay loam-------	CL	A-6	0	85-100	85-100	70-100	65-90	25-30	10-15
	10-28	Clay, clay loam	CL	A-7	0	85-100	85-100	70-100	65-85	40-50	20-30
	28	Weathered bedrock.	---	---	---	---	---	---	---	---	---
54---------- Meredith	0-9	Extremely stony sandy loam.	GM, SM	A-4, A-2, A-1	40-60	40-80	35-70	30-60	20-50	25-35	NP-10
	9-26	Very stony loam, very gravelly loam, very gravelly coarse sandy loam.	GM, GM-GC	A-1, A-2	20-40	50-60	40-50	30-40	20-30	15-25	NP-10
	26-60	Fragmental material.	GP	A-1	85-100	5-15	0-10	0-5	0	---	NP
55, 56---------- Mord	0-18	Loam----------	CL-ML	A-4	5-20	85-95	85-95	75-85	55-70	20-30	5-10
	18-47	Gravelly clay loam.	CL	A-6, A-7	0-5	60-80	60-75	55-70	50-60	30-50	15-25
	47-60	Gravelly clay---	CL, CH, GC	A-7	0-5	55-75	50-75	50-70	45-65	40-60	15-30
57---------- Mulstay	0-4	Stony loam------	CL-ML, CL	A-4, A-6	25-30	90-95	90-95	75-90	60-70	20-35	5-15
	4-21	Clay loam, clay	CL, CH	A-7, A-6	0-10	95-100	90-100	85-95	60-85	35-55	15-30
	21-60	Clay loam, clay	CH, CL	A-7	0	100	100	90-100	80-95	40-60	20-35
58, 59---------- Newcomb	0-12	Gravelly sandy loam.	ML, GM	A-4	0-5	55-80	50-75	45-70	35-60	25-35	NP-10
	12-60	Very gravelly loamy sand, very gravelly sand.	GP-GM	A-1	0-5	25-50	20-40	20-30	5-10	---	NP
60*, 61*: Newcomb----------	0-12	Gravelly sandy loam.	ML, GM	A-4	0-5	55-80	50-75	45-70	35-60	25-35	NP-10
	12-60	Very gravelly loamy sand, very gravelly sand.	GP-GM	A-1	0-5	25-50	20-40	20-30	5-10	---	NP
Rock outcrop.											
62, 63---------- Peeler	0-5	Sandy loam------	SM	A-2, A-4	0	80-95	75-90	50-65	25-40	20-25	NP-5
	5-60	Gravelly sandy clay loam, gravelly clay loam, cobbly sandy clay loam.	SC	A-2, A-6	0-30	65-90	60-75	30-45	20-40	30-35	10-15
64*: Pergelic Cryorthents.											
Rock outcrop.											
65---------- Quander	0-10	Cobbly loam-----	SM	A-4, A-2	15-30	70-85	45-60	40-55	30-45	25-40	NP-10
	10-60	Very stony loam, very stony sandy clay loam, very cobbly sandy clay loam.	SC, GC	A-2	25-55	50-75	35-60	30-50	20-30	25-40	10-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
66---------- Quander	0-10 10-60	Stony loam------ Very stony loam, very stony sandy clay loam, very cobbly sandy clay loam.	SM SC, GC	A-4, A-2 A-2	15-30 25-55	70-85 50-75	45-60 35-60	40-55 30-50	30-45 20-30	25-40 25-40	NP-10 10-20
67*: Rock outcrop.											
Cryoboralfs.											
68*: Rock outcrop.											
Cryoborolls.											
69*: Rock outcrop.											
Haploborolls.											
70---------- Rogert	0-5 5-14 14	Gravelly sandy loam. Very gravelly sandy loam, very cobbly sandy loam. Unweathered bedrock.	GM GM, GP-GM ---	A-4, A-2 A-1 ---	5-10 10-50 ---	60-75 20-50 ---	55-70 20-50 ---	35-50 15-35 ---	30-40 5-20 ---	25-35 --- ---	NP-5 NP ---
71---------- Roxal	0-6 6-15 15	Loam------------ Clay loam, loam Weathered bedrock.	CL-ML, ML CL ---	A-4 A-6 ---	0 0 ---	75-100 80-100 ---	75-100 75-100 ---	70-90 70-95 ---	50-70 60-75 ---	25-35 20-35 ---	5-10 10-15 ---
72---------- Roxal	0-6 6-15 15	Loam------------ Clay loam, loam Weathered bedrock.	CL-ML, ML CL ---	A-4 A-6 ---	0 0 ---	75-100 80-100 ---	75-100 75-100 ---	70-90 70-95 ---	50-70 60-75 ---	25-35 20-35 ---	5-10 10-15 ---
73*. Rubble land											
74, 75, 76--------- Scout	0-2 2-42 42-60	Cobbly sandy loam. Very gravelly fine sandy loam, extremely stony sandy loam, very cobbly sandy loam. Very gravelly sandy loam, extremely stony sandy loam, very cobbly sandy loam.	GM, SM GM, SM GM, SM	A-2, A-4 A-2, A-1 A-2, A-1	20-30 20-70 20-80	65-85 50-75 45-75	60-80 45-60 40-60	35-55 30-55 25-45	30-50 15-35 15-30	15-25 15-25 15-25	NP-5 NP-5 NP-5
77, 78---------- Sudduth	0-13 13-28 28-60	Loam------------ Clay loam, loam Clay, channery clay, channery clay loam.	ML CL CH, GC, SC	A-4 A-7 A-7	0 0 0-10	95-100 95-100 50-95	85-90 90-95 50-95	75-85 85-95 50-95	55-70 65-75 35-90	30-40 40-50 55-65	5-10 20-30 30-40

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
79, 80---------- Tamp	0-10	Gravelly sandy loam.	SM, GM	A-2, A-1	0-5	60-80	50-75	30-50	15-35	15-25	NP-5
	10-60	Gravelly sandy clay loam, gravelly clay loam, gravelly loam.	GC, SC, CL	A-2, A-6	0-5	60-80	50-75	40-65	20-55	25-40	10-20
81---------- Tine	0-14	Gravelly sandy loam.	GM, SM	A-2, A-1	5-15	50-75	50-75	25-50	15-35	15-20	NP-5
	14-23	Very gravelly loamy sand, very cobbly loamy sand.	GP-GM, SP-SM	A-1	15-60	30-60	30-60	20-50	5-10	---	NP
	23-60	Very gravelly sand, very cobbly sand.	GP, SP	A-1	15-70	30-60	30-60	20-50	0-5	---	NP
82---------- Tine	0-14	Cobbly sandy loam.	SM	A-2, A-1	15-30	60-75	60-75	25-50	15-35	15-20	NP-5
	14-23	Very gravelly loamy sand, very cobbly loamy sand.	GP-GM, SP-SM	A-1	15-60	30-60	30-60	20-50	5-10	---	NP
	23-60	Very gravelly sand, very cobbly sand.	GP, SP	A-1	15-70	30-60	30-60	20-50	0-5	---	NP
83---------- Tine	0-14	Cobbly sandy loam.	SM	A-2, A-1	15-30	60-75	60-75	25-50	15-35	15-20	NP-5
	14-60	Very gravelly loamy sand, very cobbly loamy sand.	GP-GM, SP-SM	A-1	15-60	30-60	30-60	20-50	5-10	---	NP
84---------- Tolman	0-7	Stony loam.	CL-ML, CL	A-4	15-25	85-95	85-95	75-90	50-70	20-30	5-10
	7-17	Very gravelly clay loam, very gravelly loam, very gravelly sandy clay loam.	GC	A-6, A-2	15-35	50-60	40-50	30-40	25-40	20-30	10-15
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
85*: Torriorthents.											
Rock outcrop.											
86, 87---------- Uinta	0-7	Sandy loam------	SM	A-1, A-2	0-10	80-100	80-90	45-65	15-30	---	NP
	7-45	Sandy clay loam, clay loam.	SM-SC, CL-ML	A-2, A-4	0-10	80-100	75-100	45-85	25-65	20-30	5-10
	45-60	Gravelly sandy clay loam, very cobbly sandy loam.	GM, SM, SM-SC, GM-GC	A-2, A-6, A-1, A-4	10-35	50-90	50-90	35-80	15-50	25-40	NP-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
88, 89---------- Upson	0-18	Stony sandy loam	SM	A-2	10-20	70-95	60-90	35-60	25-35	15-20	NP-5
	18-36	Sandy loam, gravelly sandy loam, coarse sandy loam.	SM-SC, SM	A-2, A-1	0-5	70-95	50-85	25-40	20-35	15-25	NP-10
	36	Weathered bedrock.	---	---	---	---	---	---	---	---	---
90---------- Waybe	0-5	Clay loam-------	CL	A-6	0	85-100	85-100	85-100	70-80	30-40	10-20
	5-16	Silty clay loam, clay.	CL	A-6, A-7	0	85-100	85-100	85-100	85-95	35-50	15-25
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
91, 92---------- Woodhall	0-12	Loam----------	CL-ML, ML	A-4	0-5	80-95	75-95	70-90	50-70	25-35	5-10
	12-30	Very stony clay loam, very cobbly loam, very stony loam.	CL-ML	A-4	45-60	75-90	75-75	70-70	50-60	20-30	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
93, 94, 95--------- Youga	0-14	Loam----------	ML, SM, CL-ML, SM-SC	A-4, A-5	0-15	75-95	75-90	60-80	40-60	25-45	5-10
	14-60	Clay loam, gravelly clay loam, gravelly loam.	CL	A-6, A-7	0-5	75-90	65-90	60-75	55-65	30-50	10-25

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
							K	T
	In	Pct	In/hr	In/in	pH			
1, 2----------	0-4	30-45	0.06-0.2	0.14-0.16	6.6-7.8	High---------	0.28	3
Aaberg	4-22	36-45	0.06-0.2	0.12-0.15	6.6-8.4	High---------	0.28	
	22	---	---	---	---	----------	----	
3, 4----------	0-23	15-25	2.0-6.0	0.16-0.18	6.1-7.3	Low----------	0.28	5
Anvik	23-40	20-35	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.32	
	40-60	27-32	0.6-2.0	0.15-0.17	6.1-7.3	Moderate-----	0.28	
5, 6----------	0-7	10-27	0.6-2.0	0.14-0.20	6.1-7.3	Low----------	0.37	2
Benteen	7-38	25-35	0.6-2.0	0.08-0.18	6.6-7.8	Moderate-----	0.32	
	38	---	---	---	---	----------	----	
7, 8, 9----------	0-24	30-40	0.2-0.6	0.16-0.19	7.9-8.4	Moderate-----	0.28	5
Binco	24-60	40-50	0.06-0.2	0.14-0.16	7.9-8.4	High---------	0.28	
10*:								
Bross----------	0-12	15-18	2.0-6.0	0.07-0.09	4.5-5.5	Low----------	0.10	5
	12-22	12-18	6.0-20.0	0.04-0.07	4.5-5.5	Low----------	0.10	
	22-60	5-10	6.0-20.0	0.04-0.05	4.5-5.5	Low----------	0.10	
Mirror----------	0-8	13-18	0.6-2.0	0.19-0.22	4.5-5.5	Low----------	0.15	3
	8-31	12-20	2.0-6.0	0.05-0.07	4.5-5.5	Low----------	0.10	
	31	---	---	---	---	----------	----	
11----------	0-16	14-25	0.6-2.0	0.13-0.16	6.1-7.3	Low----------	0.20	2
Cebone	16-36	35-45	0.06-0.2	0.14-0.17	6.1-7.3	High---------	0.28	
	36	---	---	---	---	----------	----	
12, 13, 14-------	0-10	18-25	0.6-2.0	0.16-0.18	6.1-7.8	Low----------	0.37	5
Cimarron	10-32	35-60	0.06-0.2	0.14-0.16	6.1-7.8	High---------	0.32	
	32-60	35-45	0.06-0.2	0.14-0.16	6.1-7.8	High---------	0.32	
15, 16, 17, 18---	0-9	15-25	0.6-2.0	0.16-0.18	6.1-7.3	Low----------	0.20	4
Clayburn	9-47	20-35	0.6-2.0	0.14-0.16	6.1-7.3	Moderate-----	0.28	
	47-60	20-35	0.6-2.0	0.10-0.12	6.1-7.3	Moderate-----	0.20	
19, 20, 21-------	0-8	15-27	0.6-2.0	0.15-0.17	6.1-6.5	Low----------	0.32	5
Cowdrey	8-46	40-50	0.06-0.2	0.14-0.16	6.1-7.3	High---------	0.10	
	46-60	35-50	0.06-0.2	0.14-0.16	6.1-7.3	High---------	0.10	
22*. Cryaquepts								
23*: Cryoborolls.								
Rock outcrop.								
24*: Cryorthents.								
Rock outcrop.								
25*. Cumulic Cryaquolls								
26*:								
Dahlquist-------	0-6	12-25	2.0-6.0	0.06-0.10	6.6-7.8	Low----------	0.15	5
	6-30	20-35	0.6-2.0	0.06-0.11	6.6-7.8	Low----------	0.20	
	30-60	7-20	>6.0	0.03-0.05	7.9-9.0	Low----------	0.15	

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
							K	T
	In	Pct	In/hr	In/in	pH			
26*:								
Boettcher	0-2	20-25	0.6-2.0	0.14-0.16	7.4-7.8	Moderate	0.32	2
	2-33	35-50	0.06-0.2	0.14-0.16	7.4-8.4	High	0.32	
	33	---	---	---	---	---	---	
27*:								
Dahlquist	0-6	12-25	2.0-6.0	0.06-0.10	6.6-7.8	Low	0.15	5
	6-30	20-35	0.6-2.0	0.06-0.11	6.6-7.8	Low	0.20	
	30-60	7-20	>6.0	0.03-0.05	7.9-9.0	Low	0.15	
Stunner	0-6	15-25	0.6-2.0	0.14-0.16	6.6-7.8	Low	0.20	5
	6-22	27-35	0.2-0.6	0.17-0.20	6.6-8.4	Moderate	0.28	
	22-60	15-25	0.6-2.0	0.14-0.16	7.9-9.0	Low	0.28	
28*:								
Dahlquist	0-6	12-25	2.0-6.0	0.06-0.10	6.6-7.8	Low	0.15	5
	6-30	20-35	0.6-2.0	0.06-0.11	6.6-7.8	Low	0.20	
	30-60	7-20	>6.0	0.03-0.05	7.9-9.0	Low	0.15	
Stunner	0-6	15-25	0.6-2.0	0.14-0.16	6.6-7.8	Low	0.20	5
	6-22	27-35	0.2-0.6	0.17-0.20	6.6-8.4	Moderate	0.28	
	22-60	15-25	0.6-2.0	0.14-0.16	7.9-9.0	Low	0.28	
29, 30	0-5	15-27	0.6-2.0	0.16-0.18	6.6-9.0	Low	0.28	5
Forelle	5-60	20-35	0.6-2.0	0.16-0.21	6.6-9.0	Moderate	0.32	
31*, 32*, 33*:								
Frisco	0-14	14-25	2.0-6.0	0.07-0.10	5.1-7.3	Low	0.17	5
	14-60	18-30	0.6-2.0	0.05-0.09	5.1-7.3	Low	0.15	
Peeler	0-5	10-20	6.0-20	0.11-0.13	5.6-7.3	Low	0.15	5
	5-60	18-35	0.6-2.0	0.08-0.10	5.6-7.8	Low	0.15	
34, 35	0-8	20-27	0.6-2.0	0.16-0.18	6.1-7.3	Low	0.28	2
Gateway	8-30	35-45	0.06-0.2	0.14-0.16	6.1-7.3	High	0.32	
	30	---	---	---	---	---	---	
36	0-7	20-27	0.6-2.0	0.16-0.18	4.5-5.5	Low	0.28	5
Grenadier	7-15	20-25	0.6-2.0	0.10-0.13	5.1-5.5	Low	0.15	
	15-60	15-25	2.0-6.0	0.04-0.08	5.1-5.5	Low	0.10	
37, 38	0-5	14-25	0.6-2.0	0.18-0.20	6.6-7.8	Low	0.28	5
Harsha	5-40	20-35	0.6-2.0	0.15-0.17	7.4-8.4	Moderate	0.32	
	40-60	15-30	0.6-2.0	0.15-0.17	7.9-9.0	Moderate	0.32	
39	0-2	14-25	0.6-2.0	0.18-0.20	6.6-7.8	Low	0.28	5
Harsha	2-37	20-35	0.6-2.0	0.15-0.17	7.4-8.4	Moderate	0.32	
	37-60	15-30	0.6-2.0	0.15-0.17	7.9-9.0	Moderate	0.32	
40	0-5	15-25	0.6-6.0	0.16-0.18	7.4-7.8	Low	0.28	5
Harsha	5-40	20-35	0.6-2.0	0.15-0.17	7.4-8.4	Moderate	0.32	
	40-60	15-30	0.6-2.0	0.15-0.17	7.9-8.4	---	0.32	
41*. Histic Cryaquolls								
42	0-6	15-27	0.6-2.0	0.09-0.11	6.1-7.8	Low	0.28	1
Irigul	6-8	20-35	0.6-2.0	0.07-0.09	7.4-8.4	Low	0.20	
	8	---	---	---	---	---	---	
43	0-5	15-27	0.6-2.0	0.16-0.18	6.1-6.5	Low	0.32	2
Lake Creek	5-35	15-27	0.6-2.0	0.08-0.12	6.1-7.3	Low	0.37	
	35	---	---	---	---	---	---	

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
							K	T
	In	Pct	In/hr	In/in	pH			
44----------	0-19	15-25	0.6-2.0	0.10-0.15	5.6-7.3	Low----------	0.20	5
Leadville	19-43	27-35	0.6-2.0	0.08-0.10	6.1-7.3	Low----------	0.10	
	43-60	20-27	0.6-2.0	0.05-0.07	6.1-7.3	Low----------	0.10	
45, 46, 47-------	0-6	20-25	0.6-2.0	0.19-0.21	6.6-7.8	Low----------	0.37	5
Leavitt	6-60	20-35	0.6-2.0	0.16-0.18	6.6-9.0	Moderate-----	0.32	
48----------	0-5	12-20	2.0-6.0	0.06-0.09	4.5-6.0	Low----------	0.20	5
Leighcan	5-25	10-18	2.0-6.0	0.06-0.09	4.5-6.0	Low----------	0.24	
	25-60	5-15	6.0-20	0.03-0.07	4.5-6.0	Low----------	0.24	
49----------	0-5	10-20	2.0-6.0	0.08-0.10	4.5-6.0	Low----------	0.10	5
Leighcan	5-25	10-20	2.0-6.0	0.06-0.07	4.5-6.0	Low----------	0.10	
	25-60	5-10	6.0-20	0.03-0.05	4.5-6.0	Low----------	0.10	
50, 51----------	0-2	20-27	0.6-2.0	0.13-0.18	6.6-8.4	Low----------	0.28	3
Lymanson	2-26	20-35	0.6-2.0	0.13-0.18	7.4-8.4	Moderate-----	0.32	
	26	---	---	---	---	----------	----	
52, 53----------	0-10	27-35	0.6-2.0	0.19-0.21	6.1-7.8	Low----------	0.37	2
Mayoworth	10-28	35-45	0.06-0.2	0.14-0.16	6.1-7.8	High---------	0.37	
	28	---	---	---	---	----------	----	
54----------	0-9	---	6.0-20	0.08-0.10	4.5-5.5	Low----------	0.10	2
Meredith	9-26	18-27	6.0-20	0.08-0.10	4.5-5.5	Low----------	0.10	
	26-60	---	>20	0.02-0.04	4.5-5.5	Low----------	0.10	
55, 56----------	0-18	20-27	0.6-2.0	0.18-0.20	6.1-7.3	Low----------	0.24	5
Mord	18-47	35-60	0.2-0.6	0.19-0.21	6.1-7.3	High---------	0.37	
	47-60	40-45	0.06-0.2	0.14-0.16	6.1-7.8	High---------	0.32	
57----------	0-4	20-27	0.2-0.6	0.15-0.17	6.6-7.3	Low----------	0.37	5
Mulstay	4-21	35-45	0.06-0.2	0.14-0.16	6.6-7.8	High---------	0.32	
	21-60	35-45	0.06-0.2	0.14-0.16	7.4-8.4	High---------	0.32	
58, 59----------	0-12	10-20	0.6-2.0	0.14-0.16	5.6-7.3	Low----------	0.24	5
Newcomb	12-60	5-10	6.0-20.0	0.06-0.08	5.6-7.3	Low----------	0.10	
60*, 61*:								
Newcomb---------	0-12	10-20	0.6-2.0	0.14-0.16	5.6-7.3	Low----------	0.24	5
	12-60	5-10	6.0-20.0	0.06-0.08	5.6-7.3	Low----------	0.10	
Rock outcrop.								
62, 63----------	0-5	10-20	2.0-6.0	0.12-0.14	6.1-7.3	Low----------	0.28	5
Peeler	5-60	18-35	0.6-2.0	0.14-0.16	5.6-7.8	Low----------	0.15	
64*:								
Pergelic Cryorthents.								
Rock outcrop.								
65, 66----------	0-10	15-25	0.6-2.0	0.16-0.18	6.1-7.3	Low----------	0.15	5
Quander	10-60	20-30	0.6-2.0	0.08-0.12	6.1-7.3	Low----------	0.10	
67*:								
Rock outcrop.								
Cryoboralfs.								
68*:								
Rock outcrop.								
Cryoborolls.								

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
							K	T
	In	Pct	In/hr	In/in	pH			
69*:								
Rock outcrop.								
Haploborolls.								
70----------	0-5	15-20	2.0-6.0	0.07-0.09	6.1-7.8	Low----------	0.17	1
Rogert	5-14	5-10	2.0-6.0	0.05-0.07	6.1-7.8	Low----------	0.10	
	14	---	---	---	---	----------	----	
71----------	0-6	15-27	0.6-2.0	0.16-0.18	7.4-8.4	Low----------	0.28	2
Roxal	6-15	20-35	0.6-2.0	0.15-0.17	8.5-9.0	Low----------	0.32	
	15	---	---	---	---	----------	----	
72----------	0-6	15-27	0.6-2.0	0.16-0.18	7.4-8.4	Low----------	0.28	2
Roxal	6-15	20-35	0.6-2.0	0.15-0.17	8.5-9.0	Low----------	0.32	
	15	---	---	---	---	----------	----	
73*.								
Rubble land								
74, 75, 76-------	0-2	3-10	2.0-6.0	0.07-0.09	5.1-6.5	Low----------	0.32	2
Scout	2-42	3-10	2.0-6.0	0.06-0.08	5.1-6.5	Low----------	0.24	
	42-60	3-10	2.0-6.0	0.04-0.06	5.1-6.5	Low----------	0.32	
77, 78----------	0-13	15-25	0.6-2.0	0.16-0.18	6.1-7.3	Low----------	0.28	5
Sudduth	13-28	20-35	0.2-0.6	0.19-0.21	6.1-7.3	Moderate-----	0.37	
	28-60	35-45	0.06-0.2	0.14-0.16	6.1-7.8	High----------	0.43	
79, 80----------	0-10	10-18	2.0-6.0	0.11-0.13	6.1-7.3	Low----------	0.15	5
Tamp	10-60	20-30	0.6-2.0	0.14-0.16	6.1-7.3	Moderate-----	0.20	
81----------	0-14	10-15	6.0-20	0.07-0.10	6.1-7.8	Low----------	0.15	3
Tine	14-23	5-10	6.0-20	0.05-0.07	6.1-7.8	Low----------	0.10	
	23-60	0-5	>20	0.03-0.05	6.1-7.8	Low----------	0.10	
82----------	0-14	10-15	6.0-20	0.07-0.10	6.1-7.8	Low----------	0.15	3
Tine	14-23	5-10	6.0-20	0.05-0.07	6.1-7.8	Low----------	0.10	
	23-60	0-5	>20	0.03-0.05	6.1-7.8	Low----------	0.10	
83----------	0-14	10-15	6.0-20	0.07-0.10	6.1-7.8	Low----------	0.15	3
Tine	14-60	5-10	6.0-20	0.05-0.07	6.1-7.8	Low----------	0.10	
84----------	0-7	15-27	0.6-2.0	0.14-0.18	6.1-7.8	Low----------	0.32	1
Tolman	7-17	20-35	0.6-2.0	0.05-0.11	6.1-7.8	Low----------	0.24	
	17	---	---	---	---	----------	----	
85*:								
Torriorthents.								
Rock outcrop.								
86, 87----------	0-7	14-18	2.0-6.0	0.07-0.13	6.6-7.3	Low----------	0.17	5
Uinta	7-45	25-35	0.6-2.0	0.08-0.15	6.1-7.8	Moderate-----	0.20	
	45-60	15-25	2.0-6.0	0.07-0.15	6.1-7.8	Moderate-----	0.20	
88, 89----------	0-18	10-15	2.0-6.0	0.10-0.13	5.6-7.3	Low----------	0.17	2
Upson	18-36	10-18	2.0-6.0	0.10-0.13	5.6-7.3	Low----------	0.17	
	36	---	---	---	---	----------	----	
90----------	0-5	---	0.06-0.2	0.12-0.18	7.4-8.4	Moderate-----	0.37	1
Waybe	5-16	---	0.06-0.2	0.14-0.20	7.4-9.0	Moderate-----	0.37	
	16	---	---	---	---	----------	----	
91, 92----------	0-12	20-25	0.6-2.0	0.15-0.17	6.1-7.3	Low----------	0.32	2
Woodhall	12-30	30-35	0.6-2.0	0.10-0.14	6.1-7.3	Low----------	0.15	
	30	---	---	---	---	----------	----	

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
							K	T
	In	Pct	In/hr	In/in	pH			
93, 94, 95-------	0-14	15-35	0.6-2.0	0.10-0.18	6.1-7.8	Low----------	0.24	5
Youga	14-60	20-35	0.2-0.6	0.12-0.18	6.1-7.8	Moderate-----	0.20	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Bedrock		Potential frost action	Risk of corrosion	
		Depth	Hardness		Uncoated steel	Concrete
		In				
1, 2--- Aaberg	D	20-40	Rippable	Low	High	Low.
3, 4--- Anvik	B	>60	---	Moderate	High	Low.
5, 6--- Benteen	B	20-40	Hard	Moderate	High	Low.
7, 8, 9--- Binco	D	>60	---	Moderate	High	Moderate.
10*:						
Bross---	C	>60	---	Moderate	High	High.
Mirror---	B	20-40	Hard	Moderate	High	High.
11--- Cebone	C	20-40	Rippable	Moderate	Moderate	Low.
12, 13, 14--- Cimarron	C	>60	---	Moderate	High	Low.
15, 16, 17, 18--- Clayburn	B	>60	---	Moderate	High	Low.
19, 20, 21--- Cowdrey	C	>60	---	Moderate	High	Low.
22*. Cryaquepts						
23*: Cryoborolls.						
Rock outcrop.						
24*: Cryorthents.						
Rock outcrop.						
25*. Cumulic Cryaquolls						
26*:						
Dahlquist---	B	>60	---	Low	High	Low.
Boettcher---	C	20-40	Rippable	Low	High	Low.
27*, 28*:						
Dahlquist---	B	>60	---	Low	High	Low.
Stunner---	B	>60	---	Low	High	Low.
29, 30--- Forelle	B	>60	---	Low	High	Low.
31*, 32*, 33*:						
Frisco---	B	>60	---	Moderate	High	Moderate.
Peeler---	B	>60	---	Moderate	High	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Bedrock		Potential frost action	Risk of corrosion	
		Depth	Hardness		Uncoated steel	Concrete
		In				
34, 35---------- Gateway	C	20-40	Rippable	Moderate----------	High----------	Low.
36---------- Grenadier	B	>60	---	Moderate----------	High----------	High.
37, 38, 39, 40---- Harsha	B	>60	---	Low----------	High----------	Low.
41*. Histic Cryaquolls						
42---------- Irigul	D	5-20	Hard	Low----------	High----------	Low.
43---------- Lake Creek	C	20-40	Hard	Moderate----------	High----------	Low.
44---------- Leadville	B	>60	---	Moderate----------	High----------	Moderate.
45, 46, 47-------- Leavitt	B	>60	---	Moderate----------	High----------	Low.
48---------- Leighcan	B	>60	---	High----------	High----------	Low.
49---------- Leighcan	B	>60	---	Moderate----------	High----------	High.
50, 51---------- Lymanson	C	20-40	Rippable	Moderate----------	High----------	Low.
52, 53---------- Mayoworth	C	20-40	Rippable	Moderate----------	High----------	Low.
54---------- Meredith	C	>60	---	Low----------	High----------	High.
55, 56---------- Mord	C	>60	---	Moderate----------	High----------	Low.
57---------- Mulstay	C	>60	---	Moderate----------	High----------	Low.
58, 59---------- Newcomb	A	>60	---	Low----------	Moderate----------	Low.
60*, 61*: Newcomb----------	A	>60	---	Low----------	Moderate----------	Low.
Rock outcrop.						
62, 63---------- Peeler	B	>60	---	Moderate----------	High----------	Low.
64*: Pergelic Cryorthents.						
Rock outcrop.						
65, 66---------- Quander	B	>60	---	Moderate----------	High----------	Low.
67*: Rock outcrop.						

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Bedrock		Potential frost action	Risk of corrosion	
		Depth	Hardness		Uncoated steel	Concrete
		In				
67*: Cryoboralfs.						
68*: Rock outcrop.						
Cryoborolls.						
69*: Rock outcrop.						
Haploborolls.						
70---------- Rogert	D	10-20	Hard	Low----------	High----------	Low.
71, 72---------- Roxal	D	10-20	Rippable	Moderate----------	High----------	Low.
73*. Rubble land						
74, 75, 76-------- Scout	B	>60	---	Moderate----------	High----------	Moderate.
77, 78---------- Sudduth	C	>60	---	Moderate----------	Moderate----------	Low.
79, 80---------- Tamp	B	>60	---	Moderate----------	Moderate----------	Moderate.
81, 82, 83-------- Tine	A	>60	---	Low----------	Moderate----------	Low.
84---------- Tolman	D	10-20	Hard	Moderate----------	High----------	Low.
85*: Torriorthents.						
Rock outcrop.						
87, 86---------- Uinta	B	>60	---	Moderate----------	High----------	Low.
88, 89---------- Upson	C	20-40	Rippable	Moderate----------	High----------	Low.
90---------- Waybe	D	10-20	Rippable	Moderate----------	High----------	Low.
91, 92---------- Woodhall	C	20-40	Hard	Moderate----------	Moderate----------	Low.
93, 94, 95-------- Youga	B	>60	---	Moderate----------	High----------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Aaberg	Fine, montmorillonitic Borollic Vertic Camborthids
Anvik	Fine-loamy, mixed Boralfic Cryoborolls
Benteen	Fine-loamy, mixed Argic Pachic Cryoborolls
Binco	Fine, montmorillonitic Borollic Vertic Camborthids
Boettcher	Fine, montmorillonitic Borollic Haplargids
Bross	Loamy-skeletal, mixed Pergelic Cryumbrepts
Cebone	Fine, montmorillonitic Boralfic Cryoborolls
Cimarron	Fine, montmorillonitic Argic Vertic Cryoborolls
Clayburn	Fine-loamy, mixed Argic Pachic Cryoborolls
Cowdrey	Fine, montmorillonitic Typic Cryoboralfs
Dahlquist	Loamy-skeletal, mixed Borollic Haplargids
Forelle	Fine-loamy, mixed Borollic Haplargids
Frisco	Loamy-skeletal, mixed Typic Cryoboralfs
Gateway	Fine, montmorillonitic Typic Cryoboralfs
Grenadier	Loamy-skeletal, mixed Dystric Cryochrepts
Harsha	Fine-loamy, mixed Borollic Haplargids
Irigul	Loamy-skeletal, mixed Lithic Cryoborolls
Lake Creek	Loamy-skeletal, mixed Typic Cryoboralfs
Leadville	Loamy-skeletal, mixed Typic Cryoboralfs
Leavitt	Fine-loamy, mixed Argic Cryoborolls
Leighcan	Loamy-skeletal, mixed Dystric Cryochrepts
Lymanson	Fine-loamy, mixed Argic Cryoborolls
Mayoworth	Fine, montmorillonitic Argic Cryoborolls
Meredith	Loamy-skeletal over fragmental, mixed Pergelic Cryumbrepts
Mirror	Loamy-skeletal, mixed Pergelic Cryumbrepts
Mord	Fine, montmorillonitic Boralfic Cryoborolls
Mulstay	Fine, montmorillonitic Borollic Haplargids
Newcomb	Sandy-skeletal, mixed Alfic Cryochrepts
Peeler	Fine-loamy, mixed Typic Cryoboralfs
Quander	Loamy-skeletal, mixed Argic Cryoborolls
Rogert	Loamy-skeletal, mixed Lithic Cryoborolls
Roxal	Loamy, mixed (calcareous), shallow Typic Cryorthents
Scout	Loamy-skeletal, mixed Typic Cryochrepts
Stunner	Fine-loamy, mixed Borollic Haplargids
Sudduth	Fine, montmorillonitic Argic Pachic Cryoborolls
Tamp	Fine-loamy, mixed Typic Cryoborolls
Tine	Sandy-skeletal, mixed Typic Cryoborolls
Tolman	Loamy-skeletal, mixed Lithic Argiborolls
Uinta	Fine-loamy, mixed Typic Cryoboralfs
Upson	Coarse-loamy, mixed, nonacid Typic Cryorthents
Waybe	Clayey, mixed (calcareous), shallow Typic Cryorthents
Woodhall	Loamy-skeletal, mixed Argic Cryoborolls
Youga	Fine-loamy, mixed Argic Cryoborolls

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